MEASURING SUSTAINABLE AGRICULTURE STATUS USING MULTIASPECT SUSTAINABILITY ANALYSIS

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ABSTRACT

This study aims to evaluate the sustainability status of an agricultural unit utilizing the Multiaspect Sustainability Analysis (MSA) framework aligned with the international Rainforest Alliance standards. The inherent complexity of the agro-industrial sector necessitates a holistic evaluation method to prevent linear and fragmented assessments. The MSA approach is operationalized through a hierarchical structure that segregates the evaluation system into five strategic aspects: environmental, socio-economic, legal-institutional, cultural, and infrastructural aspects. A total of 39 operational factors are quantified employing a weighted binary scoring system to systematically map the aggregate index of sustainability status. The integrated synthesis reveals a robust interdependence among all aspects. Ecological protection and the minimization of chemical inputs directly reinforce the provision of decent wages and the financial resilience of farm households. These conditions are further strengthened by the guarantee of human rights and gender inclusivity, which are governed by regulatory compliance, supply chain traceability, and the availability of digital technological infrastructure. Consistently, the integration of these five aspects within the MSA model offers a tactical roadmap for plantation management to detect limiting factors and formulate targeted intervention strategies toward achieving global sustainable agriculture certification.

Keywords: Agro-industry, Multiaspect Sustainability Analysis (MSA), Rainforest Alliance, Sustainability Status, Sustainable Agriculture.

I. INTRODUCTION

The global agricultural sector is currently facing a crucial dilemma between increasing production capacity to meet world food demands and the increasingly uncontrolled exploitation of natural resources. Conventional agriculture reliant on massive chemical inputs, large-scale land conversion, and the neglect of labor rights has been proven to trigger severe environmental degradation and widen social inequalities. In response to this multifaceted crisis, the sustainable agriculture paradigm has emerged as an urgent, strategic alternative solution. Sustainable agriculture is defined as a commodity governance system that integrates economic viability, social equity, and ecological sustainability into a unified production system, while also incorporating infrastructure, law, and institutional frameworks. Through this approach, cultivation activities are directed toward optimizing long-term farm profitability without compromising the environment's carrying capacity or degrading the fundamental human rights of the workforce. Although the urgency of sustainable agriculture is globally acknowledged, its operationalization at the field level requires practical guidelines and implementable standardization instruments. Within the landscape of international commodity certification, the Rainforest Alliance standard is recognized as one of the most comprehensive and globally legitimate benchmarks for agricultural sustainability. Significant reductions in global deforestation are imperative to mitigate climate change and biodiversity loss[1]. The importance of adopting this standard lies in its holistic approach: rather than merely prohibiting deforestation or protecting biodiversity on paper, it transforms the entire supply chain management toward greater ethics and transparency. This standard sets strict operational boundaries, ranging from stringent bans on child labor exploitation and the provision of decent living wages for farmworkers to mandatory geolocation-based product traceability. By establishing this standard as a primary benchmark, agribusiness stakeholders can align their operations with global market demands that are increasingly selective regarding sustainability and production ethics.

However, the complexity of variables constituting sustainability indicators often leads to analytical overlap when evaluated using conventional, linear, and partial assessment methods. Failure to identify trade-offs among different aspects frequently results in an unobjective representation of a plantation's sustainability status. Consequently, the application of Multiaspect Sustainability Analysis (MSA) becomes critical for precisely mapping and measuring sustainability indices. The MSA approach offers a holistic,

integrated assessment methodology by dividing the evaluation system into five interconnected strategic aspects : Ecological Aspects, Socio-Economic Aspects, Legal and Institutional Aspects, Cultural Aspects, Supporting Infrastructure Aspects.

Through the MSA instrument, sustainability status is no longer measured solely by economic profit or physical productivity. For instance, within the ecological aspects, MSA evaluates the extent to which energy efficiency and water conservation align with wildlife protection. These metrics are then dynamically linked to farmers' domestic economic resilience, institutional legal compliance, workplace gender inclusiveness, and the availability of digital technologies supporting product traceability. This multiaspect approach enables policymakers and plantation management to identify specific weaknesses across individual indicators while formulating targeted intervention strategies. Given the importance of integrating global standardization instruments with robust multiaspect analytical tools, this evaluation instrument aims to assess the sustainability status of a plantation unit using an MSA-based framework derived directly from the Rainforest Alliance guidelines. Through an in-depth examination of the interactions among these five strategic aspects, this research intends to contribute theoretically by delivering a comprehensive evaluation model, as well as practically by offering actionable recommendations for an adaptive, equitable, and sustainable plantation governance system in the future. Multiaspect Sustainability Analysis (MSA) is applied as the primary analytical tool to evaluate agricultural sustainability performance. The selection of the MSA method over other frameworks is driven by its adaptability to local contexts and its capability to accommodate diverse, holistic perspectives[2]. The multiaspect evaluation method integrates environmental, socio-economic, cultural, legal-institutional, and infrastructure aspects into a composite sustainability index and identifies key leverage factors influencing overall performance. This method is grounded in the principles of the Rapid Appraisal Procedure (RAP), enabling a structured and efficient sustainability assessment using expert-based evaluations[3]. Ultimately, this assessment instrument is designed to evaluate and map the sustainability status of agricultural business units by leveraging the Multiaspect Sustainability Analysis (MSA) framework aligned with Rainforest Alliance standards.

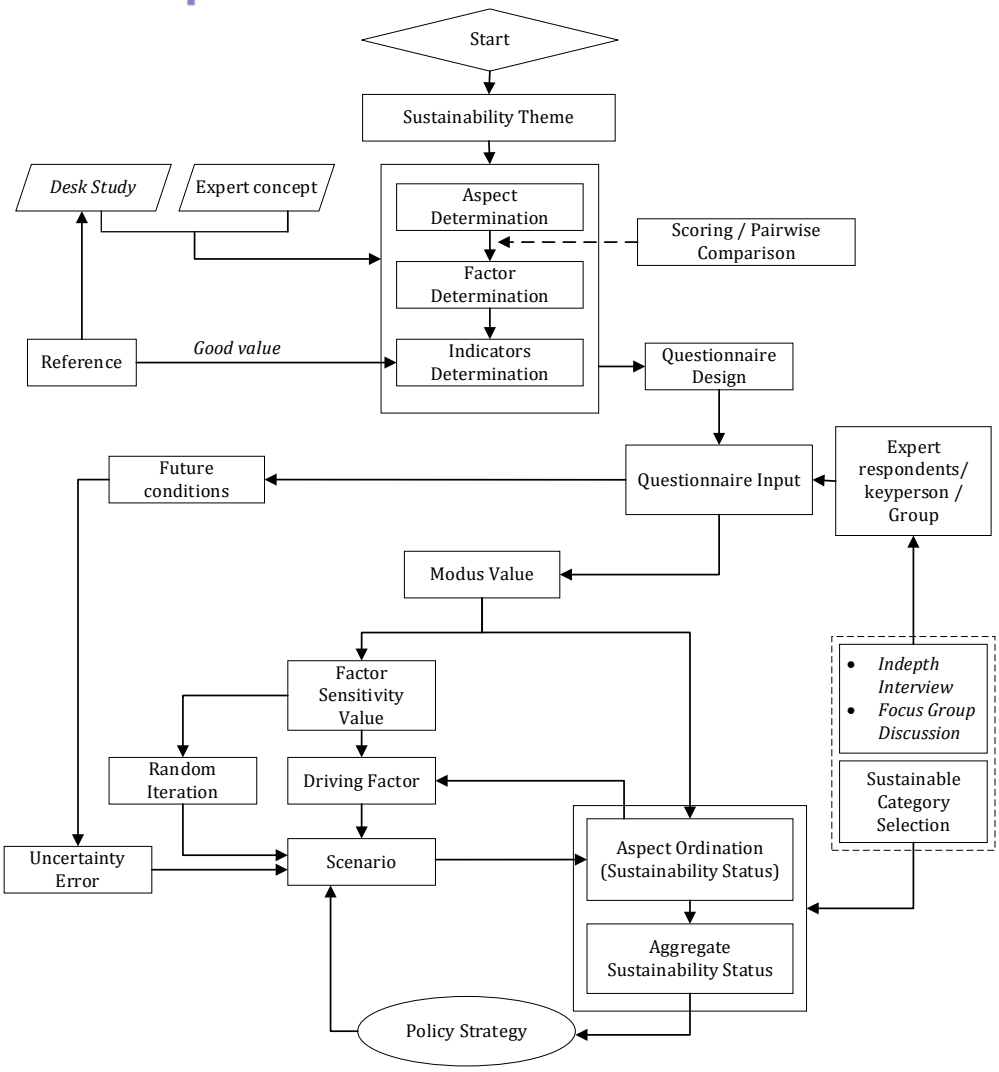
II. CONCEPTUAL FRAMEWORK OF SUSTAINABLE AGRICULTURE USING MULTIASPECT SUSTAINABILITY ANALYSIS

2.1. Sustainable Agriculture

Sustainable agriculture is recognized as an achieved state that successfully integrates agricultural production with environmental conservation[4]. It serves as a holistic approach designed to attain optimal conditions across every evaluated perspective, given that all variables and assessment indicators are intrinsically interconnected[5]. The measurement of this multiaspect concept is executed using the Multiaspect Sustainability Analysis (MSA) method, guided by the Sustainable Agriculture Standard: Farm Requirements issued by the Rainforest Alliance in 2020[6]. This guideline is adopted to evaluate the sustainability of an agricultural enterprise across five strategic perspectives Environmental Aspects: Aims to minimize ecological damage caused by agricultural activities; Socio-Economic Aspects: Seeks to ensure living income and decent welfare for farmers, as well as the profitability of agricultural production; Cultural Aspects: Focuses on preserving local wisdom and facilitating generational renewal among farmers; Infrastructure Aspects: Pertains to the development of physical and operational facilities that support commodity production; Legal and Institutional Aspects: Governs and enforces regulatory compliance while facilitating effective communication among stakeholders. Consequently, the development of these guidelines is conducted by establishing a hierarchical ordination of indicators across each aspect and factor. This structure enables precise evaluation of sustainability status and supports the planning of future intervention scenarios using the MSA method.

2.2. MSA Concept For Sustainable Agriculture

Multiaspect Sustainability Analysis (MSA) is employed to determine the sustainability status score of agricultural systems. This assessment aims to formulate strategic interventions for future decision-making. It is categorized as a rapid appraisal technique, as it utilizes existing databases compiled through consultations with qualified experts or selected respondents who meet defined criteria. Furthermore, this evaluation can be continuously updated whenever new data or conditions emerge, without requiring a complete re-analysis with updated formulations or the construction of a new model. The conceptual framework for the MSA approach is illustrated in Figure 1.



Gambar 1. Conceptual framework of the Multiaspect Sustainability Analysis approach[3]

The database utilized in Multiaspect Sustainability Analysis (MSA) comprises primary data, secondary data, literature reviews, assessment scores provided by responsible and competent experts in the relevant domain, and input from experts during Focus Group Discussions (FGDs). Evaluations are conducted by expert respondents, with the sample size adjusted according to the specific context of the study. Generally, respondents represent the ABGCM stakeholder framework, which encompasses Academics, Business actors, Government representatives, Community leaders, and Media observers. The number of respondents does not need to be statistically large; rather, emphasis is placed on their depth of knowledge and expertise in the researched field, as MSA is an expert-based approach. These respondents do not constitute a random sample, but rather key stakeholders or key informants who are engaged through in-depth interviews, direct observation, or Focus Group Discussions. Furthermore, an odd number of expert respondents is recommended to prevent ties when determining the modal value. The evaluation technique involves selecting indicator scores that reflect actual current conditions or expert judgments. Beyond evaluating existing conditions, MSA can also assess prospective future conditions. Evaluating future scenarios assists in mapping out the necessary strategic interventions required to maintain or enhance sustainability status[3].

The data collected from expert evaluations are aggregated using the mode (the most frequently occurring value) and subsequently processed to generate several analytical outputs. The primary outputs generated by the MSA methodology include the sustainability status index, leverage factors, Monte Carlo random iterations, and uncertainty error estimates. Subsequently, the identified leverage factors are manipulated to simulate desired scenarios, which can then be translated into actionable policies or strategic frameworks for organizational development in the future.

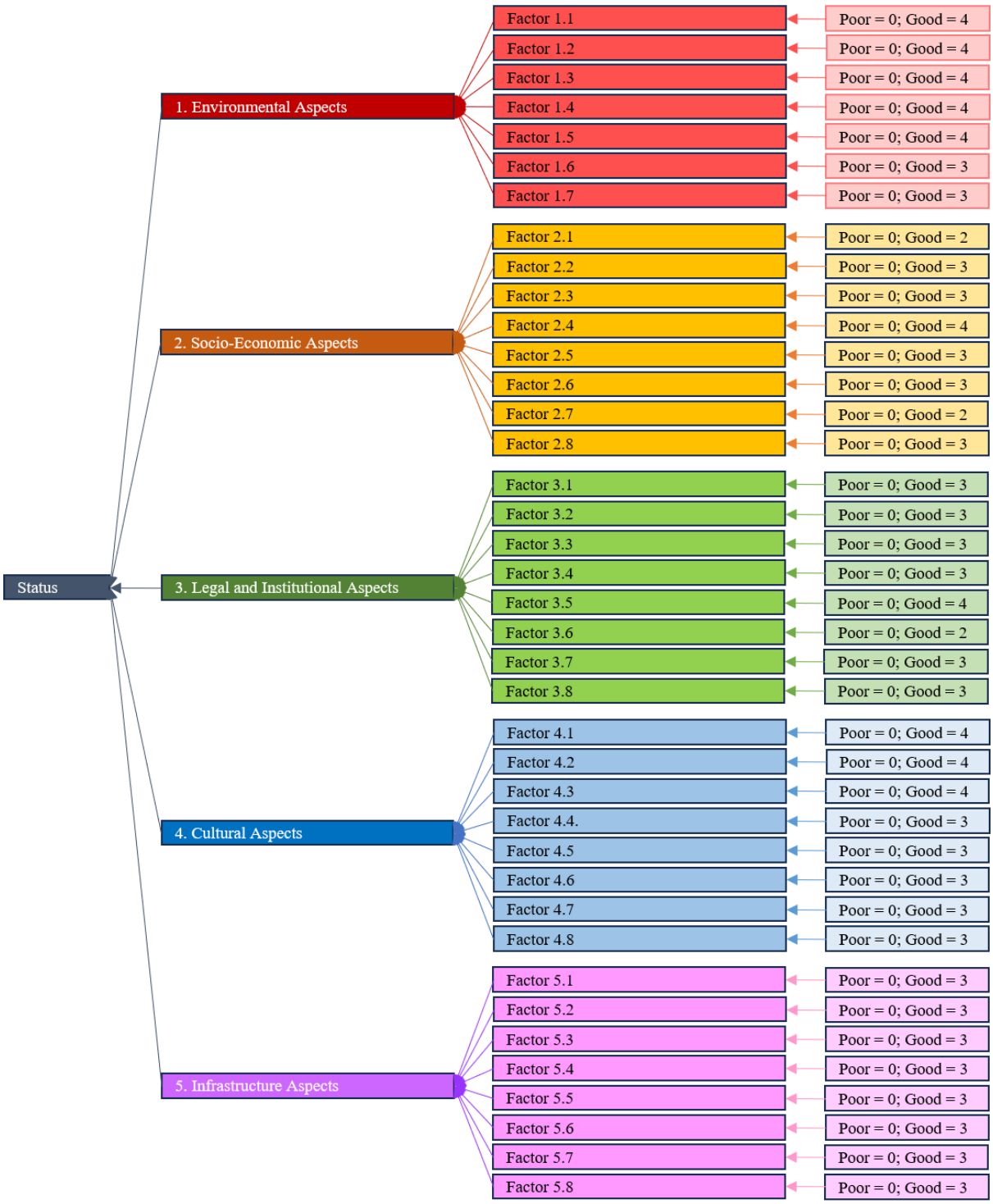


Figure 2. Flowchart of Agriculture Sustainability Status Determination

Figure 2 illustrates the flowchart for determining the sustainability status of agricultural practices utilizing the Multiaspect Sustainability Analysis (MSA) approach based on the 2020 Rainforest Alliance guidelines. The mapping framework categorizes the evaluation into five core aspects: environmental, socio-economic, legal-institutional, cultural, and infrastructure aspects. Each aspect is hierarchically broken down into specific supporting factors, encompassing a total of 39 operational indicators. The evaluation framework applies a weighted binary scoring system, in which unfavorable conditions are assigned a score of zero, whereas optimal conditions—categorized as "Good"—receive scores ranging from two to four,

depending on the relative urgency and weighting of each parameter. This structured diagrammatic model facilitates an objective and systematic computation of the aggregate sustainability index.
The nomenclature for sustainability statuses can be adapted according to the specific criteria or score intervals obtained from the assessment. In this study, the evaluation employs four distinct categories based on a 25-point interval scale (Table 2). Consequently, the assessment yields four sustainability levels: unsustainable, less sustainable, sustainable, and very sustainable.

Table 1. Sustainability Status Assessment[3]

Status Value	Sustainable Category
0-25	Unsustainable
>25-50	Less sustainable
>50-75	Sustainable
>75-100	Very sustainable

III. INSTRUMENT FOR MEASURING AGRICULTURAL SUSTAINABILITY STATUS

Developing a standardized assessment instrument for agricultural sustainability using the Multiaspect Sustainability Analysis (MSA) approach represents a strategic measure to quantitatively measure, evaluate, and mitigate the ecological impacts of agricultural activities. This framework incorporates and adapts international benchmarks from the Rainforest Alliance 2020 Sustainable Agriculture Standard.

3.1. ENVIRONMENTAL ASPECTS

The ecological aspects serves as the cornerstone for implementing a responsible and sustainable agribusiness system. Under the Multiaspect Sustainability Analysis (MSA) framework, environmental sustainability is evaluated by the extent to which cultivation practices maintain ecosystem functions and minimize environmental degradation. A comprehensive assessment within this aspects encompasses key evaluation clusters: biodiversity protection, soil and water resource management, and mitigation strategies for pollution and global climate change impacts. A fundamental driver of this aspects is Biodiversity and Wildlife Protection. Agricultural units are deemed sustainable when they successfully integrate efforts to protect native ecosystems and wildlife habitats, completely halt land clearing (zero deforestation), conserve indigenous vegetation, and safeguard wild animals from hunting and habitat fragmentation. Parallel to biological protection, the ecological viability of a farm is assessed through Soil Conservation and Soil Fertility Management. Preserving cultivation media quality is achieved sustainably through organic matter applications, soil erosion control, and the adoption of farming practices that preserve the physical and chemical properties of the soil.

Another essential factor sustaining environmental resilience is Water Resource and Riparian Zone Management. Irrigation water use must prioritize efficiency to prevent disruptions to local hydrological yields. Focus on land and water governance is paramount to driving the transformative shifts needed for sustainable agricultural practices—enhancing yields and supporting livelihoods while simultaneously protecting and restoring natural resource bases[4]. Furthermore, agricultural operations are required to maintain watercourse cleanliness, establish protective riparian buffer zones, and promote collective water conservation actions within production areas. These measures must operate in synergy with Waste, Wastewater, and Pollution Management. The handling of agricultural by-products—including solid waste and liquid domestic effluent—must utilize safe and effective systems to minimize contamination risks to soil and natural water bodies. A crucial transformation in modern cultivation methods is represented by Integrated Pest Management (IPM) and Reduced Agrochemical Use. Sustainability indicators reject absolute reliance on synthetic chemicals, particularly without proper Personal Protective Equipment (PPE). Peak performance in this factor is attained when agricultural units transition toward biological approaches, such as planting refugia vegetation and utilizing natural predators (biological control agents), reserving chemical pesticides solely as a last resort when pest infestations exceed economic thresholds.

Two complementary factors determining long-term ecological resilience are energy governance and climate response. Through Energy Efficiency and Greenhouse Gas (GHG) Emission Reduction, farm managers are encouraged to optimize operational power consumption, minimize carbon release into the atmosphere, and adopt global warming mitigation frameworks. Finally, this resilience is reinforced by Climate Change Adaptation and Agroforestry Development. Environmental commitment is completed by integrating perennial trees with agricultural commodities within agroforestry systems, simultaneously enhancing adaptive capacity and boosting crop resilience against extreme weather anomalies. Conceptually, assessing these seven environmental factors within the MSA framework reinforces that

agricultural productivity must not compromise environmental carrying capacity; rather, it must proceed hand-in-hand with holistic ecosystem restoration.

3.2. SOCIO-ECONOMICS ASPECTS

The socio-economic aspects within the agricultural sustainability framework plays a crucial role in establishing the foundation for farmers' well-being while safeguarding long-term business continuity. Guided by the Multiaspect Sustainability Analysis (MSA) instrument, sustainability within this sector is evaluated through eight core factors that integrate international benchmarks and modern empirical literature. Based on the adopted evaluation matrix, upholding fundamental labor rights and ensuring financial stability serve as primary determinants of a plantation unit's sustainability status. Sustainability standards—as sets of rules followed by supply chain actors to demonstrate their commitment to social equity and environmental protection—aim to mitigate these systemic vulnerabilities[7]. The first fundamental factor centers on Decent Wages and Living Income. This standard posits that sustainability is not achieved merely when workers earn formal wages, but rather when total household income sustains a dignified standard of living within the region. If domestic earnings remain below the living income threshold, household economic resilience remains vulnerable. This vulnerability directly correlates with Household Economic Resilience, which evaluates a farmer's capacity to withstand market volatility, climate variability, and macroeconomic shocks. Fully resilient households are those capable of adapting across all three risk categories rather than just a single threat.

To mitigate external economic risks, Household Income Diversification emerges as an effective structural strategy. Relying solely on a single commodity across a given land area leaves farmers exposed to crop failure and market price drops. A shift toward sustainability is attained either by utilizing additional land for alternative crops or through downstream value-addition via diversified plantation product processing. Such diversification must simultaneously be balanced by enhancing Agricultural Productivity and Profitability. Farming sustainability requires integrating yield optimization, operational cost efficiency, and consistent long-term profitability. Conversely, accelerating productivity and modernizing plantations cannot occur without Access to Financial Services and Sustainable Investment. Compliance in this factor is measured by the inclusivity of financial support provided to farmers, ranging from operational credit availability and conventional capital access to dedicated funds for green investments. This liquidity serves as an essential modality for implementing Input Use Efficiency. Through prudent input governance, the application of production elements—such as chemical fertilizers, pesticides, water, and energy—shifts from exploitative practices to precision agriculture tailored to actual crop requirements, thereby minimizing negative environmental externalities.

However, technological efficiency and input management depend heavily on human resource capacity. Thus, Capacity Building, Training, and Agricultural Extension Services serve as a critical bridge for knowledge transfer. Structured, regular training and extension interventions effectively transform agricultural workers' mindsets toward more responsible farming practices. Finally, this investment in human capital must be safeguarded by Occupational Health, Safety, and Working Conditions. A safe work environment extends beyond physical protective measures to include comprehensive healthcare coverage for all plantation personnel. Collectively, integrating these eight parameters within the MSA framework demonstrates that socio-economic sustainability in agriculture cannot be achieved through a piecemeal approach. Strong interdependence exists between worker protection, agronomic proficiency, financial resilience, and institutional inclusivity in building a resilient and sustainable agricultural ecosystem.

3.3. LEGAL AND INSTITUTIONAL ASPECTS

The legal and institutional aspects serve as the binding framework for all operational instruments within a sustainable agricultural system. Under the Multiaspect Sustainability Analysis (MSA) framework, strengthening organizational governance and ensuring legal compliance act as primary indicators to guarantee the stability of responsible farming operations. A comprehensive assessment within this aspects is conducted across eight strategic parameters derived from international standards to evaluate the extent to which institutional structures support integration into modern markets while preserving ecosystem integrity. The foundational factor initiating this analysis is Compliance with Regulations and Sustainability Standards. Agricultural institutions are required not only to comply with domestic regulatory frameworks, but also to strictly align their operations with global sustainability standards and international certification mandates[1]. Non-compliance at any regulatory level degrades the operational legitimacy of the plantation. Aligned with regulatory enforcement is the Institutional Capacity and Governance of Farmers' Organizations. Institutional sustainability is realized when farmer groups or cooperatives possess mature

managerial competencies, demonstrated through functional governance systems and the ability to formulate effective long-term strategic plans.

This governance maturity is practically reflected in an organization's capacity for Risk Assessment and Implementation of Management Plans. Adaptive institutions are required to periodically identify potential operational threats and translate mitigation strategies into annual management blueprints. Such risk management cannot function optimally without an Internal Inspection, Monitoring, and Evaluation System. The presence of a consistent, continuous, and meticulously documented self-monitoring mechanism serves as authentic evidence that quality control and compliance within the plantation operate according to established protocols. Beyond internal oversight, organizational transparency is reinforced through Grievance, Remediation, and Transparency Mechanisms. An organization demonstrates high integrity when it provides inclusive, accessible grievance channels for workers at all levels, manages complaints openly, responds effectively to resolutions, and ensures financial and physical safety for informants through strict whistleblower protection. This transparency physically manifests across the supply chain via Product Traceability and Documentation Systems. Achieving product traceability from the field to the end consumer strictly requires accurate record-keeping instruments to guarantee the authenticity of non-exploitative commodities in global markets.

In the modern era, supply chain efficiency is accelerated by Digitalization, Geolocation, and Agricultural Mapping Systems. Institutional sustainability is measured by the ownership of spatial visualization data—such as coordinate points, digital mapping, and geographic information systems (GIS) of farm areas—that are not only comprehensive, but also regularly updated to prevent land-use overlaps. Ultimately, all legal and technological infrastructures must converge toward equity through Stakeholder Participation in Governance and Decision-Making. An institutional structure is deemed democratic and sustainable when it engages all key actors—from smallholders and gender-inclusive labor forces (both men and women) to external stakeholders—in formulating strategic policies. Collectively, these eight legal and institutional parameters within the MSA framework emphasize that sustainability relies not merely on physical productivity, but on robust administrative systems, legal compliance, equitable participation, and holistic technological transparency.

3.4. CULTURAL ASPECTS

The cultural aspects of a sustainable agricultural system serves as the humanistic foundation that ensures plantation operations are conducted ethically and in harmony with the local social order. Within the Multiaspect Sustainability Analysis (MSA) framework, cultural sustainability encompasses not only the preservation of tradition, but also social justice, labor rights protection, and community inclusiveness. A comprehensive evaluation of this aspects is conducted across eight key determinants integrating global standards to foster an equitable and dignified agricultural environment. The first crucial factor within the plantation's social structure is Gender Equality and Women's Empowerment. Cultural sustainability mandates the elimination of gender biases by granting women equal opportunities to participate in the workforce and access capacity-building programs. Furthermore, optimal performance is attained when women are not merely operational laborers, but hold leadership positions and actively participate in strategic decision-making processes. Parallel to this, the future of agricultural sustainability depends on Youth Participation in Agriculture. This factor emphasizes mobilizing younger generations into agribusiness activities through technical training, technological innovation, and active roles in maintaining the generational continuity of the farming profession.

Furthermore, humanistic pillars are reinforced through Human Rights and Labor Rights Protection. Plantation entities are required to prioritize and protect fundamental labor rights across all operational levels. This protection directly correlates with the Prevention of Discrimination, Violence, and Harassment. A healthy cultural climate is characterized by a work and social environment free from discriminatory practices, physical or psychological intimidation, and any form of harassment. An agro-industrial moral commitment is also evaluated through the Prevention of Child Labor and Forced Labor. Agricultural units achieve the highest ethical sustainability standards when their supply chains and production systems are demonstrably free from child exploitation and forced labor. To foster a democratic work environment, these rights must be accompanied by Freedom of Association and Strengthening Social Cohesion. This factor assesses workers' rights to form or join trade unions, supported by harmonious social relations among internal employees and mutually beneficial interactions with the surrounding community.

Externally, a farm's integration with its surrounding environment is evaluated through Community Participation and Local Community Empowerment. Sustainable agricultural institutions must not operate in isolation; local communities must be integrated into regional development initiatives to ensure tangible benefits, including economic well-being and social infrastructure development. Finally, this socio-cultural

framework is completed by the Preservation of Local Values, Traditions, and Indigenous Knowledge. Long-term sustainability is achieved when plantation modernization aligns with preserving cultural heritage, safeguarding traditional knowledge, and respecting local agricultural practices. Policies that empower local communities to manage protected areas often yield improved quality of life and more effective, enduring conservation outcomes[8]. Conceptually, these eight cultural parameters within the MSA framework demonstrate that agricultural sustainability cannot be detached from human identity. Balancing worker rights, gender and generational inclusivity, and respect for local customs remains paramount to achieving sustainable social justice.

3.5. INFRASTRUCTURE ASPECTS

Physical and technological infrastructure constitutes the material foundation driving operational activities within a sustainable agricultural ecosystem. Under the Multiaspect Sustainability Analysis (MSA) model, the availability of adequate supporting facilities serves as a key catalyst to enhance production efficiency while mitigating negative environmental impacts. A comprehensive evaluation of this aspects encompasses eight strategic infrastructure factors to ensure the adoption of safe and responsible modern agribusiness practices. The first technical parameter is Processing and Storage Infrastructure. Post-harvest sustainability requires processing and storage facilities that not only accommodate yields but also adhere to strict hygiene standards, operate efficiently to reduce post-harvest losses, and guarantee product security. The presence of high-quality processing facilities must be supported linearly by reliable Irrigation Infrastructure and Water Conservation. Sustainable water governance extends beyond maintaining distribution flow to fields; it must be engineered to promote water-use efficiency and preserve local hydrological balances.

Furthermore, controlling environmental externalities is evaluated through Waste Management and Sanitation Infrastructure. Sustainability parameters strictly prohibit indiscriminate waste disposal; agricultural units are required to operate domestic disposal systems and operational waste treatment facilities designed in compliance with environmental quality standards. Alongside ecosystem preservation, fulfilling fundamental worker needs is rigorously assessed through Occupational Health, Safety, and Worker Housing Infrastructure. The highest level of compliance is achieved when plantation entities provide medical facilities, protective equipment, and decent, humane housing complexes for laborers[6][7]. In the era of digital transformation, agribusiness competitiveness is bolstered by the availability of Information Technology and Agricultural Digitalization Infrastructure. The sustainability of this aspect is measured by digital capabilities in facilitating field data collection, performing real-time monitoring, and managing information databases that support sustainability reporting. This digital infrastructure is subsequently converged into Traceability Infrastructure and Certification Data Systems. Global market transparency requires effective, accurately documented certification databases and product traceability instruments to verify commodity origins.

Two concluding factors that complete this infrastructure aspects are power supply and human resource capacity. Through Energy Infrastructure and Energy Efficiency, agro-industrial units are encouraged to optimize operational power consumption while transitioning energy sources toward environmentally friendly technologies. Finally, mastery over these physical systems is accommodated by Training, Extension, and Technical Service Infrastructure. Operational sustainability necessitates adequate physical educational facilities, extension spaces, and technical support centers to ensure continuous capacity building and skill development for farmers. Overall, assessing these eight infrastructure factors within the MSA framework reinforces that physical modernization in agriculture must remain intertwined with ecological responsibility, occupational safety, and technological transparency to achieve holistic sustainability.

IV. CONCLUSION

Based on the sustainability assessment utilizing the Multiaspect Sustainability Analysis (MSA) framework across the five examined aspects, it can be concluded that the successful development of the agricultural and plantation sectors cannot be achieved through a piecemeal approach. Within the environmental aspects, commitments to ecosystem restoration are realized through biological protection, soil and water conservation, and reduced chemical input usage. This ecological performance linearly correlates with the socio-economic aspects, which guarantees living wages, enterprise diversification, and financial resilience for smallholders. From a cultural perspective, the operational framework upholds humanistic values by enforcing human rights, gender equality, and the preservation of indigenous knowledge. These dynamic interrelationships are legally bound by the legal and institutional aspects, which prioritizes transparency, product traceability, and compliance with global regulations. Finally, the

implementation of these four pillars is materially accelerated by the infrastructure aspects through digital technologies, hygienic post-harvest facilities, and adequate occupational safety amenities. Aggregately, these five aspects demonstrate strong integration and mutual interdependence. Harmonizing ecological responsibility, socio-economic well-being, legal compliance, cultural inclusivity, and infrastructure modernization constitutes an absolute prerequisite for establishing a resilient, ethical, and sustainable agribusiness ecosystem in the future.

REFERENCES

[1] Lambin Eric F., Holly K. Gibbs, Robert Heilmayr, Kimberly M. Carlson, Leonardo C. Fleck, Rachael D. Garrett, Yann le Polain de Waroux, Constance L. McDermott, David McLaughlin, Peter Newton, Christoph Nolte, Pablo Pacheco, Lisa L. Rausch, Charlotte Streck, Tannis Thorlakson & Nathalie F. Walker. 2018. The role of supply-chain initiatives in reducing deforestation. *Nature Clim Change* **8**, 109–116. https://doi.org/10.1038/s41558-017-0061-1

[2] Anwar, M.A., Suprihatin., Sasongko, N.A., Najib, M., Pronoto, B., Firmansyah, I., and E.S Soekotjo. 2025. Sustainable Waste Management Strategies for Multilayer Plastic in Indonesia. Cleaner and Responsible Consumtion, 16. 100254: 1-15. Doi: https://doi.org/10.1016/j.clrc.2025.100254.

[3] Firmansyah I. 2022. Multiaspect Sustainability Analysis (Theory and Application). Expert Simulation Program Article, 1 (1): 1-14.

[4] FAO. (2021). *The State of the World's Land and Water Resources for Food and Agriculture: Systems at breaking point (SOLAW 2021)*. Food and Agriculture Organization of the United Nations.

[5] Purvis, B., Mao, Y. & Robinson, D. (2019). Three pillars of sustainability: in search of conceptual origins. *Sustain Sci* 14, 681–695. https://doi.org/10.1007/s11625-018-0627-5

[6] Rainforest Alliance. 2020. Standar pertanian berkelanjutan: Pedoman kebun (Versi 1.1).

[7] Meemken EM, Christopher BB, Hope CM, Matin Q, Thomas R, Jorge S. 2021. Sustainability standards in global agrifood supply chains. Nature Food 2(10):758-765. DOI:10.1038/s43016-021-00360-3

[8] IPBES. 2022. Methodological Assessment Report on the Diverse Values and Valuation of Nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Balvanera P., Pascual U., Christie M., Baptiste B., González-Jiménez D.(eds.). IPBES secretariat, Bonn, Germany. https://doi.org/10.5281/zenodo.6522522

[9] Waarts YR , V Janssen, R Aryeetey, D. Onduru, D Heriyanto, S Tin Aprilliya, N Guessan, L Courbois, D Bakker, VJ Ingram. 2021. Multiple pathways towards achieving a living income for different types of smallholder tree-crop commodity farmers. Food Security. 13:1467–1496. doi: 10.1007/s12571-021-01220-5.

[10] Tokou BA, Coral C, Montiel FI, Adou Yao CY, Sieber S and Löhr K. 2025. Diversification strategies to improve cocoa farmers' household income: the case of Côte d'Ivoire. Front. Sustain. Food Syst. 9:1524997. doi: 10.3389/fsufs.2025.1524997.

Standard Instrument for Measuring Sustainable Agriculture Using Multiaspect Sustainability Analysis (MSA)

Table 1. Environment Aspects

No	Factor	No	Indicator	Additional Criteria
1	Biodiversity and Wildlife Protection[6]	0	There is no assessment criteria	• Natural ecosystems, wildlife habitats, and biodiversity are protected • Deforestation is absent • Natural vegetation is conserved • Wildlife is protected.
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are three assessment criteria	
		4	There are all assessment criteria	
2	Soil Conservation and Soil Fertility Management[6]	0	There is no assessment criteria	• Soil fertility is maintained through soil conservation. • Soil fertility is maintained through the use of organic matter. • Soil fertility is maintained through erosion control. • Sustainable farming practices are practiced.
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are three assessment criteria	
		4	There are all assessment criteria	
3	Water Resources and Riparian Zone Management[6]	0	There is no assessment criteria	• Efficient water use. • Maintained water source/channel quality. • Riparian zone protection. • Water resource conservation measures.
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are three assessment criteria	
		4	There are all assessment criteria	
4	Waste, Wastewater, and Pollution Management[6]	0	There is no assessment criteria	• Safe solid waste management. • Safe liquid waste management. • Minimized soil and water pollution. • Effective waste management systems are in place.
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are three assessment criteria	
		4	There are all assessment criteria	
5	Integrated Pest Management and Reducing the Use of Agrochemicals[6]	0	Pest control relies entirely on chemical pesticides and does not use PPE (Personal Protective Equipment)	
		1	Pest control relies entirely on chemical pesticides and does not use PPE	
		2	Pesticide use is being reduced and applied selectively (only when pest populations exceed economic thresholds), and does not use PPE	
		3	Pesticide use is being reduced and applied selectively (only when pest populations exceed economic thresholds), and does use PPE	
		4	Planting refuge plants, using biological agents, and chemical pesticides are the last control options.	
6	Energy Efficiency and Reducing Greenhouse Gas Emissions[6]	0	There is no assessment criteria	• Efficient energy use in agricultural operations. • Reduced greenhouse gas emissions in agricultural operations. • Climate change mitigation practices are implemented in agricultural operations
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are all assessment criteria	
7	Climate Change Adaptation and Agroforestry Development[6]	0	There is no assessment criteria	• Agroforestry systems are implemented • Climate change adaptation strategies are implemented • Resilience to climate risks is increased
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are all assessment criteria	

Table 2. Socio-Economic Aspects

No	Factor	No	Indicator	Additional Criteria
1	Living Wages and Income[6]	0	Workers do not receive a living wage and farmers' incomes do not meet a decent standard of living.	
		1	Workers earn a living wage and farmers' incomes do not meet a decent standard of living.	
		2	Workers earn a living wage and farmers' incomes meet a decent standard of living.	
2	Agricultural Productivity and Agricultural Profitability[6]	0	There is no assessment criteria	• Optimal crop productivity • Increased production efficiency • Stable farming profitability
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are all assessment criteria	
3	Household Income Diversification[9][10]	0	Farmer Households have only one type of crop on the same area	
		1	Farmer Households have one or more types of crops on the same area	
		2	Farmer Households have one or more types of crops on additional land	
		3	Farmer Households diversify their management of plantation products effectively	
4	Access to Financial Services and Sustainable Investment[6]	0	There is no assessment criteria	• Farmers have access to financial services, • Farmers have access to sustainable investments, • Farmers have access to business credit, • Farmers have access to agricultural financing support
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are three assessment criteria	
		4	There are all assessment criteria	
5	Health, Safety, and Working Conditions[6]	0	The employee's work environment is unsafe and unhealthy	
		1	Safe and healthy employee work environment	
		2	The employee work environment is safe and healthy; and workers receive adequate health and safety protection.	
		3	The employee work environment is safe and healthy; and workers receive adequate occupational health and safety protection.	
6	Capacity Building, Training, and Agricultural Extension Services[6]	0	There is no assessment criteria	• Farmers and workers receive regular training, • Farmers and workers receive extension services, • Farmers and workers receive continuous capacity building
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are all assessment criteria	
7	Efficient Utilization of Agricultural Inputs[6]	0	The use of fertilizers, pesticides, water and energy is not done efficiently.	
		1	The use of fertilizers, pesticides, water and energy is carried out efficiently or based on needs.	
		2	The use of fertilizers, pesticides, water and energy is carried out efficiently and based on needs.	

No	Factor	No	Indicator	Additional Criteria
8	Household Economic Resilience[6]	0	Farming households lack the capacity to withstand economic, climate, and market risks.	
		1	Farming households have the capacity to withstand economic risks, but not climate change and markets.	
		2	Farming households have the capacity to withstand economic and climate risks, but not market changes.	
		3	Rumah tangga petani memiliki kemampuan bertahan terhadap risiko ekonomi, perubahan iklim, dan pasar.	

Table 3. Legal and Institutional Aspects

No	Factor	No	Indicator	Additional Criteria
1	Compliance with Regulations and Sustainability Standards[6]	0	No compliance with national regulations, sustainability standards, and certification requirements	
		1	Compliance with national regulations, but not with sustainability standards and certification requirements	
		2	Compliance with national regulations and sustainability standards, but not with certification requirements	
		3	High compliance with national regulations, sustainability standards, and certification requirements	
2	Institutional Capacity and Management of Farmer Organizations[6]	0	There is no assessment criteria	• Farmer organizations have management capacity • Farmer organizations have effective governance capacity • Farmer organizations have effective strategic planning capacity
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are all assessment criteria	
3	Risk Assessment and Management Plan Implementation[6]	0	No regular risk assessments	
		1	Perform regular risk assessments	
		2	Perform regular risk assessments or integrate them into the annual management plan or	
		3	Perform regular risk assessments and integrate them into the annual management plan or	
4	Internal Inspection, Monitoring, and Evaluation System[6]	0	No internal monitoring and evaluation systems	
		1	Internal monitoring and evaluation systems are in place and run intermittently	
		2	Internal monitoring and evaluation systems are in place but not documented	
		3	Internal monitoring and evaluation systems are in place and run regularly and are well documented	
5	Complaints, Correction, and Transparency Mechanism[6]	0	There are no assessment criteria	• Transparent (the complaint handling process and status are clear/open) • Easily Accessible (complaint channels are accessible to all levels of farmers/workers) • Responsive (there is prompt follow-up and a guaranteed resolution time) • Protecting Reporters (there is an anonymity system or guaranteed security from intimidation/whistleblower protection)
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are three assessment criteria	
		4	There are all assessment criteria	
6	Product Traceability and Documentation System[6]	0	Agricultural products cannot be traced	
		1	Agricultural products can be traced properly through an accurate documentation or traceability system	
		2	Agricultural products can be properly traced through an accurate documentation and traceability system.	

No	Factor	No	Indicator	Additional Criteria
7	Digitalization, Geolocation, and Agricultural Mapping System[6]	0	The farm lacks geolocation data, digital maps, and a spatial information system.	
		1	The farm has geolocation data, digital maps, and a spatial information system, but they are incomplete.	
		2	The farm has complete geolocation data, digital maps, and a spatial information system, but they are not updated.	
		3	The farm has complete geolocation data, digital maps, and a spatial information system, which are updated regularly.	
8	Stakeholder Participation in Governance and Decision-Making[6]	0	There are no farmers or female workers involved in decision-making.	
		1	There are workers and stakeholders actively involved in decision-making.	
		2	There are farmers, workers, and stakeholders actively involved in decision-making.	
		3	There are farmers, male and female workers, and stakeholders actively involved in decision-making.	

Tabel 4. Cultural Aspects

No	Factor	No	Indicator	Additional Criteria
1	Gender Equality and Women's Empowerment[6]	0	There are no assessment criteria	• Women have equal access to work participation • Women have equal access to training/capacity building • Women have equal access to leadership • Women have equal access to decision-making.
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are three assessment criteria	
		4	There are all assessment criteria	
2	Youth Participation in Agriculture[6]	0	There are no assessment criteria	• Young people are actively involved in agricultural activities • Young people are actively involved in agricultural training • Young people are actively involved in providing agricultural innovation/technology • Young people are actively involved in creating farmer regeneration.
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are three assessment criteria	
		4	There are all assessment criteria	
3	Protection of Human Rights and Labor Rights[6]	0	Human Rights and Workers' Rights are not respected in all agricultural activities.	
		1	Human rights and workers' rights are respected in all agricultural activities.	
		3	Human rights are fulfilled and workers' rights are respected, but not protected, in all agricultural activities.	
		4	Human rights are fulfilled and workers' rights are respected and protected in all agricultural activities.	
4	Prevention of Discrimination, Violence, and Harassment[6]	0	There is no assessment criteria	• There is no discrimination in the workplace and community. • There are no acts of violence in the workplace and community. • There are no acts of harassment in the workplace and community.
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are all assessment criteria	
5	Prevention of Child Labor and Forced Labor[6]	0	Child labor and forced labor are present throughout the production chain.	
		1	Child labor and forced labor are present throughout the production chain.	
		2	No child labor or forced labor is present throughout the production chain.	
		3	No child labor and forced labor is present throughout the production chain.	
6	Freedom of Association and Strengthening Social Cohesion[6]	0	There is no assessment criteria	• Freedom of association for workers is respected • Social relations between workers are harmonious • Social relations with the community are harmonious
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are all assessment criteria	

No	Factor	No	Indicator	Additional Criteria
7	Community Participation and Local Community Empowerment[6]	0	Local communities are not involved in development activities and do not receive economic and social benefits.	
		1	Local communities are involved in development activities but do not receive economic and social benefits.	
		2	Local communities are involved in development activities and receive economic or social benefits.	
		3	Local communities are involved in development activities and receive economic and social benefits.	
8	Preservation of Local Values, Traditions, and Indigenous Knowledge[6]	0	There is no assessment criteria	• Local Cultural Values are Maintained • Traditional knowledge is maintained • Agricultural practices based on local wisdom are maintained
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are all assessment criteria	

Table 5. Infrastructure Aspects

No	Factor	No	Indicator	Additional Criteria
1	Agricultural Processing and Storage Infrastructure[6]	0	Agricultural processing and storage facilities are not available.	
		1	Agricultural processing and storage facilities are available.	
		2	Hygienic and efficient agricultural processing and storage facilities are available.	
		3	Hygienic, efficient, and safe agricultural processing and storage facilities are available.	
2	Irrigation and Water Conservation Infrastructure[6]	0	Irrigation and water conservation infrastructure is not functioning properly.	
		1	Irrigation and water conservation infrastructure is not functioning properly.	
		2	Irrigation and water conservation infrastructure is functioning properly, but does not support efficient water use.	
		3	Irrigation and water conservation infrastructure is functioning properly and supports efficient water use.	
3	Waste Management and Sanitation Infrastructure[6]	0	Lack of sanitation infrastructure	
		1	Availability of community sanitation infrastructure	
		2	Sanitation and waste management infrastructure is available, but does not meet environmental standards	
		3	Sanitation and waste management infrastructure is available, but does not meet environmental standards	
4	Workplace Health, Safety, and Housing Infrastructure[6]	0	There is no assessment criteria	• Worker occupational health facilities are in adequate condition. • Worker occupational safety facilities are available in adequate condition. • Worker housing facilities are available in adequate condition.
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are all assessment criteria	
5	Information Technology and Agricultural Digitalization Infrastructure[6]	0	There is no digital agricultural infrastructure.	
		1	There is digital agricultural infrastructure that supports agricultural data collection.	
		2	There is digital agricultural infrastructure that supports agricultural data collection and monitoring.	
		3	There is digital agricultural infrastructure that supports the collection, monitoring, and management of sustainability information.	
6	Traceability Infrastructure and Certification Data Systems[6]	0	The product certification and traceability data system is not operating effectively	
		1	The product certification and traceability data system is not operating effectively	
		2	The product certification and traceability data system is operating effectively and is well documented	
		3	The product certification and traceability data system is operating effectively and is well documented	

No	Factor	No	Indicator	Additional Criteria
7	Energy and Energy Efficiency Infrastructure[6]	0	Energy infrastructure does not support energy efficiency.	
		1	Energy infrastructure supports energy efficiency.	
		2	Energy infrastructure supports energy efficiency or more environmentally friendly energy use.	
		3	Energy infrastructure does not support energy efficiency.	
8	Training, Extension, and Technical Services Infrastructure[6]	0	There is no assessment criteria	• Training facilities are available to support farmer capacity building. • Extension services are available to support farmer capacity building. • Technical service facilities are available to support farmer capacity building.
		1	There is one assessment criteria	
		2	There are two assessment criteria	
		3	There are all assessment criteria	

Standar Instrument Penilaian Pertanian Berkelanjutan
***Multiaspect Sustainability Analysis* (MSA)**
(Versi Bahasa Indonesia)

Tabel 1. Aspek Lingkungan

No	Faktor	No	Indikator	Kriteria Tambahan
1	Keanekaragaman Hayati dan Perlindungan Satwa Liar[6]	0	Tidak terdapat salah satu kriteria penilaian	• Ekosistem alami, habitat satwa liar, keanekaragaman hayati terlindungi • Tidak terjadi Deforestasi • Terdapat konservasi vegetasi alami • Terdapat perlindungan satwa.
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat tiga kriteria penilaian	
		4	Terdapat empat kriteria penilaian	
2	Konservasi Tanah dan Pengelolaan Kesuburan Tanah[6]	0	Tidak terdapat satu kriteria penilaian	• Kesuburan tanah dipelihara melalui konservasi tanah, • Kesuburan tanah dipelihara melalui penggunaan bahan organik • Kesuburan tanah dipelihara melalui pengendalian erosi • Terjadi Praktik Budidaya Berkelanjutan
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat tiga kriteria penilaian	
		4	Terdapat semua kriteria penilaian	
3	Pengelolaan Sumber Daya Air dan Zona Tepi Sungai[6]	0	Tidak terdapat satu kriteria penilaian	• Penggunaan air efisien, • Kualitas sumber/saluran air terjaga, • Perlindungan zona riparian, • Tindakan konservasi sumber daya air.
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat tiga kriteria penilaian	
		4	Terdapat semua kriteria penilaian	
4	Pengelolaan Limbah, Air Limbah, dan Polusi[6]	0	Tidak terdapat satu kriteria penilaian	• Pengelolaan Limbah padat secara aman; • Pengelolaan Limbah cair secara aman; • Pencemaran tanah dan air diminimalkan; • Tersedia sistem pengelolaan limbah yang efektif.
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat tiga kriteria penilaian	
		4	Terdapat semua kriteria penilaian	
5	Pengelolaan Hama Terpadu dan Pengurangan Penggunaan Bahan Kimia Pertanian[6]	0	Pengendalian hama bertumpu penuh pada pestisida kimia serta tidak memakai APD (Alat Pelindung Diri)	
		1	Pengendalian hama bertumpu penuh pada pestisida kimia serta memakai APD	
		2	Penggunaan pestisida mulai dikurangi dan diaplikasikan secara selektif (hanya saat populasi hama melewati ambang batas ekonomi), dan tidak menggunakan APD	
		3	Penggunaan pestisida mulai dikurangi dan diaplikasikan secara selektif (hanya saat populasi hama melewati ambang batas ekonomi), dan menggunakan APD	
		4	Penanaman tanaman refugia, Penggunaan Agen Hayati, serta pestisida kimia menjadi opsi terakhir pengendalian.	
6	Efisiensi Energi dan Pengurangan Emisi Gas Rumah Kaca[6]	0	Tidak terdapat satu kriteria penilaian	• Penggunaan energi efisien dalam operasional pertanian; • Emisi gas rumah kaca berkurang dalam operasional pertanian; • Terdapat praktik mitigasi perubahan iklim dalam operasional pertanian
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat semua kriteria penilaian	
7	Adaptasi Perubahan Iklim dan Pengembangan Agroforestri[6]	0	Tidak terdapat satu kriteria penilaian	• Sistem Agroforestri diterapkan • Terdapat strategi adaptasi perubahan iklim • Ketahanan terhadap resiko iklim meningkat
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat semua kriteria penilaian	

Tabel 2. Aspek Sosial Ekonomi

No	Faktor	No	Indikator	Kriteria Tambahan
1	Upah dan Penghasilan yang Layak[6]	0	Pekerja tidak memperoleh upah layak dan pendapatan petani tidak memenuhi standar hidup layak	
		1	Pekerja memperoleh upah layak dan pendapatan petani tidak memenuhi standar hidup layak	
		2	Pekerja memperoleh upah layak dan pendapatan petani memenuhi standar hidup layak	
2	Produktivitas Pertanian dan Keuntungan Pertanian[6]	0	Tidak terdapat kriteria penilaian	• Produktivitas tanaman optimal, • Efisiensi produksi meningkat, • Profitabilitas usaha tani stabil.
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat seluruh kriteria penilaian	
3	Diversifikasi Pendapatan Rumah Tangga[9][10]	0	Rumah Tangga Petani memiliki hanya satu jenis tanaman pada luasan sama	
		1	Rumah Tangga Petani memiliki satu atau lebih jenis tanaman pada luasan sama	
		2	Rumah Tangga Petani memiliki satu atau lebih jenis tanaman pada luasan tambahan	
		3	Rumah Tangga Petani melakukan diversifikasi pengelolaan produk perkebunan yang berjalan efektif	
4	Akses ke Layanan Keuangan dan Investasi Berkelanjutan[6]	0	Tidak terdapat kriteria penilaian	• Petani memiliki akses terhadap layanan keuangan, • Petani memiliki akses terhadap investasi keberlanjutan, • Petani memiliki akses terhadap kredit usaha • Petani memiliki akses terhadap dukungan pembiayaan pertanian
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat tiga kriteria penilaian	
		4	Terdapat keempat kriteria penilaian	
5	Kesehatan, Keselamatan, dan Kondisi Kerja[6]	0	Lingkungan kerja pegawai tidak aman dan tidak sehat;	
		1	Lingkungan kerja pegawai aman dan sehat;	
		2	Lingkungan kerja pegawai aman dan sehat; serta pekerja memperoleh perlindungan kesehatan atau keselamatan kerja yang memadai	
		3	Lingkungan kerja pegawai aman dan sehat; serta pekerja memperoleh perlindungan kesehatan dan keselamatan kerja yang memadai	
6	Peningkatan Kapasitas, Pelatihan, dan Layanan Penyuluhan Pertanian[6]	0	Tidak terdapat kriteria penilaian	• Petani dan pekerja memperoleh pelatihan rutin, • Petani dan pekerja memperoleh layanan penyuluhan • Petani dan pekerja memperoleh peningkatan kapasitas berkelanjutan
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat seluruh kriteria penilaian	
7	Efisiensi Pemanfaatan Input Pertanian[6]	0	Penggunaan pupuk, pestisida, air, dan energi tidak dilakukan secara efisien	
		1	Penggunaan pupuk, pestisida, air, dan energi dilakukan secara efisien atau berbasis kebutuhan	
		2	Penggunaan pupuk, pestisida, air, dan energi dilakukan secara efisien dan berbasis kebutuhan	

No	Faktor	No	Indikator	Kriteria Tambahan
8	Ketahanan Ekonomi Rumah Tangga[6]	0	Rumah tangga petani tidak memiliki kemampuan bertahan terhadap risiko ekonomi, iklim, dan pasar.	
		1	Rumah tangga petani memiliki kemampuan bertahan terhadap risiko ekonomi, namun tidak untuk perubahan iklim, dan pasar.	
		2	Rumah tangga petani memiliki kemampuan bertahan terhadap risiko ekonomi, dan iklim, namun tidak untuk perubahan pasar.	
		3	Rumah tangga petani memiliki kemampuan bertahan terhadap risiko ekonomi, perubahan iklim, dan pasar.	

Tabel 3. Aspek Hukum dan Kelembagaan

No	Faktor	No	Indikator	Kriteria Tambahan
1	Kepatuhan terhadap Peraturan dan Standar Keberlanjutan[6]	0	Tidak ada kepatuhan terhadap regulasi nasional, standar keberlanjutan, dan persyaratan sertifikasi	
		1	Terdapat Kepatuhan terhadap regulasi nasional, namun tidak terhadap standar keberlanjutan, dan persyaratan sertifikasi	
		2	Terdapat Kepatuhan terhadap regulasi nasional, dan standar keberlanjutan, namun tidak terhadap persyaratan sertifikasi	
		3	Kepatuhan tinggi terhadap regulasi nasional, standar keberlanjutan, dan persyaratan sertifikasi	
2	Kapasitas Kelembagaan dan Manajemen Organisasi Petani[6]	0	Tidak terdapat kriteria penilaian	• Organisasi petani memiliki kapasitas manajemen • Organisasi petani memiliki kapasitas tata kelola yang efektif • Organisasi petani memiliki kapasitas perencanaan strategis yang efektif
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat seluruh kriteria penilaian	
3	Penilaian Risiko dan Implementasi Rencana Manajemen[6]	0	Tidak melakukan penilaian risiko secara berkala	
		1	Melakukan penilaian risiko secara berkala	
		2	Melakukan penilaian risiko secara berkala atau mengintegrasikannya ke dalam rencana manajemen tahunan atau	
		3	Melakukan penilaian risiko secara berkala dan mengintegrasikannya ke dalam rencana manajemen tahunan atau	
4	Sistem Inspeksi, Pemantauan, dan Evaluasi Internal[6]	0	Tidak terdapat Sistem internal, monitoring, dan evaluasi	
		1	Terdapat Sistem internal, monitoring, dan evaluasi yang berjalan sesekali	
		2	Terdapat Sistem internal, monitoring, dan evaluasi yang berjalan rutin, namun tidak terdokumentasi	
		3	Terdapat Sistem internal, monitoring, dan evaluasi yang berjalan rutin, serta terdokumentasi dengan baik	
5	Mekanisme Pengaduan, Perbaikan, dan Transparansi[6]	0	Tidak terdapat kriteria penilaian	• Transparan (proses dan status penanganan keluhan jelas/terbuka) • Mudah Diakses (saluran pengaduan terjangkau oleh semua lapisan petani/pekerja) • Responsif (adanya tindak lanjut yang cepat dan kepastian waktu penyelesaian) • Melindungi Pelapor (adanya sistem anonimitas atau jaminan keamanan dari intimidasi/whistleblower protection
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat tiga kriteria penilaian	
		4	Terdapat empat kriteria penilaian	

No	Faktor	No	Indikator	Kriteria Tambahan
6	Sistem Ketelusuran dan Dokumentasi Produk[6]	0	Produk Pertanian tidak dapat ditelusuri	
		1	Produk Pertanian dapat ditelusuri dengan baik melalui sistem dokumentasi atau keterlacakan yang akurat	
		2	Produk Pertanian dapat ditelusuri dengan baik melalui sistem dokumentasi dan keterlacakan yang akurat	
7	Digitalisasi, Geolokasi, dan Sistem Pemetaan Pertanian[6]	0	Kebun tidak memiliki data geolokasi, peta digital, dan sistem informasi spasial	
		1	Kebun memiliki data geolokasi, peta digital, dan sistem informasi spasial, namun tidak lengkap	
		2	Kebun memiliki data geolokasi, peta digital, dan sistem informasi spasial yang lengkap, namun belum diperbarui	
		3	Kebun memiliki data geolokasi, peta digital, dan sistem informasi spasial yang lengkap, dan diperbarui berkala	
8	Partisipasi Pemangku Kepentingan dalam Tata Kelola dan Pengambilan Keputusan[6]	0	Tidak terdapat petani, pekerja perempuan yang terlibat dalam pengambilan keputusan	
		1	Terdapat pekerja dan pemangku kepentingan yang terlibat aktif dalam pengambilan keputiusan	
		2	Terdapat petani, pekerja, dan pemangku kepentingan yang terlibat aktif dalam pengambilan keputiusan	
		3	Terdapat petani, pekerja laki-laki dan perempuan, seerta pemangku kepentingan yang terlibat aktif dalam pengambilan keputiusan	

Tabel 4. Aspek Budaya

No	Faktor	No	Indikator	Kriteria Tambahan
1	Kesetaraan Gender dan Pemberdayaan Perempuan[6]	0	Tidak terdapat kriteria penilaian	• Perempuan memiliki akses setara terhadap partisipasi kerja • Perempuan memiliki akses setara terhadap pelatihan/ peningkatan kapasitas • Perempuan memiliki akses setara terhadap Kepemimpinan • Perempuan memiliki akses setara terhadap pengambilan keputusan.
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat tiga kriteria penilaian	
		4	Terdapat empat kriteria penilaian	
2	Partisipasi Pemuda dalam Pertanian[6]	0	Tidak terdapat kriteria penilaian	• Kaum muda terlibat aktif dalam kegiatan pertanian • Kaum muda terlibat aktif dalam pelatihan pertanian • Kaum muda terlibat aktif dalam memberikan inovasi/teknologi pertanian • Kaum muda terlibat aktif dalam menciptakan regenerasi petani.
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat tiga kriteria penilaian	
		4	Terdapat empat kriteria penilaian	
3	Perlindungan Hak Asasi Manusia dan Hak Buruh[6]	0	Tidak terdapat pemenuhan Hak Asasi Manusia dan Hak Pekerja dalam seluruh aktivitas pertanian	
		1	Terdapat pemenuhan Hak asasi manusia atau hak pekerja dihormati dalam seluruh aktivitas pertanian.	
		3	Terdapat pemenuhan Hak asasi manusia dan hak pekerja dihormati, namun tidak dilindungi dalam seluruh aktivitas pertanian.	
		4	Terdapat pemenuhan Hak asasi manusia dan hak pekerja dihormati serta dilindungi dalam seluruh aktivitas pertanian.	
4	Pencegahan Diskriminasi, Kekerasan, dan Pelecehan[6]	0	Tidak terdapat kriteria penilaian	• Tidak terdapat diskriminasi di lingkungan kerja dan masyarakat. • Tidak terdapat upaya kekerasan di lingkungan kerja dan masyarakat. • Tidak terdapat uapaya pelecehan di lingkungan kerja dan masyarakat.
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat tiga kriteria penilaian	
5	Pencegahan Pekerja Anak dan Kerja Paksa[6]	0	Terdapat praktik pekerja anak dan kerja paksa dalam seluruh rantai produksi	
		1	Terdapat praktik pekerja anak atau kerja paksa dalam seluruh rantai produksi	
		2	Tidak Terdapat praktik pekerja anak atau kerja paksa dalam seluruh rantai produksi	
		3	Tidak Terdapat praktik pekerja anak dan kerja paksa dalam seluruh rantai produksi	
6	Kebebasan Berserikat dan Penguatan Kohesi Sosial[6]	0	Tidak terdapat kriteria penilaian	• Kebebasan berserikat untuk pekerja dihormati • Hubungan sosial antar pekerja berjalan harmonis • Hubungan sosial dengan masyarakat berjalan harmonis
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat tiga kriteria penilaian	

No	Faktor	No	Indikator	Kriteria Tambahan
7	Partisipasi Masyarakat dan Pemberdayaan Masyarakat Lokal[6]	0	Masyarakat lokal tidak dilibatkan dalam kegiatan pembangunan dan tidak memperoleh manfaat ekonomi serta sosial.	
		1	Masyarakat lokal dilibatkan dalam kegiatan pembangunan, namun tidak memperoleh manfaat ekonomi serta sosial.	
		2	Masyarakat lokal dilibatkan dalam kegiatan pembangunan, dan memperoleh manfaat ekonomi atau sosial.	
		3	Masyarakat lokal dilibatkan dalam kegiatan pembangunan, dan memperoleh manfaat ekonomi serta sosial.	
8	Pelestarian Nilai-Nilai Lokal, Tradisi, dan Pengetahuan Adat[6]	0	Tidak terdapat kriteria penilaian	• Nilai Budaya lokal Dipertahankan • Pengetahuan tradisional tetap dipertahankan • Praktik pertanian berbasis kearifa lokal tetap dipertahankan
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat semua kriteria penilaian	

Tabel 5. Aspek Infrastruktur

No	Faktor	No	Indikator	Kriteria Penilaian
1	Infrastruktur Pengolahan dan Penyimpanan Pertanian[6]	0	Tidak tersedia fasilitas pengolahan dan penyimpanan hasil pertanian	
		1	Tersedia fasilitas pengolahan atau penyimpanan hasil pertanian	
		2	Tersedia fasilitas pengolahan dan penyimpanan hasil pertanian yang higienis atau efisien.	
		3	Tersedia fasilitas pengolahan dan penyimpanan hasil pertanian yang higienis dan efisien, serta aman	
2	Infrastruktur Irigasi dan Konservasi Air[6]	0	Infrastruktur irigasi dan konservasi air tidak berfungsi dengan baik	
		1	Infrastruktur irigasi atau konservasi air tidak berfungsi dengan baik	
		2	Infrastruktur irigasi dan konservasi air berfungsi baik, namun tidak mendukung efisiensi penggunaan air.	
		3	Infrastruktur irigasi dan konservasi air berfungsi baik, serta mendukung efisiensi penggunaan air.	
3	Pengelolaan Limbah dan Infrastruktur Sanitasi[6]	0	Tidak tersedianya Infrastruktur sanitasi	
		1	Tersedianya Infrastruktur sanitasi masyarakat	
		2	Terdapat Infrastruktur sanitasi dan pengelolaan limbah, namun tidak memenuhi standar lingkungan	
		3	Terdapat Infrastruktur sanitasi dan pengelolaan limbah, serta memenuhi standar lingkungan	
4	Infrastruktur Kesehatan, Keselamatan, dan Perumahan Pekerja di Tempat Kerja[6]	0	Tidak terdapat kriteria penilaian	• Fasilitas kesehatan kerja pekerja dalam kondisi layak • Fasilitas keselamatan kerja pekerja tersedia dalam kondisi layak. • Fasilitas perumahan pekerja tersedia dalam kondisi layak.
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat semua kriteria penilaian	
5	Teknologi Informasi dan Infrastruktur Digitalisasi Pertanian[6]	0	Tidak terdapat infrastruktur digital pertanian	
		1	Terdapat Infrastruktur digital pertanian yang mendukung pengumpulan data pertanian	
		2	Terdapat Infrastruktur digital pertanian yang mendukung pengumpulan, dan monitoring data pertanian	
		3	Terdapat Infrastruktur digital pertanian yang mendukung pengumpulan, monitoring, dan pengelolaan informasi keberlanjutan	
6	Infrastruktur Ketertelusuran dan Sistem Data Sertifikasi[6]	0	Sistem data sertifikasi dan keterlacakan produk tidak berjalan efektif	
		1	Sistem data sertifikasi atau keterlacakan produk tidak berjalan efektif	
		2	Sistem data sertifikasi dan keterlacakan produk berjalan efektif dan terdokumentasi dengan baik	
		3	Sistem data sertifikasi dan keterlacakan produk berjalan efektif dan terdokumentasi dengan baik	

No	Faktor	No	Indikator	Kriteria Penilaian
7	Infrastruktur Energi dan Efisiensi Energi[6]	0	Infrastruktur energi tidak mendukung efisiensi energi	
		1	Infrastruktur energi mendukung efisiensi energi	
		2	Infrastruktur energi mendukung efisiensi energi atau penggunaan energi yang lebih ramah lingkungan.	
		3	Infrastruktur energi mendukung efisiensi energi dan penggunaan energi yang lebih ramah lingkungan.	
8	Infrastruktur Pelatihan, Penyuluhan, dan Layanan Teknis[6]	0	Tidak terdapat kriteria penilaian	• Tersedia fasilitas pelatihan yang mendukung peningkatan kapasitas petani • Tersedia fasilitas penyuluhan yang mendukung peningkatan kapasitas petani. • Tersedia fasilitas layanan teknis yang mendukung peningkatan kapasitas petani.
		1	Terdapat satu kriteria penilaian	
		2	Terdapat dua kriteria penilaian	
		3	Terdapat semua kriteria penilaian	