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RESEARCH ARTICLE

Strategy to Accelerate the Green Economy Transition through the Implementation of Climate Smart Agriculture and Circular Economy

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ABSTRACT

The objective of this research is to analyze Strategy to Accelerate the Green Economy Transition Through the Implementation of Climate Smart Agriculture and Circular Economy. This study is research with a mixed-method approach. This research consists of three concepts. There are two data used in this research, which are primary data and secondary data. The analytical methods used in this research are MACTOR and Analytical Hierarchy Process (AHP). The research result shows that the actors with the strongest convergence are the Women Farmers Group, Local Traders, and Farmers Organization. The strong relationships between these actors in the Green Economy Transition Acceleration Strategy. The actors who have a very strong relationship are the Women Farmers Group, Local Traders, and Farmers Organization. The result of the AHP analysis shows that the most prioritized criteria in the Strategy to Accelerate the Green Economy Transition Through the Implementation of Climate Smart Agriculture and Circular Economy in Supporting the Realization of Sustainable Consumption and Production is economic criteria. The most prioritized policy alternative in Strategy to Accelerate the Green Economy Transition Through the Implementation of Climate Smart Agriculture and Circular Economy in Supporting the Realization of Sustainable Consumption and Production is Subsidy assistance for organic fertilizers and pesticides. The suggestion that can be given in this research is that implementing climate-smart agricultural practices requires a strong commitment from stakeholders, so it requires motivation and cooperation between farmers, government, and economic actors. The implementation of climate-smart agricultural practices must be carried out with a coherent strategy that requires close supervision.

INTRODUCTION

Climate change is present as an essential environmental problem faced by modern society. In Malaysia, climate change projections show risks and threats such as an increase in temperature of 0.8-2.0 degrees Celsius, the duration of heat waves, an increase in the duration of dry spells (+2 days), an increase in frequency (3-23%) and intensity (2-7%) of heavy rain events. Climate vulnerability mapping in Malaysia then shows a significant impact, especially on the agricultural sector. Climate change will not only affect the productivity of agricultural products but will also cause economic consequences on agricultural profitability, agricultural supply and demand, and trade prices [1]. This will likely have many cross-sector impacts including socio-economic, such as water scarcity and economic restructuring. It is estimated that by 2100, the impacts of climate change will cost between 2.5-7% of gross domestic product (GDP) with the impacts and burdens of climate change borne disproportionately by those who are most socially and economically vulnerable.

On the other hand, global food demand continues to increase, pushing agricultural activities to continue to increase to balance it. Several studies show that world agricultural production must increase by 70% to meet food demand by 2050 [2] [3] Although increased agricultural production has maintained a balance between production and nature conservation, it has created major challenges in the long-term sustainable management of natural resources [4] [5] [6]. Moreover, modern agricultural systems are considered to lead to waste, such as Europe which produces around 700 million tons of agricultural waste (agriculture and food).

The combination of climate change which has a significant impact on agricultural productivity and global food demand which continues to increase, drives the urgency to immediately formulate the right hands of strategy. Thus, big innovation is needed to make it happen, one of which is through the agricultural circular economy. Circular Agriculture focuses on using minimal amounts of external input, closing nutrition loops, regenerating soil, and minimizing impacts on the environment [7]. If implemented on a wider scale, circular agriculture can reduce resource requirements and the ecological footprint of the agricultural sector [8][42]. It can also help ensure the minimization of land use, chemical fertilizers, and waste, potentially reducing global $CO2$ emissions [9].

The strategy to accelerate the achievement of a green economy based on the implementation of climate-smart agriculture (CSA) is rooted in global challenges related to climate change, environmental degradation, and the need to ensure food security. Increasingly intensive climate change, marked by the increasing frequency of natural disasters such as floods, droughts, and extreme weather, has had a significant impact on the agricultural sector, which is the backbone of the economy in many countries, including Indonesia. On the other hand, conventional agricultural practices that still rely heavily on chemical inputs such as synthetic fertilizers and pesticides often worsen soil degradation, water pollution, and greenhouse gas emissions, thus not being in line with sustainable development goals.

In this context, the green economy has emerged as a development paradigm that prioritizes a balance between economic growth, environmental sustainability, and social inclusiveness. However, the implementation of this concept requires a specific approach in the agricultural sector, given its strategic role in maintaining ecosystem balance while providing food for a growing population. CSA is one of the proposed solutions because this approach not only increases agricultural productivity but also supports adaptation to climate change and mitigation of its impacts. Thus, CSA has great potential to be a catalyst in accelerating the transition to a green economy.

Climate change has become one of the greatest global challenges of this century, with significant impacts on agricultural systems and food security. Rising global temperatures, changing rainfall patterns, and the intensity of natural disasters such as droughts and floods threaten agricultural productivity, which is the backbone of the economy and livelihoods of millions of people, especially in developing countries. On the other hand, the agricultural sector is also a major contributor to greenhouse gas emissions, especially through activities such as land-use change, livestock farming, and the use of chemical fertilizers. To address these challenges, a holistic approach is needed that can not only increase the productivity and adaptation of the agricultural sector to climate change, but also support the transition to a sustainable green economy.

In this context, Climate Smart Agriculture (CSA) has emerged as an innovative approach that integrates three main objectives: increasing productivity sustainably, strengthening resilience to climate change, and reducing greenhouse gas emissions. CSA emphasizes the importance of adopting technology, ecosystem-based agricultural practices, and supporting policies to ensure that the agricultural sector can meet global food needs without compromising the environment. However, the implementation of CSA often faces various challenges, such as limited access for farmers to environmentally friendly technologies, lack of economic incentives, and weak integration of policies across sectors. This shows the need for a comprehensive and contextual implementation strategy, especially to bridge the gap between technological innovation and its application in the field.

The transition to a green economy as a sustainable development paradigm requires integration between CSA strategies with economic, social, and environmental approaches. CSA can be a catalyst in accelerating this transition by creating new opportunities, such as carbon markets, increasing resource efficiency, and empowering rural communities. However, the success of this transition depends on multi-party collaboration, from the government, private sector, academics, to local communities. Therefore, in-depth research is needed to formulate a CSA implementation strategy that is not only technically effective, but also relevant to local needs and able to drive structural transformation towards a green economy.

However, CSA adoption still faces various challenges, ranging from low farmer access to environmentally friendly technology, limited availability of organic farming inputs, to infrastructure and capital issues. On the other hand, policies that support this transition are often not well integrated, so that their implementation is not optimal. In addition, an evidence-based approach is still needed that considers local needs, natural resource potential, and stakeholder participation to ensure the effectiveness of the strategies implemented.

In this context, the Circular Economy of the agricultural sector is a promising strategy to save relevant resources and reduce the negative environmental impacts of agricultural activities while improving economic performance [10] [11]. Circular agriculture is also more labor intensive compared to conventional agriculture, which offers a strategy to stimulate the economy in rural areas. Thus, implementing circular agriculture practices can make an important contribution to poverty alleviation and food security as well as creating new job opportunities, especially for rural women [12][41]. Moreover, in Malaysia, the agricultural sector contributes 14.30% to National GDP with labor absorption reaching 37.13 million people. Without adaptation to climate change through circular agriculture, it is estimated that food crop production in 2050 will decline until it becomes economically unviable [13] [14] [15]. In the future, this condition will not only have an impact on decreasing farming income but will also worsen national poverty. Based on the data of the Central Bureau of Statistics , of the total poor population in Malaysia of 27.54 million people, around 55.79% of this number are in rural areas, with the main livelihood in the small-scale agricultural sector.

The National Commitment to a circular economy in Malaysia can be realized by encouraging Malaysian businesses, government, and CSO stakeholders to pledge their commitment to the circular economy. This initiative will not only accelerate the achievement of Jakstranas targets but also the Sustainable Development Goals (SDGs), especially for Sustainable Consumption and Production So far, the impact of changes in agricultural output due to climate change, both with autonomy and policy adaptation, has not been widely highlighted. The vulnerability of the agricultural sector to climate change and global food demand challenges makes it important to assess its impact on the sector. This work requires the role of all stakeholders to develop appropriate policies. The shift towards a circular economy is a long process and there is no shortcut for it. Therefore, participation from each element, institutional synchronization, and uniformity of parameters in evaluating development achievements, not only from the economic aspect but also from the environmental aspect [16] [17]. Based on this argument, this study attempts to provide a scientific basis for decision-making in promoting a sustainable agricultural circular economy in Malaysia.

The urgency of implementing Climate Smart Agriculture (CSA) is increasing along with the increasing pressure from climate change on the global food system and efforts to transition to a green economy. Climate change not only threatens the sustainability of agricultural production through increasing frequency and intensity of natural disasters such as droughts, floods, and pest attacks, but also exacerbates the socio-economic crisis in areas that are highly dependent on the agricultural sector. Meanwhile, the agricultural sector is also a significant source of greenhouse gas emissions, especially from unsustainable land use practices, deforestation, and excessive use of chemical fertilizers. CSA is a strategic solution to address these challenges because this approach integrates three main objectives: increasing farmer productivity and income, increasing adaptation to climate change, and reducing greenhouse gas emissions. In the context of a green economy, CSA has the potential to support the transformation of agricultural systems to be more efficient and environmentally friendly, thus making a significant contribution to sustainable natural resource management.

However, the urgency of implementing CSA is also driven by the urgent need to address the disparity in access to technology, knowledge, and resources between small and large-scale farmers, which often hinders the inclusive development of the agricultural sector. Implementing CSA requires not only the adoption of innovative technologies, but also supportive policies, financial incentives, strengthening local capacities, and cross-sector collaboration. By accelerating the adoption of CSA, countries can promote rural economic diversification, create new green jobs, and improve global food security. In this context, research on CSA is critical to explore the most effective implementation strategies, identify challenges, and formulate policy recommendations that can accelerate the transition to an inclusive and sustainable green economy.

The novelty concept offered in this research is the formulation of a policy model for the realization of Sustainable Consumption and Production through the development of a combination of climate-smart agriculture and circular economy in the agricultural sector. Previous research related to the realization of Sustainable Consumption and Production only emphasized sustainable agriculture without considering climate change which could affect the agricultural sector. The climate-smart agriculture approach is chosen because the current climate change is a serious threat to the sustainability of the agricultural sector in providing sustainable food. Meanwhile, the circular economy approach is chosen to realize efficient agriculture with minimal waste (zero waste) and to provide safe and sustainable food. The concept promoted is mixed crop-livestock and organic farming, agroforestry, water recycling, and wastewater reuse, which are key elements of a circular agricultural model that aims to reduce CO2 emissions, use natural resources more efficiently, and cut the use of inputs significantly. Meanwhile, the concept promoted related to climate-smart agriculture is a smart agricultural pattern that includes crop diversification, irrigation, water management, and disaster risk management.

The implementation of climate-smart agriculture and circular economy concepts in the agricultural sector is definitely not an easy thing and requires synergy and collaboration between stakeholders. Therefore, this research attemps to map the roles and interactions between stakeholders (actors) who will be involved in implementing climate-smart agriculture) and circular economy in the agricultural sector in order to increase harmonization and reduce the occurrence of conflicts between interests. Meanwhile, to develop policy models that need to be implemented, this research seeks to develop strategic priorities for implementing climate-smart agriculture and circular economy in the agricultural sector from upstream to downstream aspects. The objective of this research is to analyze the Strategy to Accelerate the Green Economy Transition Through the Implementation of Climate Smart Agriculture and Circular Economy.

LITERATURE REVIEW

The theoretical framework for understanding the Agriculture Circular Economy (ACE), Policy Development of Agriculture Circular Economy, and Climate-Smart Agriculture (CSA) focuses on the relationship between environmental sustainability, economic efficiency, and adaptation to climate change in the agricultural sector. ACE is an approach that aims to create an agricultural system based on the principles of a circular economy, where waste and resources are reused in the production cycle. This involves managing organic waste as compost, using water efficiently, and utilizing biomass for renewable energy. This concept aims to reduce greenhouse gas emissions, minimize resource waste, and improve the sustainability of agricultural systems [18] [19][40]. Circular economy in agriculture is an innovative approach that aims to transform traditional linear agricultural systems into sustainable, regenerative, and resource-efficient models. This concept emphasizes the reuse, recycling, and valorization of agricultural waste, transforming it into valuable resources rather than discarding it as by-products. By implementing circular practices, agricultural systems can significantly reduce environmental degradation, minimize waste, and promote the sustainable use of natural resources, all while fostering economic growth.

At its core, the agricultural circular economy seeks to close the loop in resource use. For instance, crop residues, animal manure, and food processing waste can be repurposed into organic fertilizers or biogas, reducing reliance on synthetic inputs and fossil fuels. These practices not only lower greenhouse gas emissions but also enhance soil fertility and biodiversity. Similarly, innovations such as precision farming and agroecological methods align with circular principles by optimizing resource use, reducing water consumption, and minimizing chemical inputs.

Another key element of the agricultural circular economy is its ability to integrate diverse stakeholders, including farmers, researchers, policymakers, and businesses. Collaboration is essential to develop infrastructure, technologies, and policies that support circular practices. For example, agro-industrial symbiosis involves linking farms with industries to utilize waste products efficiently—such as using brewery waste as animal feed. This creates mutually beneficial relationships and stimulates local economies.

Additionally, circular economy models in agriculture promote resilience against climate change. By restoring degraded ecosystems, enhancing water-use efficiency, and adopting regenerative agricultural techniques, farmers can better adapt to changing weather patterns. Circular practices also encourage localized food systems, reducing the carbon footprint associated with transportation and fostering community food security.

However, transitioning to a circular agricultural economy poses challenges, including the need for initial investments, technological advancements, and education for farmers. Addressing these barriers requires coordinated efforts from governments, private sectors, and international organizations to provide incentives, funding, and capacity-building programs.

Ultimately, the circular economy in agriculture offers a promising pathway to achieving sustainable food systems, balancing ecological integrity with economic viability. By rethinking how resources are produced, consumed, and recycled, this approach contributes to global efforts toward sustainability, aligning with the United Nations Sustainable Development Goals (SDGs), particularly those related to responsible consumption and production, climate action, and zero hunger. Adopting circular practices in agriculture is not just an option—it is a necessity for the future of our planet.

Policy development to support ACE is essential in encouraging implementation at the farmer, community, and national levels. Policy development in this context includes regulations that support the use of organic inputs such as environmentally friendly fertilizers and pesticides, incentives for circular technologies, and strengthening value chains that support waste recycling. Good policies must involve various stakeholders, including governments, the private sector, research institutions, and farmers, to ensure the sustainability and scalability of ACE. In addition, this policy needs to include spatial planning that takes into account the potential waste from the agricultural sector, development of infrastructure for waste processing, and support for technological innovation that allows circular systems to be implemented effectively [20].

Climate-Smart Agriculture (CSA) is a comprehensive approach designed to address the intertwined challenges of food security and climate change. As global temperatures rise and weather patterns become increasingly unpredictable, CSA offers a framework to ensure agricultural systems remain productive, resilient, and sustainable. This concept integrates three primary goals: increasing agricultural productivity to meet the needs of a growing population, enhancing resilience to climate variability and extreme weather events, and reducing greenhouse gas emissions from agricultural practices. By harmonizing these objectives, CSA provides a pathway to achieve sustainable development while mitigating climate impacts.

One of the key aspects of CSA is its focus on adopting context-specific practices that suit local environmental, economic, and social conditions. For example, in regions prone to drought, CSA promotes the use of drought-resistant crop varieties, efficient irrigation systems, and water harvesting techniques. In flood-prone areas, strategies such as agroforestry, raised bed farming, and improved drainage systems are encouraged. The flexibility of CSA ensures that farmers can tailor solutions to their unique challenges, thereby maximizing benefits and minimizing risks.

Furthermore, CSA incorporates innovative technologies and traditional knowledge to enhance farming efficiency and sustainability. Precision agriculture tools, such as satellite imagery, sensors, and data analytics, enable farmers to optimize resource use, reduce waste, and monitor crop health. Meanwhile, traditional practices like crop rotation, intercropping, and organic composting are revitalized to improve soil fertility and reduce dependency on chemical inputs. The combination of modern and indigenous techniques under CSA not only boosts productivity but also fosters biodiversity and ecosystem health.

Equally important is the emphasis CSA places on stakeholder collaboration and capacity building. Governments, research institutions, NGOs, and private sector players work together to develop policies, provide financial support, and disseminate knowledge. For instance, insurance schemes and subsidies can help farmers adopt CSA practices, while training programs and extension services equip them with the necessary skills. This collaborative approach ensures that farmers, particularly smallholders, are empowered to make informed decisions and adapt to changing conditions.

Despite its potential, the implementation of CSA faces challenges, including high upfront costs, limited access to technology, and a lack of supportive policies in some regions. Overcoming these barriers requires strategic investments in research, infrastructure, and education, as well as international cooperation to mobilize resources and share best practices. Climate-smart agriculture also necessitates monitoring and evaluation mechanisms to assess its impacts and refine strategies over time.

CSA, on the other hand, is an adaptive approach that aims to increase agricultural productivity, resilience to climate change, and contribution to mitigating greenhouse gas emissions. CSA is closely related to ACE as both focus on sustainability and resource efficiency. CSA encourages practices such as crop rotation, agroforestry, use of climate-resilient seeds, and water-saving technologies, which are in line with the ACE principle of reducing resource waste [21]. In this context, CSA can be considered as a complement to ACE, by providing practical solutions for adaptation and mitigation within a circular economy framework.

This theoretical framework positions ACE as a long-term vision for building a fully sustainable agricultural system, while policy development serves as a key pillar in integrating the ACE concept into real practice. CSA, as an evidence-based approach, is a catalyst that enables the implementation of this strategy on the ground. The concepts of Agriculture Circular Economy (ACE), Policy Development of Agriculture Circular Economy, and Climate-Smart Agriculture (CSA) are interrelated in an effort to realize an agricultural system that is sustainable, efficient, and adaptive to the challenges of climate change. ACE focuses on circular resource management in the agricultural sector, with the main principles of reducing waste, reusing by-products, and maximizing the added value of all components of the agricultural chain [22] [23]. In this approach, organic waste can be processed into compost, biomass is used as renewable energy, and resources such as water and nutrients are reused to support ecosystem sustainability. The main goal of ACE is to create an agricultural system that is not only productive but also environmentally friendly and contributes to the green economy.

In order for the ACE principle to be widely applied, it is necessary to develop a supportive policy, or Policy Development of Agriculture Circular Economy. This policy includes providing incentives for farmers and agribusiness actors to use circular technology, developing adequate waste management infrastructure, and regulations that encourage the use of environmentally friendly inputs such as organic fertilizers and biopesticides [24] [25]. Furthermore, this policy also needs to include financing strategies, such as access to business capital and green credit, to support the adoption of circular technology by farmers, especially in developing countries. Without comprehensive policies, ACE will only be an ideal concept without real implementation in the field.

CSA, as an adaptive approach in the agricultural sector, has a close relationship with ACE because both aim to improve the efficiency of resource use while reducing environmental impacts. CSA focuses on three main pillars, namely increasing productivity sustainably, strengthening resilience to the impacts of climate change, and reducing greenhouse gas emissions from agricultural activities [26] [27] [28]. CSA practices, such as crop rotation, agroforestry, water-saving technologies, and the use of climate-resilient seeds, naturally support the principles of ACE by encouraging better resource efficiency and management. For example, the use of crop residues in the CSA system can be integrated with the principles of ACE by processing the residues into compost or renewable energy [29] [30].

The linkages between ACE, Policy Development of Agriculture Circular Economy, and CSA create strong synergies in building a sustainable agricultural sector. Policies developed to support ACE can strengthen the implementation of CSA by providing relevant regulatory frameworks and incentives [31]. Conversely, CSA can be a key driver in the implementation of ACE by providing practical solutions for resource efficiency and adaptation to climate change.

RESEARCH METHODS

This research is research with a mixed-method approach. This research consists of three concepts. There are two data used in this research, which are primary data and secondary data. The primary data in this research are used to answer the second and third research objectives. Primary data in this research come from the informants selected using the purposive sampling technique. The informants in this research consist of several stakeholders including farmers, government, academics, banks, and businessmen. Primary data in this research are obtained by surveys, in-depth interviews, questionnaires, Focus Group Discussions (FGD), and observations.

The first analysis method in this research is MACTOR. Mactor is based on inter-actor influence. The Mactor method is used to see the preferences of each stakeholder and the level of support for the identified goals.

With this concept, the input to MACTOR is via a position matrix (known as 1MAO [Matrix Actor Objective] and 2MAO) which uses Salience variables from actor to objective. The third matrix is MID (Matrix of Direct Influence) which uses influence variables. In software calculations, user input only requires the MID matrix, 1MAO, and 2 MAO matrices. Then, it will be calculated by a computer through a mathematical algorithm process. Based on the MID matrix, MACTOR then calculates the direct and indirect effects of one actor on other actors as mentioned in Figure (X.X). This matrix is a MIDI matrix (Matrix of Indirect and Direct Influence). The MIDI matrix from A to B is calculated using the formula:

$$MIDI_{A\rightarrow B} = MID_{A\rightarrow B} + \sum\nolimits_{C} [\min(MID_{A\rightarrow C}, MID_{C\rightarrow B})]$$

This matrix is then used in the next stage to determine the "balance of power". Because of the balance of power, we must first calculate the total direct and indirect influence of the actor. If M_A is interpreted as the total direct influence of actor A on another (for example B), then:

$$M_A = \sum\nolimits_{B} (MIDI_{A,B}) - MIDI_{A,A}$$

If we define D_A as the total direct and indirect influence that A receives from other actors (in other words, actor A's dependency), then:

$$D_A = \sum\nolimits_{B} (MIDI_{B,A}) - MIDI_{A,A}$$

By using these two components with the coefficient of basic of power, it is then calculated using the formula:

$$r_A = \left[\frac{(M_A - MIDI_{A,A})}{\sum_A (M_A)}\right] x \left[\frac{M_A}{M_A + D_A}\right]$$

In the next step, MACTOR then calculates the so-called matrix $3MAO$, which is the matrix that becomes the basis and important in the discussion of $MACTOR$. This matrix $3MAO$ resulted from a previous process or is a product of $2MAO$ and r_A or

$$3MAO_{A,i} = 2MAO_{A,i} \times r_A$$

By knowing the matrix $3MAO$, various furniture can be produced. One of them is the mobilization coefficient which shows the reaction of each actor in a situation. This feature is generated through the formula:

$$Mob_A = \sum |3MAO|$$

The analysis result of $3MAO$ also produces features of agreement and disagreement on a goal that is calculated through:

$$Ag_A = \sum\nolimits_a (3MAO_{A,i}(3MAO > 0))$$

$$DisAg_A = \sum\nolimits_a (3MAI_{Ai}(3MAO < 0))$$

Another feature that is also important and is produced from the matrix $3MAO$ is the convergence matrix ($3CCA$) which describes how much actors agree on an issue and divergence ($3DDA$) which describes the opposite situation. The convergence matrix is generated via the equation:

$$3CAA = \frac{1}{2}\sum\nolimits_i (|3MAO_{A,i}| + |3MAO_{B,i}|)(3MAO_{A,i} \times 3MAO_{B,i} > 0)$$

Meanwhile, the divergence matrix is written:

$$3DAA = \frac{1}{2}\sum\nolimits_i (|3MAO_{A,i}| + |3MAO_{B,i}|)(3MAO_{A,i} \times 3MAO_{B,i} < 0)$$

The calculation result of convergence and divergence between actors then produces the final indicator of $MACTOR$, which is the ambivalent coefficient for each actor calculated using the formula:

$$3EQ_i = 1 - \left[\frac{(\sum_k ||3CAA_{i,k} - 3DAA_{i,k}||)}{\sum_k ||3CAA_{i,k} + 3DAA_{i,k}||}\right]$$

These formulas describe the analysis of $MACTOR$. In its implementation, the analytical framework of $MACTOR$ uses the following principles:

Building a table of "strategies of actors".

Identifying strategic issues and objectives

Simply mapping the actor's position in the objective related to the pros and cons of the objectives

Determining the priority goals of each actor

Analyzing the balance of power for each actor

Integration of balance of power in convergence and divergence analysis

The second analysis method is Analytical Hierarchy Process (AHP). This method is a comprehensive decision-making model that consider qualitative and quantitative matters. Through the Analytical Hierarchy Process (AHP) method, several strategies will be produced that can be used to develop strategies for implementing Sustainable Consumption and Production through climate smart agriculture and circular economy in the agricultural sector in Malaysia. Basically, the mathematical formulation of the AHP model is done using a matrix. For example, in an operating subsystem of operational elements, namely operational elements A1, A2,..., An, then the result of pairwise comparison of these operational elements will form a comparison matrix. Pairwise comparisons start from the highest hierarchical level, where a criterion is used as the basis for making comparisons.

RESULTS AND DISCUSSION

The comprehensive understanding of the relationships between actors in supporting the Green Economy Transition Acceleration Strategy begins with mapping the relationships between actors. The result of processing data on the influence between actors using the MACTOR tool can be seen in Table 1 below. The numbers in column Ii show the influence score, while the numbers in row Di show the dependency between actors.

Table 1. Matrix of Influence and Dependences Between Actors

MDII	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	Ii
A1	22	21	15	13	18	13	16	23	12	16	147
A2	19	18	15	13	17	14	14	19	12	14	137
A3	21	21	15	14	18	16	18	21	13	18	160
A4	18	18	14	13	16	14	15	18	12	16	141
A5	17	17	14	13	15	13	15	17	11	14	131
A6	21	21	14	13	15	15	16	21	12	15	148
A7	21	21	14	12	16	13	13	21	12	14	144
A8	24	23	16	14	18	16	18	24	14	17	160
A9	18	18	13	13	15	13	15	18	11	14	137
A10	20	20	14	13	15	13	15	19	12	14	141
Di	179	180	129	118	148	125	142	177	110	138	1446

Information:

A1 : Inorganic farmers

A2 : Organic Farmers

A3 : Women Farmers Group

A4 : Agent

A5 : Processing Industry

A6 : Local Traders

A7 : Farmers Organization

A8 : Department of Agriculture

A9 : Local Community

A10 : Non-Governmental Organizations

Table 1. shows that stakeholders who have high influence in the Green Economy Transition Acceleration Strategy are the Women Farmers Group and the Department of Agriculture with a score of 160 and the actor with the lowest is Processing Industry with a score of 131.

Then, the stakeholders who have a high dependency tendency are Organic Farmers with a score of 180, Inorganic Farmers with a score of 179, and Processing Industry with a score of 148. Meanwhile, the stakeholder with the lowest influence is the Local Community with a score of 110. This can also be seen in Figure 4.1. The following will map stakeholders into the influence and dependence quadrants.

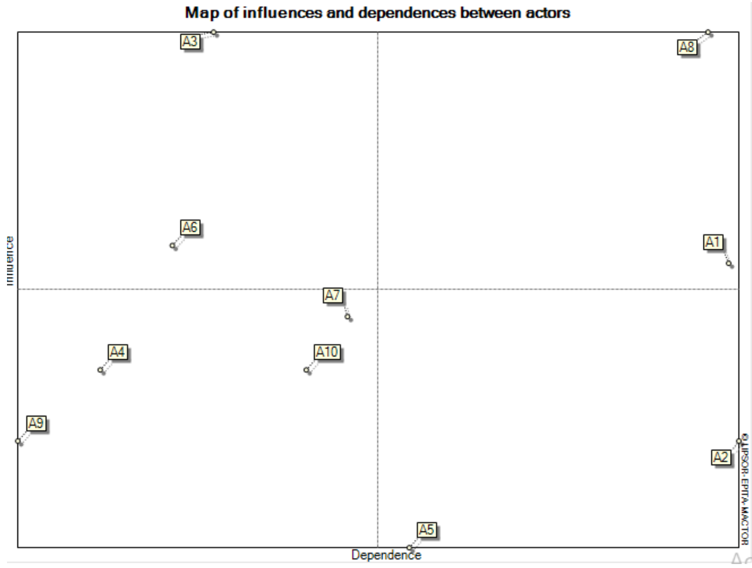

Figure 2. Map of Influences and Dependences between Actors

Source: Processed Primary Data, 2023

Based on Figure 4.2, it can be seen that the actors who have the highest influence and dependence on the Green Economy Transition Acceleration Strategy are Inorganic farmers and the Department of Agriculture.

Actors' Preferences for Objectives

The actor preference matrix for objective, presents the preferences of the actors involved in the Green Economy Transition Acceleration Strategy towards the expected goals or targets which are included in three aspects, namely economic aspects, social aspects, and environmental aspects.

Table 2. Degree of Actor Mobilization and Objectives

2MAO	O1	O2	O3	O4	O5	O6	Absolute sum
A1	-2	-3	-2	-3	2	1	13
A2	2	2	1	2	3	3	13
A3	3	2	1	1	4	3	14
A4	2	2	1	2	3	3	13
A5	2	-3	-2	-1	3	4	15
A6	2	1	2	3	2	4	14
A7	1	2	2	4	3	3	15
A8	2	1	3	2	2	4	14
A9	1	2	1	1	3	3	11
A10	2	1	2	2	3	3	13
Number of agreements	17	13	13	17	28	31	
Number of disagreements	-2	-6	-4	-4	0	0	
Number of positions	19	19	17	21	28	31	

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Information:

O1 : Farmer Household Income

O2 : Increasing Agricultural Production

O3 : Local Economic Improvement

O4 : Continuity of Supply

O5 : Prohibition on the use of chemical fertilizers and pesticides

O6 : Environmental sustainability and agricultural land

Table 2 presents the position of each actor on each target/objective by considering the degree of opinion of the actors regarding the competitiveness target and the hierarchy of targets. The output of this matrix is two, the first is the degree of mobilization which will explain the target/objective that most mobilizes the actors. Second, mobilization which will explain the actors who are most mobilized to use resources to achieve these objectives or goals.

The degree of mobilization (bottom row) shows which goals are expected to become the main issues that provoke stakeholder reactions. In the Green Economy Transition Acceleration Strategy effort, the issues of greatest concern are Environmental sustainability and agricultural land (31) and Prohibition on the use of chemical fertilizers and pesticides (28).

Meanwhile, the most mobilized actors are the Processing Industry (15), and the Farmers Organization (15.) These actors are the actors who are most actively mobilized in responding to problems in the Green Economy Transition Acceleration Strategy. In more detail, we can see the preferences of the actors regarding the issues/goals in the Green Economy Transition Acceleration Strategy in the following picture:

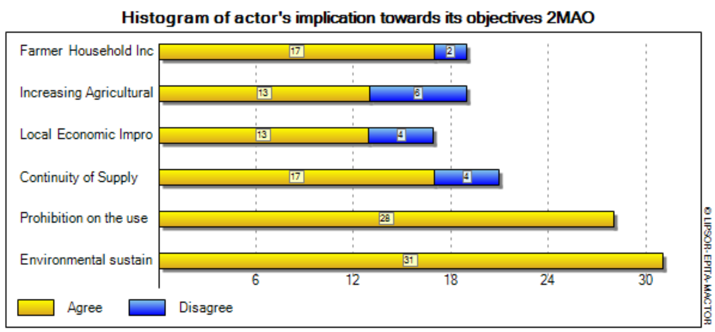


Figure 3. Histogram of Actors' Perceptions of Objectives

Source: Processed Primary Data, 2023

Based on the mapping of perceptions between actors, it can be further explored that the area's objectives have received little resistance or rejection from some actors. However, more actors agree with the targets to be achieved in the Green Economy Transition Acceleration Strategy. There are several objections, namely: Increasing Agricultural Production and Continuity of Supply Chain.

Potential Conflict Between Actors

Analysis of potential conflict between actors aims to identify the actors with the greatest possibility of conflict in the Green Economy Transition Acceleration Strategy. The analysis result of potential conflicts between actors can be seen in the following picture:

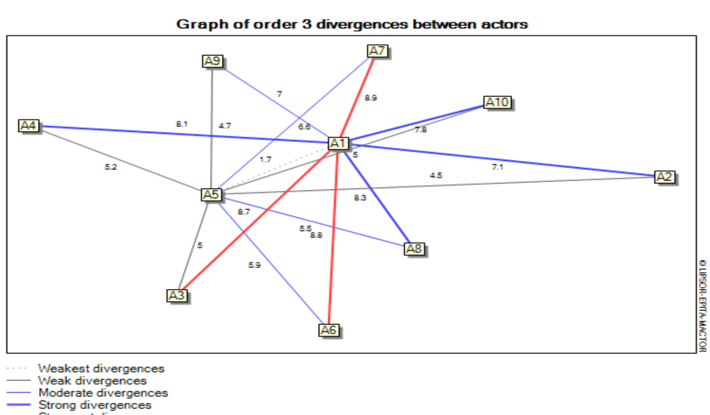


Figure 4. Divergence Matrix between Actors

Source: Processed Primary Data, 2023

Figure 4 shows that in Green Economy Transition Acceleration Strategy efforts, there is the potential for conflicts of interest to arise. The actor activities that most strongly give rise to conflict are Inorganic Farmers, Women Farmers Groups, Local Traders, and Farmers Organizations. These four actors have the potential to give rise to strong category conflicts (strong divergences). Apart from that, these four actors are also prone to conflict with other actors such as Organic Farmers, Agent, Department of Agriculture, and Non-Governmental Organizations. Thus, in implementing the green economy strategy, it is necessary to prioritize a participatory approach and in-depth discussions so that potential conflicts that arise can be minimized.

Potential for Collaboration between Actors

The Green Economy Transition Acceleration Strategy requires synergy and collaboration between actors. The potential for collaboration/cooperation between actors can be seen from the degree of convergence between actors as follows:

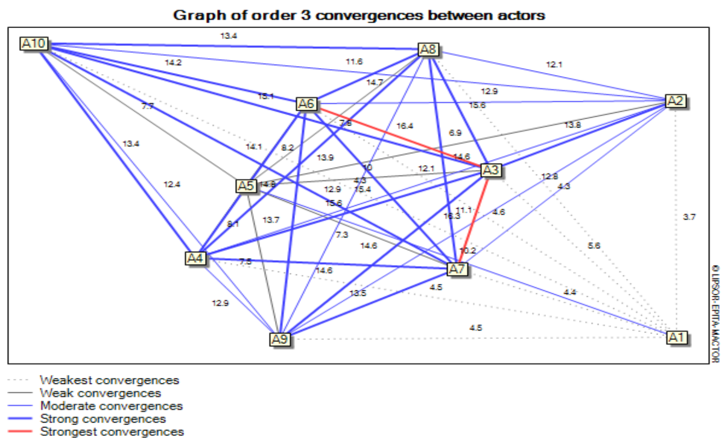


Figure 5. Convergence Matrix between Actors

Source: Processed Primary Data, 2023

Figure 5 explains that the degree of convergence (agreement and approval) between actors in the Green Economy Transition Acceleration Strategy generally tends to be moderate. Based on the objectives/goals and the role they have in mobilizing resources, we can map the actors with the "strongest convergences" who have the most important role in the Green Economy Transition Acceleration Strategy. The actors who have the strongest convergence are the Women Farmers Group, Local Traders, and Farmers Organization.

Map of Net Distances Between Objective

Map of net distances between objectives used to identify goals for which actors take the same position (either pro or cons). This graph maps the objectives with respect to the scale value (the difference between the convergence matrix value and the divergence matrix value as presented in the following image:

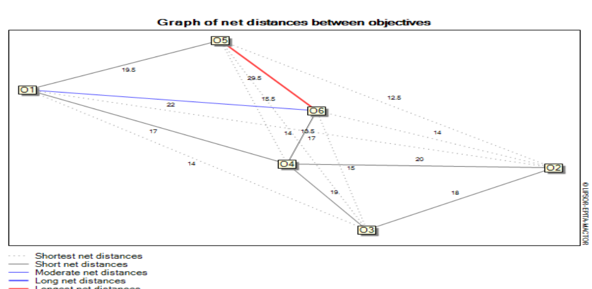


Figure 6. Graph of Net Distance between Objectives

Source: Processed Primary Data, 2023

The image of the net distance between objectives presented in Figure 4.6 illustrates the relationship between program objectives. The possible levels of closeness that occur between objectives are depicted in red and blue. The red color shows a stronger relationship distance than the blue color. The relationship between distances between objectives in the Green Economy Transition Acceleration Strategy where Prohibition on the use of chemical fertilizers and pesticides and Environmental sustainability and agricultural land have a strong relation.

Map of Net Distances between Actor

The net distance between actors illustrates the possibility of cooperation between actors. The possible levels of cooperation between actors are depicted in red and blue. Red indicates a stronger distance that allows for stronger cooperation. The distance graph between actors can be seen in the following picture:

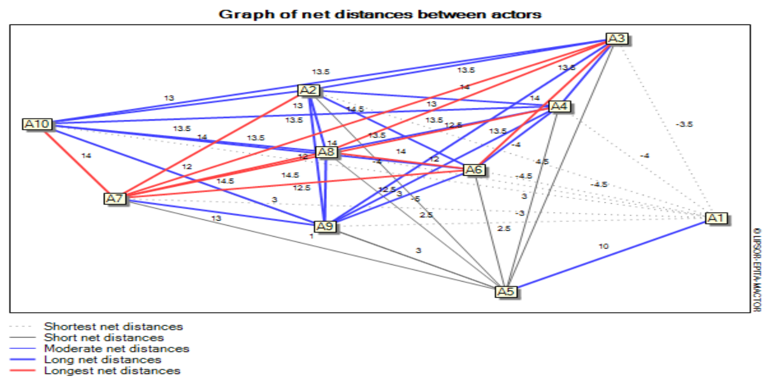


Figure 7. Map of Net Distance between Actors

Source: Processed Primary Data, 2023

The net distance relationship between actors in the Green Economy Transition Acceleration Strategy shows that the relationship between them is very strong (shown in bold red). This shows the strong connection between these actors in the Green Economy Transition Acceleration Strategy. The actors who have a very strong relationship are the Women Farmers Group, Local Traders, and Farmers Organization.

AHP analysis in this research is used to develop priorities of Strategy to Accelerate the Green Economy Transition Through the Implementation of Climate Smart Agriculture and Circular Economy in Supporting the Realization of Sustainable Consumption and Production. The components used for AHP analysis in this research include several criteria and alternatives based on the results of the literature review, previous research, and interviews with key persons who have been determined previously and are competent in the agricultural sector. The results of the analysis between criteria are as follows:

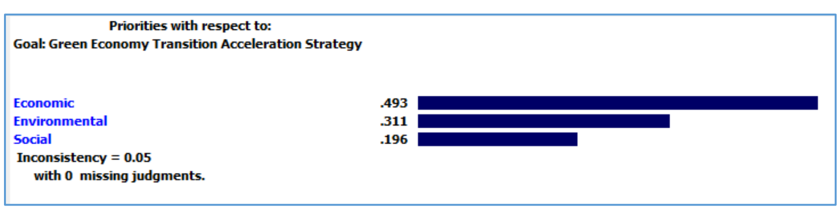


Figure 8. The result of Inter-Criteria Analysis

Source: Output Expert Choice, 2023

Figure 8 explains that the most prioritized criteria in the Strategy to Accelerate the Green Economy Transition Through the Implementation of Climate Smart Agriculture and Cilcular Economy in Supporting the Realization of Sustainable Consumption and Production is economic criteria with a weight value of 0.493 or 49.3%. From the result of the Analytical Hierarchy Process (AHP) calculation with the expert choice 11 programs, the inconsistency ratio result is obtained at 0.05 < 0.10, which means that the answers given by the key persons are consistent.

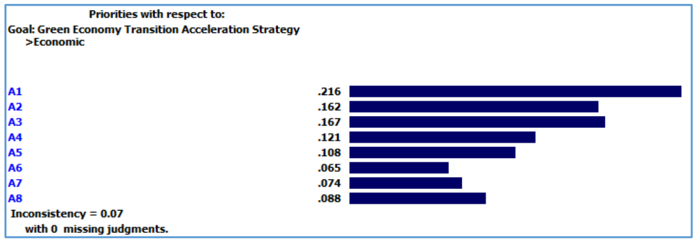


Figure 9. The Result of Analysis Between Alternatives Based on Economic Criteria

Source: Output Expert Choice, 2023

Information:

A1 : Subsidy assistance for organic fertilizers and pesticides

A2 : Access to affordable organic fertilizers and pesticides

A3 : Quality and guarantee of organic fertilizers and pesticides in solving problems

A4 : Prices of organic fertilizers and pesticides are competitive

A5 : Expansion of access to business capital

A6 : Quality irrigation canals

A7 : Sophisticated agricultural equipment technology

A8 : Assistance in providing seeds

Based on Figure 9, it can be explained that the most prioritized alternative based on economic criteria is subsidy assistance for organic fertilizers and pesticides with a weight value of 0.216 or around 2.6%. From the result of the Analytical Hierarchy Process (AHP) calculation with the expert choice 11 programs, the inconsistency ratio result is obtained at 0.05 < 0.10, which means that the answers given by the key persons are consistent.

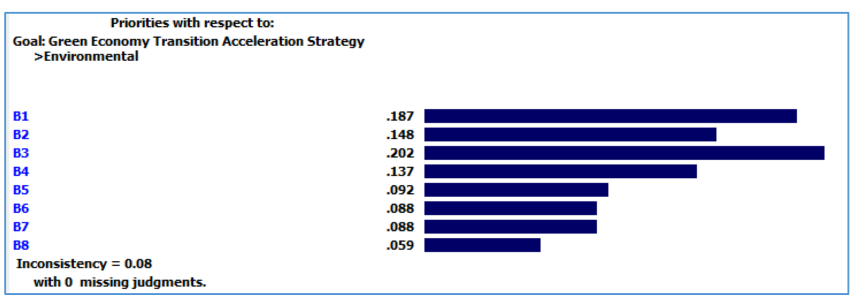


Figure 10. The Result of Analysis Between Alternatives Based on Environmental Criteria

Source: Output Expert Choice, 2023

Information:

B1 : Subsidy assistance for organic fertilizers and pesticides

B2 : Access to affordable organic fertilizers and pesticides

B3 : Quality and guarantee of organic fertilizers and pesticides in solving problems

B4 : Competitive prices of organic fertilizers and pesticides

B5 : Expansion of access to business capital

B6 : Quality irrigation canals

B7 : Advanced agricultural equipment technology

B8 : Assistance in providing seeds

Based on Figure 10, it can be explained that the most prioritized alternative based on environmental criteria is the Quality and guarantee of organic fertilizers and pesticides in solving problems with a weight value of 0.202 or around 20.2%. From the result of the Analytical Hierarchy Process (AHP) calculation with the expert choice 11 programs, the inconsistency ratio result is obtained at 0.08 < 0.10, which means that the answers given by the key persons are consistent.

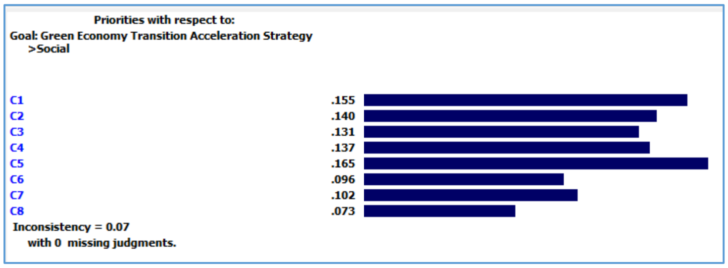


Figure 11. The Result of Analysis Between Alternatives Based on Social Criteria

Source: Output Expert Choice, 2023

Information:

C1 : Subsidy assistance for organic fertilizers and pesticides

C2 : Access to affordable organic fertilizers and pesticides

C3 : Quality and guarantee of organic fertilizers and pesticides in solving problems

C4 : Competitive organic fertilizer and pesticide prices

C5 : Expansion of access to business capital

C6 : Quality irrigation channels

C7 : Sophisticated agricultural equipment technology

C8 : Assistance in providing seeds

Based on Figure 11, it can be explained that the most prioritized alternative based on environmental criteria is the Expansion of access to business capital with a weight value of 0.165 or around 16.5%. From the result of the Analytical Hierarchy Process (AHP) calculation with the expert choice 11 programs, the inconsistency ratio result is obtained at 0.07 < 0.10, which means that the answers given by the key persons are consistent.

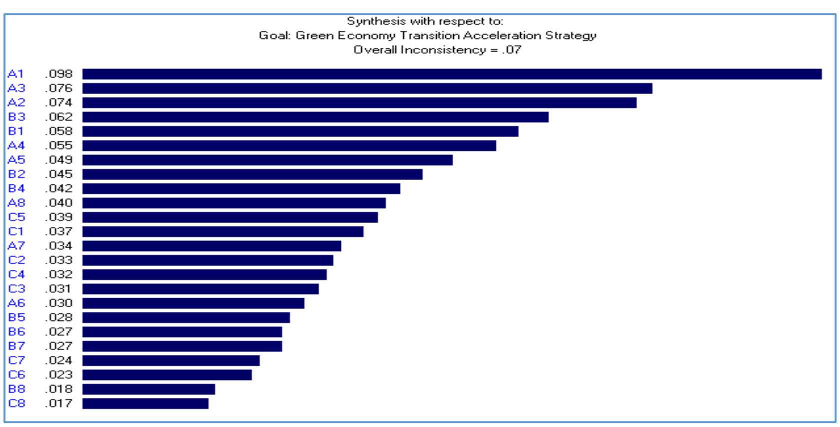
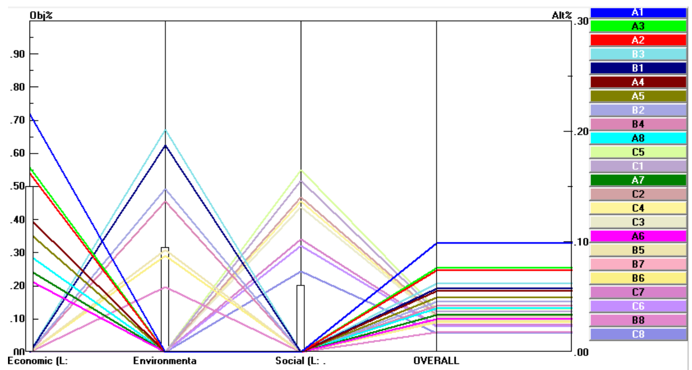


Figure 11. The Result of Analysis Between Alternatives Based on Social Criteria

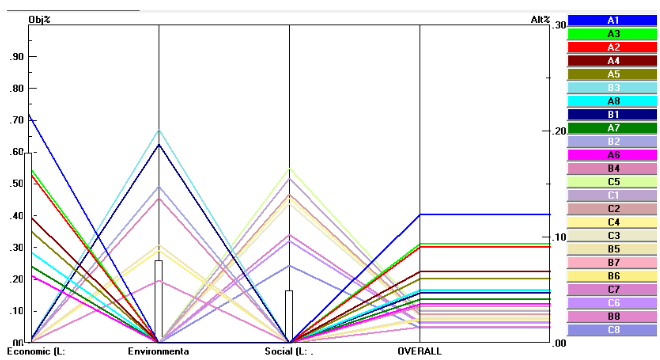
Source: Output Expert Choice, 2023

Figure 11 explains that the most prioritized policy alternative in Strategy to Accelerate the Green Economy Transition Through the Implementation of Climate Smart Agriculture and Circular Economy in Supporting the Realization of Sustainable Consumption and Production is Subsidy assistance for organic fertilizers and pesticides with a weight value of 0.098 or 9.8%. From the result of the Analytical Hierarchy Process (AHP) calculation with the expert choice 11 programs, the inconsistency ratio result is obtained at 0.07 < 0.10, which means that the answers given by the key persons are consistent.

Sensitivity analysis aims to analyze the stability of alternative priorities by creating simulated variations on strategic criteria priorities. Sensitivity analysis can be performed for both criteria and sub-criteria. Sensitivity analysis relates to the question of whether the final results will always be stable if there are changes to the input, either assessment or priority. This analysis will also see whether the change will change the alternative or not. From the sensitivity analysis, the following result is obtained:



Preliminary Result before Simulation



Final Result after Simulation

Figure 12. Sensitivity Analysis Results

Source: Output Expert Choice, 2023

Based on Figure 12, it can be seen that the initial result in the AHP calculation at Strategy to Accelerate the Green Economy Transition Through the Implementation of Climate Smart Agriculture and Circular Economy in Supporting the Realization of Sustainable Consumption and Production, is found that the most prioritized policy alternative is Subsidy assistance for organic fertilizers and pesticides as seen in Figure A. Then after simulating by increasing the economic criteria input from 0.493 or 49.3% to 60%, the prioritized policy alternative remained the same as seen in Figure B. This result shows that the assessment is stable.

DISCUSSION

Efforts to realize qualified and eco-friendly agriculture definitely require innovation and the application of appropriate technology. There needs to be support for agricultural machinery, especially at the planting stage so that farmers can cultivate more effectively. There is also a need for innovation, especially in organic fertilizers and pesticides, to make it more eco-friendly. Sustainable farmer empowerment strategy must prioritize innovation aspects, especially innovation in the production of organic fertilizers and pesticides. Apart from that, farmers' ability to utilize information and communication technology also needs to be improved. With the development of technology, digital markets are now popular in society, so there is a need for innovation and digital marketing of agricultural products [32] [33].

The second aspect that needs to be considered is the need for government input to develop agricultural-friendly policies using the CSA system. The first policy that can be implemented is the need to provide infrastructure to support the implementation of CSA. The infrastructure intended can include plant technology infrastructure, agricultural food terminals, and other infrastructure. In addition, the second policy is the need to provide information and communication facilities for promotional and marketing activities. In this case, the most urgent thing is to create conditions that support the process of eco-friendly product certification. Sustainable farmer empowerment strategies must prioritize aspects of easy access to information and communication technology to support promotion and marketing [34] [35] [36]. Farmers also need capital support to carry out their agricultural activities. Apart from direct assistance, a policy that can be implemented is to assist with easy access to financial sources at low-interest rates so as not to burden farmers.

The next aspect to consider is the institution. Agricultural businesses certainly involve many stakeholders. Of course, these actors must be able to carry out their roles effectively and efficiently. The problem is institutions at the farmer level, in this case farmer groups, still require optimal support, especially to implement the relatively new CSA. There is a need to strengthen partnerships between farmer groups and various stakeholders, both production input suppliers and marketing actors. Besides that, it is also necessary to increase the capacity and quality of agricultural extension organizations because these organizations interact directly with farmers.

Farmers who still use inorganic inputs play a critical role in the transition to more environmentally friendly farming. With education and training, they can be encouraged to adopt CSA technologies, such as more efficient fertilizer use, water-saving irrigation techniques, and monitoring carbon emissions from farming practices. CSA implementation allows inorganic farmers to reduce their negative impact on the environment while increasing productivity. With incentives from the government or local organizations, they can also introduce precision farming technologies that can reduce waste and increase yields.

Organic farmers are pioneers in sustainable farming practices that align with the goals of CSA. They utilize organic materials, such as compost and green manure, which help improve soil quality and reduce carbon footprints. By sharing knowledge and best practices, organic farmers can motivate other farmers to switch to more environmentally friendly farming methods. In addition, organic farmers can be strategic partners in promoting environmentally friendly products, opening up wider and more sustainable market opportunities.

Women's farmer groups play a strategic role in CSA adoption because they are often responsible for managing small plots and food processing. Through empowerment and training, these groups can integrate CSA practices such as agroforestry, crop diversification, and sustainable water resource management. Women’s role in the household also allows them to become agents of change, encouraging their communities to adopt consumption and production patterns that support the green economy.

Agents, such as agricultural extension workers or agribusiness representatives, act as a bridge between CSA technology and farmers. They provide technical information, distribute environmentally friendly agricultural inputs, and help farmers implement the latest innovations. By providing training tailored to local needs, agents can encourage widespread adoption of CSA technology, ensuring that these practices are not only economically profitable but also ecologically sustainable.

Processing industries play a critical role in creating demand for agricultural products produced through CSA practices. They can set sustainability standards in the supply chain, providing incentives for farmers to adopt environmentally friendly practices. In addition, they can process agricultural waste into value-added products such as bioenergy or organic fertilizer, supporting the green economy cycle and reducing carbon emissions from the agricultural sector.

Local traders act as a link between farmers and markets. By promoting transparency in the supply chain and prioritizing CSA products, local traders can create more inclusive and sustainable markets. They can also facilitate farmers' access to premium markets, where products produced through environmentally friendly practices are valued higher, providing an economic incentive for farmers to switch to CSA practices.

Farmer organizations are key actors in driving collective adoption of CSA. By providing training, access to technology, and financing, they can help their members overcome the technical and financial challenges of transitioning to climate-smart agriculture. In addition, they can serve as platforms for policy advocacy that supports the green economy, ensuring that farmers have a voice in decision-making processes.

Agriculture departments play a key role in facilitating the adoption of CSA. Through the development of regulations, subsidies, and technical support, they can create an ecosystem conducive to the adoption of the green economy. In addition, agriculture departments can partner with research institutions to develop locally appropriate CSA technologies and integrate these practices into agricultural extension programs.

Local communities play a key role in supporting the sustainability of CSA by creating a social environment that encourages environmentally friendly practices. Community participation in CSA programs, such as collective water management or restoration of degraded land, can strengthen resilience to climate change. Additionally, community support for local products produced through CSA can help accelerate the transition to a green economy. Non-governmental organizations (NGOs) play a vital role in providing technical support, funding, and advocacy for CSA implementation. They can help build farmer capacity through training, support pilot projects, and facilitate access to international markets. By working with governments and the private sector, NGOs can accelerate CSA adoption and ensure that it supports environmental sustainability while improving farmer welfare.

The strategy to accelerate the achievement of a green economy based on the implementation of climate-smart agriculture (CSA) can be realized through a holistic approach that covers various important aspects. One of the main steps is to provide subsidies for organic fertilizers and pesticides to encourage the adoption of sustainable agricultural practices. This subsidy can help farmers reduce their dependence on chemical fertilizers and pesticides, which are often the cause of environmental degradation, and accelerate the transition to more environmentally friendly agricultural practices. In addition, ensuring affordable access to organic fertilizers and pesticides is important so that farmers, especially small farmers, can easily access the necessary agricultural inputs without the burden of high costs. The government and the private sector need to work together to build an efficient distribution network so that the supply of organic fertilizers and pesticides is evenly available in various regions [37].

The quality and guarantee of organic fertilizer and pesticide products must also be considered through certification and strict supervision to ensure the effectiveness and safety of these products in solving various agricultural problems, such as soil fertility and pest control. By providing high-quality products, farmers' confidence in the use of organic products can increase [38]. In terms of the economy, the price of organic fertilizers and pesticides must remain competitive so that they are not less competitive than conventional chemical products. The government can play an important role through price controls and incentives for producers to maintain price stability in the market [39].

In addition to agricultural inputs, greater access to capital is needed to support farmers in adopting new technologies that often require significant upfront investment. Providing low-interest loans or grants can be an effective solution in this regard. Agricultural infrastructure must also be improved, such as by improving the quality of irrigation channels that support efficient water use, especially in drought-prone areas. The use of modern, environmentally friendly agricultural technology, such as energy-efficient and solar-powered tools, can help increase productivity while reducing the carbon footprint of the agricultural process. In terms of seeds, it is important to provide assistance in the provision of superior seeds that are resistant to climate change such as drought, flooding, or pest attacks, to ensure sustainable harvests amidst increasingly unpredictable climate challenges.

The strategy of accelerating the green economy transition through the implementation of climate-smart agriculture (CSA) and the circular economy presents both significant opportunities and complex challenges. The main opportunity of implementing this strategy is its ability to integrate resource efficiency, climate risk management, and productivity improvement. Climate-smart agriculture can help farmers increase crop yields by utilizing modern technologies, such as precision irrigation, digital soil monitoring, and climate-resilient crop varieties. In addition, this approach supports efforts to reduce greenhouse gas emissions in the agricultural sector, thereby contributing to the achievement of global sustainability targets as stated in the Paris Agreement. The circular economy, on the other hand, opens up opportunities to reduce waste through recycling practices, product design innovation, and material reuse, which not only reduce environmental burdens but also create new jobs in the green sector. Together, these two approaches have the potential to drive economic transformation, encourage green technology innovation, and expand market access for environmentally friendly products.

However, the challenges faced in implementing this strategy are quite significant. The implementation of climate-smart agriculture requires large initial investments, both in the form of infrastructure and farmer training, which are often difficult for low-income groups to access. The technologies needed to support CSA, such as digital systems and data analytics, are also still limited in remote areas. Meanwhile, the transition to a circular economy requires systemic changes in the supply chain, which can face resistance from traditional industries that have long relied on a linear economic model. In addition, regulations and policies that support the implementation of a green economy are often not well integrated, especially in developing countries. Other challenges involve low public awareness of the importance of environmental management and limited access to financing for green innovation.

To overcome these obstacles, strong collaboration between the government, the private sector, and communities is needed. The government can provide incentives, such as subsidies for environmentally friendly technologies or cheap credit for farmers and small businesses. On the other hand, the private sector has an important role in encouraging technological innovation and investment in the green sector. Public education is also key to increasing their acceptance and participation in the implementation of a green economy.

CONCLUSION

Based on the results of the MACTOR analysis, it can be concluded that the stakeholders who have the highest influence in the Green Economy Transition Acceleration Strategy are the Women Farmers Group and the Department of Agriculture with a score of 160 and the actor with the lowest is Processing Industry with a score of 131. Then, there are stakeholders who tend to be highly dependent are Organic Farmers with a score of 180, Inorganic Farmers with a score of 179, and the Processing Industry with a score of 148. Meanwhile, the stakeholder with the lowest influence is the Local Community with a score of 110. This can also be seen in Figure 1. The following will map stakeholders into the influence and dependence quadrants. The degree of convergence (agreement and approval) between actors in the Green Economy Transition Acceleration Strategy generally tends to be moderate. Based on the objectives/goals and the role they have in mobilizing resources, we can map the actors with the "strongest convergences" who have the most important role in the Green Economy Transition Acceleration Strategy. The actors with the strongest convergence are the Women Farmers Group, Local Traders, and Farmers Organization. The strong connection between these actors in the Green Economy Transition Acceleration Strategy. The actors who have a very strong relationship are the Women Farmers Group, Local Traders, and Farmers Organization.

The result of the AHP analysis shows that the most prioritized criteria in the Strategy to Accelerate the Green Economy Transition Through the Implementation of Climate Smart Agriculture and Circular Economy in Supporting the Realization of Sustainable Consumption and Production is economic criteria with a weight value of 0.493 or 49.3%. The most prioritized policy alternative in the Strategy to Accelerate the Green Economy Transition Through the Implementation of Climate Smart Agriculture and Civil Economy in Supporting the Realization of Sustainable Consumption and Production is Subsidy assistance for organic fertilizers and pesticides with a weight value of 0.098 or 9.8 %.

The suggestion that can be given in this research is that implementing climate-smart agricultural practices requires a strong commitment from stakeholders, so it requires motivation and cooperation between farmers, government, and economic actors. The implementation of climate-smart agricultural practices must be carried out with a coherent strategy that requires close supervision. For further research, a more detailed strategic analysis can be carried out by paying attention to upstream and downstream aspects.

The strategy to accelerate the green economy transition through the implementation of climate-smart agriculture and circular economy, it is recommended that the approach used is holistic and based on scientific evidence. Research can focus on the development of innovative technologies that support resource efficiency in the agricultural sector, such as smart irrigation, climate-resistant crop varieties, and data-based monitoring systems. In addition, it is important to explore models for integrating the circular economy into agricultural supply chains, including studies on sustainable consumption patterns, organic waste management, and the potential use of renewable energy in production processes.

Research should also include policy analysis that supports sustainability. This includes evaluating the effectiveness of government incentives for green practices, such as subsidies for environmentally friendly technologies, tax breaks for circular-based businesses, or training programs for farmers. Case studies in various regions can provide contextual insights into the successes and challenges of implementing this strategy at the local, national, and international levels.

In addition, research suggestions involve a participatory approach by involving farmers, business actors, and local communities to ensure that the resulting solutions can be practically implemented and are tailored to their needs. Research should also examine innovative financing mechanisms, such as collaboration between the public and private sectors or green financing schemes, to support the implementation of the strategy in a sustainable manner.

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