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Collaborative Governance In The Development of Malapari Plants as Biodiesel Feedstock (Analysis of Collaborative Governance Readiness)

Mia Hestiana, Achmad Lutfi
Universitas Indonesia, Indonesia
E-mail: mia.hestiana@ui.ac.id, achmad.lutfi@ui.ac.id

***Correspondence:** mia.hestiana@ui.ac.id

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ABSTRACT
The role of coal in energy supply is in line with the increasing demand for power plant construction in several regions driven by economic growth and income. The purpose of this study is to determine collaborative governance in the development of malapari plants as biodiesel feedstock. This research uses qualitative research to understand social phenomena with a normative legal approach that prioritizes literature studies, data collection activities from various literature both from libraries and other places. The results obtained are education and training to farmers on sustainable agricultural practices and natural resource management is also a precondition that must be done. This knowledge can help farmers adopt practices that support the sustainable growth of malapari plants. Effective pest and disease management strategies are needed to protect malapari plants from attacks that can reduce crop yields. The conclusion of this study is that training and education programs need to be expanded to increase farmers' understanding of sustainable agricultural practices, processing technology, and agrofuel management. This can help improve the quality and quantity of malapari crop yields. Socialization to the community regarding the benefits of developing malapari plants as biofuels and their positive impacts on the environment needs to be strengthened. Public acceptance is considered to be able to support the growth of this industry.

Introduction

Global energy demand continues to increase every year. According to estimates by the International Energy Agency (IEA), by 2030, global energy demand will increase by 45%, with an average annual growth rate of 1.6%. For the most part, about 80% of the world's energy needs are met by fossil fuels. The increase in world energy demand is mainly driven by the rate of population growth and GDP. Likewise, economic growth in the Asian region which makes an important contribution to world economic growth

greatly affects world energy demand Ministry of Energy and Mineral Resources, 2008 (Moriarty & Honnery, 2012).

According to IEA estimates for the period 2006-2030, most of the world's energy demand comes from non-OECD countries, amounting to 87%. China's energy demand growth is expected to be the largest of any other region. India has also recently experienced significant growth in energy demand, one rank below China Ministry of Energy and Mineral Resources, 2008.

Another feature of energy growth during this period was the emergence of coal as a second energy supplier after oil. Coal consumption is expected to triple by 2030. Ninety-seven percent of coal use comes from non-OECD countries, with China consuming the most, accounting for two-thirds Ministry of Energy and Mineral Resources, 2008.

The role of coal in energy supply is in line with the increasing demand for power plant construction in several regions driven by economic growth and income. Coal demand growth is expected to increase by around 2% per year (coal demand growth of 4.8% in 2006-2007). The contribution of coal to global energy demand fell from 26% to 29% in 2006 Ministry of Energy and Mineral Resources, 2008 (Harjanne & Korhonen, 2019).

Furthermore, after coal, the world's energy supply is sequentially sourced from natural gas, biomass energy, nuclear energy, hydroelectric power, as well as new and renewable energy. The role of new and renewable energy sources in electricity continues to grow. It is expected that starting in 2010, the place of new and renewable energy in electric power will only be exceeded by coal and hydroelectric power plants Ministry of Energy and Mineral Resources, 2008.

Nevertheless, global energy consumption trends are still clouded by various social, environmental, and economic problems. The security of oil and gas reserves and imports is increasingly dependent on OPEC. On the other hand, increased use of fossil fuels contributes to climate change. For this reason, the IEA recommends the use of clean and efficient energy to reduce carbon emissions Ministry of Energy and Mineral Resources, 2008 (Da Rosa & Ordóñez, 2021).

According to the Central Statistics Agency (BPS), domestic energy demand will reach 2.9 billion barrels of oil equivalent (BOE) by 2050. This number will increase to 2.1 billion BOE by the forecast of 2040. The projected growth in energy demand is in line with economic growth, population, energy prices and government policies. By sector, energy demand is dominated by the industrial sector which is estimated to grow by an average of 3.9% per year BPS, 2021.

Furthermore, businesses, households and other sectors grow in tandem with the economy and population. Meanwhile, the growth rate of the transportation industry is estimated to be lower than the industrial sector, which is 3.2% per year. In terms of type, the final energy demand is still dominated by fuel oil (BBM) with an average annual growth of 2.8%. This happens because the use of fuel equipment technology is actually more efficient than other energy equipment BPS, 2021.

Table 1 Comparison of Fuel Consumption and Crude Oil Production*in million barrels

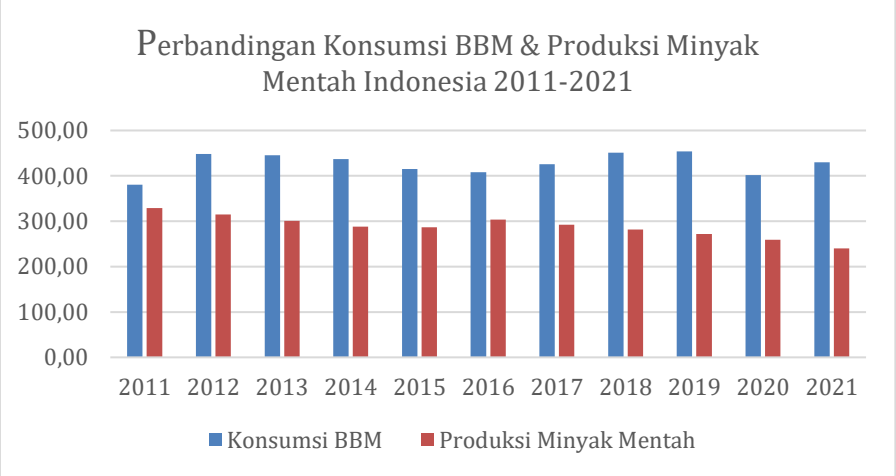
Year	Fuel Consumption	Crude Oil Production
2011	380.53	329.26
2012	448.26	314.67
2013	445.07	300.83
2014	436.58	287.90

Year	Fuel Consumption	Crude Oil Production
2015	415.17	286.81
2016	407.85	303.34
2017	425.34	292.37
2018	451.01	281.78
2019	453.86	272.02
2020	401.64	259.25
2021	430.00	240.37
2022	477.82	223.53

Source: Indonesian Energy and Economic Statistics Manual (2022)

From the table above, it can be seen that fuel consumption in Indonesia generally increases every year. Fuel consumption increased from 2017 to 2019 and decreased during the Covid-19 pandemic in 2020 but rose again in 2021. Until July 2022, Pertalite consumption increased by 16 to 8 million kiloliters or around 105.67 million barrels, diesel consumption even amounted to 9.9 million kiloliters or around 62.27 million barrels.

Figure 1 Comparison of Fuel Consumption and Crude Oil Production *in million barrels



Source: Indonesian Energy and Economic Statistics Manual (2022)

However, the increase in fuel consumption is not comparable to the increase in oil production. Conversely, from the comparison table of fuel consumption and crude oil production above, it is found that Indonesia's oil production has continued to decline since 2016. As a result, the government issued a policy on importing crude oil and fuel to meet domestic needs. This is stated in the Regulation of the Minister of Energy and Mineral Resources No.16 of 2020 concerning the Strategic Plan of the Ministry of Energy and Mineral Resources for 2020-2024.

Fuel oil is the main energy source used by people in Indonesia to run vehicles, generators, and other equipment with combustion engines. In recent years, Indonesia has transitioned from a petroleum exporting country to a petroleum importing country, and its natural reserves are expected to run out by 2030 (E-Statistic Migas, 2022).

The growing demand for energy has increased the importance of new and renewable energy sources. One of the renewable energy sources is bioenergy (Energy Law No. 30 of 2007). Modern bioenergy is the world's largest renewable energy source, accounting for 55% of renewable energy and more than 6% of global energy supply. The

Net Zero Emissions scenario by 2050 sees a rapid increase in the use of bioenergy to replace fossil fuels by 2030. Modern bioenergy use has increased by an average of about 7% per year between 2010 and 2021, and is on an upward trend. More efforts are needed to accelerate the adoption of modern bioenergy to conform to the *Net Zero Emissions* Scenario, which sees adoption increase by 10% per year between 2021 and 2030, while ensuring that bioenergy production does not cause negative social and environmental consequences International Energy Association, 2022.

The development of renewable energy itself is one of the efforts to realize sustainable development. The concept of sustainable development is economic development by paying attention to environmental aspects (Rahadian, 2016). Basically, sustainable development is related to efforts to develop sustainable energy, because so far a lot of industrial activities use fuel oil and non-renewable energy, of course, this can damage the environment and the existing ecosystem order. Not only in the process of its use, it remains in the exploration process of making fuel, it also often damages the environment because of the exploration carried out (Münger et al., 2018). Efforts to develop renewable energy are the right answer to answer efforts to realize renewable energy. The existence of renewable energy will directly protect the environment and reduce pollution and of course there is no need for large-scale environmental exploration and exploitation to get energy. Many policies, regulations, and laws that oversee the course of sustainable development in Indonesia have been made, one of which is Law No. 32 of 2009 concerning environmental protection and management (Siswanto et al., 2019).

In the development of renewable energy there are several obstacles, ranging from technology that is less feasible, the development process requires very large capital, and inadequate human resources (Caesaron & Maimury, 2017). So, it takes support and courage for the Government to invest in the development of renewable energy. Many investments made by the government are the construction of power plants and dams.

(Emerson et al., 2012) defines collaborative governance as the process and structure of decision-making and public policy management that engages people constructively across the boundaries of public institutions, levels of government, and/or public, private, and civic spaces to carry out public objectives. which cannot be achieved in any other way. Further, collaborative governance is also defined as "multipartner governance", which can include partnerships between the state, private sector, civil society, and communities, as well as combined government and hybrid arrangements such as public-private and private-social partnerships. and co-management regimes (Agrawal & Lemos, 2007).

In the definition mentioned above, Emerson does not limit collaborative governance to formal arrangements initiated by the state or public sector, but views collaborative governance as encompassing institutional forms in which private and even civil sector participation can be initiated in the long run.

(Emerson & Nabatchi, 2015) elaborate that *in collaborative governance* there is joint action both in the government sector, the private sector, and the community sector explaining several dimensions, namely the context of the system, the collaborative governance mechanism (CGR) and the elliptical collaborative dynamics, as shown in the following figure:

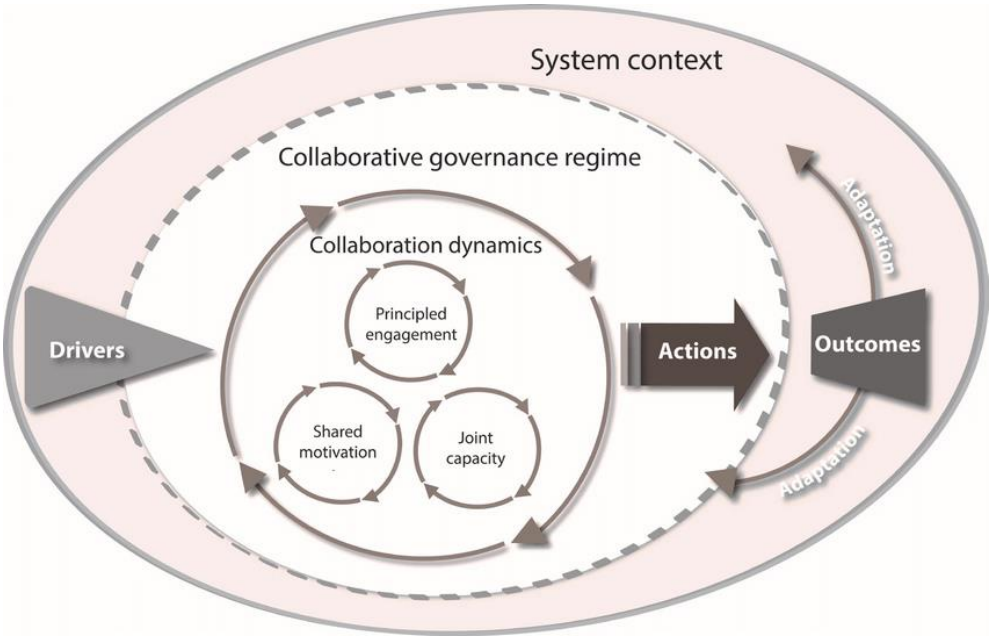


Figure 2
Model Collaborative Governance Emerson & Nabatchi (2015)
Source: Nabatchi 2015

The framework of Collaborative Governance 2015 is oval in shape where this illustrates that the collaboration process reflected through the context system, CGR and collaboration dynamics has its own dynamics that are flexible, not boxed and dynamic. In the model above, it can be seen that the collaboration process is dynamic and iterative with each other. The structure of the integrative skeleton combines multilevel dimensions and their individual components. The Nabatchi framework incorporates many of the components identified in other frameworks but configuring them in that way supposes cause-and-effect relationships among dimensions and their components and elements. Nabatchi connects it with other frameworks and presents a common proposition of how these dimensions, components, and elements interact. These propositions are the first step in building a theory (and can be used for future theory testing) because they establish general initial working assumptions about what factors cause it to collaborate and how components work together to produce the desired state. Within reason, not only are integrative frameworks (i.e., identifying all variables that are important for studying collaborative governance and how they generally relate) but there are also some initial pathways for integrating existing theories and building new theories based on those frameworks (i.e., through propositions, beginning to develop theories, for example, about what factors cause collaboration, what leads to the success and effectiveness of collaborative governance, and how a CGR can achieve adaptation).

Lebih lanjut, (Ansel, 2017) provides its definition of Collaborative Governance as follows; A governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets.

The definition can be described there are 6 important things, namely:

1. Establishment of a forum initiated by public institutions / institutions

2. Participants involved in the forum included participants from non-state actors
3. Participants are directly involved in decision-making and not just consulted by public institutions
4. The forum is formally managed and meets collectively
5. The purpose of the forum is to reach consensus (although in practice consensus may not be reached)
6. The focus in the collaboration is public policy or public management.

In collaborating, of course, an organization does not decide just like that, but has strengthening reasons. (McGuire & Agranoff, 2013) see the importance of collaboration as follows: Collaboration is necessary to enable governance to be structured so as to effectively meet the increasing demand that arises from managing across governmental, organizational, and sectoral boundaries

One of the obstacles encountered in the development of renewable energy in Indonesia can be overcome with the concept of Collaborative Governance. Wicked problems encountered such as technology that is not feasible, the development process requires very large capital, and inadequate human resources can slowly be found solutions with good collaboration between the public sector, private, academics, and also the community. The purpose of this study is to determine collaborative governance in the development of malapari plants as biodiesel feedstock.

Research Methods

To analyze policy research, a researcher can use several approaches. (Dunn et al., 2015) This research uses qualitative research to understand social phenomena with a normative legal approach that prioritizes literature studies, data collection activities from various literature both from libraries and other places. (Novianto et al., 2019). Qualitative research methods use secondary data in the form of books related to theories and concepts of object research, related articles, literature on scientific works and so on through literature studies. The analysis aims to determine collaborative governance as part of policy formulation, which in this case is a renewable energy development policy in Indonesia with a focus on exploring the collaboration process between collaboration actors who have been involved.

Results and Discussions

(Emerson & Nabatchi, 2015) elaborated that in *collaborative governance* there are joint actions between the government sector, the private sector, and the community sector. It is described that there are 3 (three) dimensions in the collaboration process, including:

System Context

This box is the outermost box which means that in the collaboration process there are external elements such as political, legal, socio-economic, and environmental that can affect and be influenced by the Collaborative Governance Regime. These external elements can influence the development and dynamics of collaboration. There are 7 (seven) elements that can affect the collaboration process, namely: *Resource conditions* where the resources owned can affect the collaboration process. The resources in question are human resources, such as; (1) Farmers, as they are the main stakeholders in the development of malapari crops. Their active participation in the decision-making process and program implementation is required. (2) Experts and officials involved in making policies and regulations related to agriculture and the development of malapari crops. (3)

Agricultural, agronomic, and related science experts who can provide scientific knowledge and research to support the development of malapari plants.

Then still in the System Context there is a Policy and legal framework where the need for policies and legal frameworks including administrative and judicial regulations in collaborating. For example, rules and regulations that support the development of malapari plants and legal protection of superior plant varieties developed through research. The level of conflict trust where the level of conflict and history between stakeholders can strengthen or weaken when collaborating. The level of such conflict affects the level of trust that impacts the employment relationship.

Socio-economics can also influence collaboration from cultural and diversity aspects, social conditions, economics, and health. There are Prior failure to address issues where this element can identify previous failures so that it can be a reference in determining the next policy in the collaboration process. Political dynamics/power relations where political dynamics and relationships between actors can influence the collaboration process. As well as Network connectedness where of course in collaborating requires network involvement to increase collaboration. Good relationships between governments, farmers, research institutions, and the private sector must be created to support a productive cooperative environment.

The seven elements above are not part of the starting conditions as developed by (Ansel, 2017), (Emerson & Nabatchi, 2015) state the context of the system is more to external elements that can affect the collaboration process. The context of the system will give rise to drivers which include leadership, consequential incentives, interdependency, and uncertainty. These drivers assist in initiation and as direction controllers for CGR.

Drivers

(Emerson & Nabatchi, 2015) state that system context and drivers are separate variables. If there are no drivers, the urge to collaborate becomes undeveloped and hampered. This is different from the formulation of (Ansel, 2017) which states that the beginning of the collaboration process has a condition that can facilitate both encourage and inhibit cooperation between stakeholders / actors in the collaboration process itself.

There are 4 (four) components in the driver variable, namely (1) Initiating Leadership In collaborating, leaders who have initiative and are able to become initiators are needed to use all resources owned to achieve goals by always motivating stakeholders to collaborate. This leadership is not limited to the public sector as a leading sector but the pivat sector can also contribute to initiating the development of the Malapari plant. Then there are Consequential incentives or incentives to participate or rewards needed both internal and external parties to motivate stakeholders to collaborate. Internal incentives include the need for resources, opportunities, and interests, while external aspects include crises, threats, or opportunities that are situational and institutional in nature. If these incentives are related to important outocmes, motivation can be increased. So that staleholders can actively participate in collaborating.

In addition, interdependence is also needed, which is a condition where individuals and organizations cannot achieve or solve their problems with the capacity of one party, so it requires collaboration with other organizations or individuals. In terms of Malapari plant development, it can be seen that there is interdependence between parties, as illustrated below;

Ministry of Energy and Mineral Resources – driving the development of Malapari plants as an alternative to biodiesel

BUMN (Pertamina) – Malapari oil processor as biofuel (BBN) and distributor of BBN BRIN – researcher of superior seeds and biodiversification of Malapari plants. Academics – researchers of technology to process Malapari seeds into ready-to-use Malapari oil. Private Sector – manager of the availability of Malapari crop development resources (land, funds, facilities and infrastructure) Farmer – manager and maintenance of Malapari plants

The last is *Uncertainty*, a condition where uncertainty occurs in public problems that are so complex "wicked problem". This is a common challenge so that all parties are encouraged to collaborate with each other in synergizing, reducing, and sharing risks to overcome wicked problems. Wicked problems in the development of Malapari crops are varied, such as the availability of infrastructure, agricultural land, oil processing technology, budget, etc.

Collaboration Dynamic

(Emerson & Nabatchi, 2015) illustrate that the dynamics of collaboration is an orientative interaction cycle. It has three components: principled engagement, shared motivation, and capacity to take joint action. These three components work together in an interactive and repetitive way and have an iterative and progressive cycle in which one component can function to produce two other components, The strong dynamics between the three components reinforce the "virtous cycle" in collaboration (e.g., Ansell and Gash, 2007; Huxham can thus produce collaborative actions or steps taken in order to implement common goals. This action in CGR can have both internal and external impacts in CGR itself.

The component consists of (1) Principle Engagement The collaboration process requires principled involvement among stakeholders / actors for example through dialogue, face-to-face, or through technology. With principled involvement, stakeholders / actors who can work together combine different content, relationships, and goals to jointly solve problems that arise. Therefore, there is a need for a common goal, a common principle that must be communicated among stakeholders / actors. Principled engagement arises from the repeated interaction of conditions of Discovery, Defiinition, Deliberation, and Determination.

In terms of Malapari development, the identification of common values, problems and interests, the interests of each actor, the value of the value actors, as well as how the construction of common interests are the main things that need to be done. The output of this condition as an example is the existence of meetings, a series of discussions on solving joint problems that can be proven by minutes of meetings, recording discussions is the first step in finding a collaboration process.

The series of discussions will pave the way to reach mutual agreement which can be outlined in a cooperation agreement or MoU, where the document can be explained in detail the duties and responsibilities of each collaboration actor.

Then the second (2) there is Shared Motivation, (Emerson & Nabatchi, 2015) suggest that shared motivation can strengthen the role of stakeholders / actors. The existence of motivation with stakeholders / actors can improve the process of mobilizing common principles. Shared motivation consists of four mutually supportive elements: mutual trust, mutual understanding, internal legitimacy and commitment. In shared motivation, *mutual trust* is found, which is a condition where all actors understand and cooperate with each other. Shared trust can arise as stakeholders/actors get to know each other, often engage and prove that they can be trusted when collaborating. With trust, it can produce mutual legitimacy in collaborating. Then there is also Mutual Understanding

(mutual understanding). A condition where stakeholders/actors can appreciate and understand their respective positions or roles in the collaboration process. When there are differences of opinion, stakeholders or actors must understand each other's interests and positions so that the goals that have been set in collaborating can be achieved.

Furthermore, there is Internal Legitimacy, which is a condition where stakeholders/actors must understand their respective roles and conditions to generate mutual trust (interpersonal validation and cognitive legitimacy). In collaborating, actors/stakeholders must be trustworthy and aware of dependence on each other so that the sustainability of the collaboration process is realized. Commitment. Conditions where stakeholders / actors must be able to minimize obstacles such as differences in interests, character so that the goal of collaborating can be achieved.

Finally, in the dynamics of collaboration, there is (3) Capacity for Joint Action. In collaborating, of course, you have common goals to be achieved. The goal, of course, is that all stakeholders/actors get results according to mutual expectations and cannot be implemented separately (Emerson & Nabatchi, 2015). In collaborating, not all actors have the same ability to act. According to (Emerson et al., 2012), capacity results from effective actions derived from the capacity of actors. The capacity to carry out joint action includes: institutional procedures and agreements, leadership, knowledge and resources.

Procedural/institutional arrangements are conditions where there are general rules, guidelines in the process (SOP/Standard of Procedure), rules for making decisions (decision rules) and organizational structures needed to collaborate. Then there is Leadership where in collaborating, leadership has an important role. These roles can among others motivate stakeholders/actors to achieve the goals of collaborating, can overcome conflicts, as initiators, facilitators and mediators in collaborative governance so that implementation can run according to agreed goals.

Furthermore, there is Knowledge where according to Emerson, (Emerson et al., 2012), knowledge is a combination of understanding and capabilities from stakeholders / actors involved in collaboration. This knowledge includes social values, work ethic, and science that are integrated with the values of collaboration actors. Finally, namely *Resources* where collaboration can be successful if stakeholders / actors can share with each other and maximize the use of resources owned.

Meanwhile, in terms of readiness to develop malapari plants as alternative bioenergy raw materials involves a number of preconditions that need to be prepared so that this business can succeed, including the selection of types of malapari plants that are suitable for the environment and soil conditions in the area to be planted by considering the needs of water, nutrients, and suitable climate. The State Innovation and Research Agency (BRIN), which has the task of conducting research on state plant development, can collaborate with academics from various universities in developing superior types of Malapari plants. Malapari has the potential to be developed as a biodiesel feedstock because of its oil content which reaches 32% of the natural stands on Lovina Beach. The characteristics of biodiesel produced are in accordance with SNI 2006 which indicates good biodiesel quality. It is necessary to multiply Malapari from elders who produce the highest oil in order to support the cultivation program of the species. (Hayat et al., 2023).

Good seeds will give better yields and reduce the risk of crop failure. Quality seeds can be obtained by plant breeding practices to produce varieties that have superior traits. This process involves selecting the parent plant that has the desired characteristics and mating it to produce the expected offspring. Collaboration with companies or

institutions specializing in seed production can increase the production capacity and distribution of seeds of malapari plants.

It is best to store malapari seeds using plastic containers coupled with husk charcoal storage media stored for five weeks to maintain moisture content of 62.92%, germination of 93.33%, and germination of 7.55% KN/et mal). Seeds can also be stored in plastic containers without storage media for five weeks to obtain a moisture content of 60.69% and a germination percentage of 91.00%.

Market research should also be conducted to understand the demand for biomass energy in the region. The Ministry of Energy and Mineral Resources has the task of compiling a roadmap for the country's energy needs, including biomass energy. The Ministry of Energy and Mineral Resources can also collaborate with SOEs such as Pertamina and several other private sectors as managers of vegetable raw materials into final products of fuel oil to ensure that the production of malapari plants is in accordance with market needs.

The availability of sufficient land to grow malapari plants on a scale that suits the needs of bioenergy production is an important thing that must also be done. Fulfilling land availability for malapari crop development can be done by providing incentives or partnerships that can increase land availability and support local economic growth. In addition, it is important to consider the use of efficient irrigation technology to ensure plants get enough water as well as to carry out maintenance and maintenance of irrigation canals to minimize water leakage and ensure even distribution of water throughout the farmland. Furthermore, this requires cross-sectoral cooperation and commitment from various parties, including the government, the private sector, and local communities.

Education and training to farmers on sustainable agricultural practices and natural resource management is also a precondition that must be done. This knowledge can help farmers adopt practices that support the sustainable growth of malapari plants. Effective pest and disease management strategies are needed to protect malapari plants from attacks that can reduce crop yields. This can be done by providing education and training to farmers on best practices in pest and disease management. This knowledge can help them identify symptoms, take preventive measures, and better manage attacks

Finally, it must identify all stakeholders in the malapari crop supply chain, including farmers, seed producers, distributors, traders, processing plants, and retailers and form strong partnerships and cooperation between all stakeholders in the supply chain. Effective collaboration can increase efficiency, reduce risk, and improve access to markets. Build cooperation with related parties, including the government, researchers, and other stakeholders, to support the development of malapari plants. By paying attention to these various preconditions, the development of malapari plants as bioenergy feedstock can be carried out more successfully and sustainably.

Conclusion

The development of malapari crops in Indonesia as an alternative to biofuel blends offers significant potential to support energy and agricultural sustainability in the country. Taking into account the challenges and opportunities, several suggestions can be taken to design an effective development strategy, namely further research is needed to identify varieties of malapari plants that have optimal quality and productivity to be used as biofuel. Technological innovation is also important to improve the efficiency of biofuel production and processing.

In addition, the government also needs to develop policies and regulations that support the development of malapari plants as a source of biofuel. These include fiscal incentives, support for research, and the establishment of clear regulations related to the use of agrofuels. In the development of malapari plants, it is necessary to apply a sustainable approach that takes into account economic, social, and environmental aspects. Sustainable agricultural practices, prudent natural resource management, and environmental impact monitoring should be integral parts of development initiatives. Risk management plans also need to be developed to address challenges such as market price fluctuations, climate change, and plant disease risks. This can involve agricultural insurance schemes and other financial instruments.

Training and education programs need to be expanded to improve farmers' understanding of sustainable agricultural practices, processing technology, and agrofuel management. This can help improve the quality and quantity of malapari crop yields. Socialization to the community regarding the benefits of developing malapari plants as biofuels and their positive impacts on the environment needs to be strengthened. Public acceptance is considered to be able to support the growth of this industry. Then, infrastructure improvements such as irrigation systems, transportation, and processing facilities are key in supporting efficient and sustainable agrofuel supply chains.

Strong partnerships between government, the private sector, and communities are essential. This collaboration can include providing technical guidance, investment, and capacity building of farmers and producers. So that the overall strategy above can be done by strengthening collaboration between various stakeholders of the development of this Malapari plant, such as the Ministry of Energy and Mineral Resources, Pertamina, BRIN, Academics, Private Sector and also the Community.

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