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Transforming ex-Coal Mining Sites into Sustainable Plantations: A Case Study of Food Natural Sustainability Project in Bomba Group

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Abstract: The Ministry of Agriculture (Kementan) is encouraging efforts to convert former mining land into productive agricultural areas to increase national food production and stocks amidst the global food crisis. Land Reclamation Technology is a necessity to reduce the cost of reclamation of ex-mining land into agricultural land. The method of reclamation of ex-mining land by moving top soil from another place is not recommended because this is a step to solve the problem by creating other new problems. Sustainability Business Model for such rejuvenation projects refer to Collaboration and Community Based and must be prioritize all stakeholders (all parties involved and affected by the activities carried out by the business) rather than the interests of shareholders.

Keyword: Plantation Technology, Coal Mining, Sustainability Plantation, Business Model

INTRODUCTION

The Ministry of Agriculture (Kementan) is encouraging efforts to convert ex-mining land into productive agricultural areas. This is done to increase national food production and stocks in facing the challenges of the global food crisis. Apart from meeting national food needs, the use of ex-mining land as an agricultural area is expected to be able to overcome environmental problems caused by mining activities.

Indonesia's Food Security Index is 60.2 below the world average of 62.2 and Asia Pacific of 63.42. One of the problems that threatens Indonesia's food security is the conversion of agricultural land which reaches 90-100 thousand hectares every year. In fact, to achieve national food independence by 2024, Indonesia still needs 12.48 million hectares of rice farming land.

Base on that background, Bomba Group as company which is one of coal mining company, supports government programs in terms of availability of food plots and special

attention in creating food independence in locations around the mine. So, the Company began conducting trials on ex-mining land management in the PT Era Energi Mandiri Mining Business License area located in Suka Merindu Village, South Merapi District, Lahat Regency, South Sumatra Province. Rice Field Printing has been running since October 2022 First Harvest in February 2023 of 500 Kg of Wet Grain.

The challenges encountered are reclamation of mining land into agricultural land causes agricultural production costs on ex-mining land to become expensive. This also results in the selling price of agricultural crops not being price competitive. The reason for the high cost of reclamation is because we still use conventional methods, namely moving top soil from other land to ex-mining land.

Based on the background, the purpose of writing this article is to build a hypothesis for further research, namely to formulate best practices of technology for rejuvenating ex-coal mining sites, a framework for agriculture, and a sustainability business model for such rejuvenation projects.

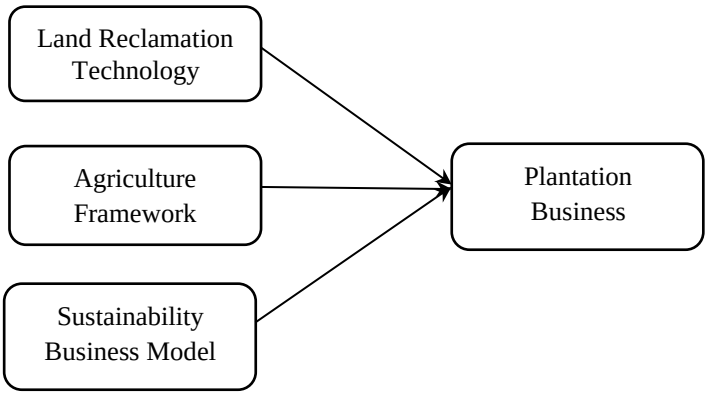
METHOD

The method for writing this Literature Review article is the descriptive qualitative method and library research, sourced from the online application Google Scholar, Mendeley and other online academic applications also refer to case study data from Food Natural Sustainability Project in Bomba Group.

In qualitative research, literature reviews must be used consistently with methodological assumptions. This means that it must be used inductively so that it does not direct the questions asked by the researcher. One of the main reasons for conducting qualitative research is that the research is exploratory in nature (Ali, H., & Limakrisna, 2013).

RESULT AND DISCUSSION

This article was written using the Research Framework Formatting Rules method as follows:



Picture 1. Research Framework Formatting Rules

Land Reclamation Technology

There are some of Common Problems in the Rehabilitation of Ex-Mining Land:

a. Rehabilitation planning for ex-mining land is not integrated locally, regionally and nationally. It Caused by Premature Mine Planning, not oriented towards restoring sustainable environmental carrying capacity, lack of competent human resources in managing the mining environment, Instant Culture, Collusion and Corruption
b. Generally, Without PAF – NAF Rock Management. Mostly Acid Mine Water
c. Erosion and Sedimentation. It's Caused by Poor management of surface runoff water, Poor Overburden Management

d. The success of the Revegetation program is low. It's Caused by Rooted Zone Land Deficit Due to Poor Governance, the presence of contaminants and pollutants inhibiting vegetation growth, Improper application of revegetation techniques.
e. The minimal contribution of the academic world to mining environmental management

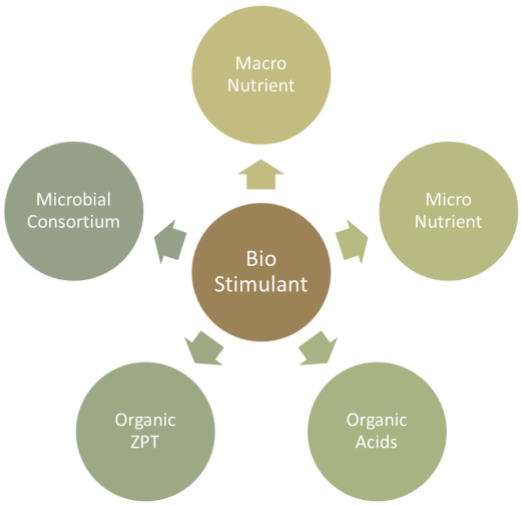
Base on that's common problem, we need to identify and doing proper step for land reclamation especially for ex Coil Mining Land Reclamation. Most of the Coal Mining company using Moving Top Soil Method for Land Reclamation. Otherwise, this activity is solving the problem with create new problem. Land which already taken the top soil of land, it's will be cause deficit Top Soil Nutrition and impact to decreasing soil and plant fertility.

Agriculture researcher doing some research to find out and solve that issue without create new problem. The Innovations called Bio stimulant Technology. Plant bio stimulants are diverse substances and microorganisms used to enhance plant growth (Calvo, P et al. 2014). The definition used for plant bio stimulants is claims-based (European Commission, 2016; Council of the European Union, 2018), meaning that it is the function of the product, not what it contains that defines it as a plant bio stimulant (Manuele Ricci et al. 2019). Plant bio stimulants have been gaining interest in sustainable agriculture due to their stimulation effects able to improve nutrient use efficiency, quality of the product and abiotic stress tolerance. (S. De Pascale et al. 2017)

Stages of Critical Land Improvement:

1. Preconditioning
   a. Physical Condition of Soil
   b. Isolation of toxic compounds
   c. Addition of Macro and Micro Nutrients
   d. Water Availability
2. Plant Growth Phases
   a. Addition of macro and micro nutrients from slow-release sources
3. Plant Enlargement Phase
   a. Bio-Stimulant to stimulate the growth of soil microorganisms (Bacteria, Fungi, Actinomycetes, Algae, Protozoa, Nematodes)

Biological components build and maintain soil: Organic matter, CEC, water holding capacity, nutrient availability, and recycling. Plants and soil microorganisms work together to protect and feed each other.



Picture 2. Bio Stimulant Component

Macro Nutrient consist of N, P, K, Ca, Mg, S. Micro Nutrient consist of Na, Cl, Fe, Zn, Cu, Mn, Br, I, Co, Se, Cr. Organic Acids consist of Humic Acid, Fulvic Acid, Amino Acid.

Organic ZPT consist of Auxin, Gibberellin, Cytokinin. Microbial Consortium consist of Cellulolytic, Amylolytic, Proteolytic, Ligninolytic, N-fixing bacteria, Phosphate Solubilizing Bacteria.

Acceleration of Carbonate Rock Weathering by Microorganisms. Rock weathering is accelerated by its presence: The ability of microorganisms to store water, Acid produced from the secretion process of microorganisms, CO2 is released from the respiratory process of microorganisms on rock surfaces.

Picture 3. Land Reclamation Result for 6 months Period

Agriculture Framework

Most agricultural companies prioritize types of crops that have high economic value. Is this wrong? No. However, for agriculture on ex-mining land, special treatment and special attention is required, apart from just agricultural yield factors, but also soil conditions, weather and climate conditions and most importantly, historical agricultural data in the area around the location of the ex-mining land.

Agricultural historical data in the area around the ex-mining land location is important because from analyzing this data, we can anticipate the risk of failure of our agriculture on the ex-mining land. Agricultural methods that have been going on for years around ex-mining areas have become important information assets to ensure our agriculture runs well. The result of carrying out this analysis is that we will get champion plants and champion farmers in each area of ex-mining land.

Steps for farming on ex-mining land:

1. Identify the types of plants that have been planted in the area and/or around the ex-mining land or champion plants
2. Identify agricultural methods that have been used in the area and/or around the ex-mining land or champion farmers
3. Identify market locations where agricultural products are sold, get information on average sales prices for the last 3 years, quantity needed and sales opportunities elsewhere
4. Plan and calculate the costs of conditioning agricultural land, seed costs, planting costs, maintenance costs, harvest costs, minimum yield targets where the key is that all these costs must be below the average sales price for the last 3 years
5. Condition the land nutrition according to the type of plants to be planted
6. Start planting

Apart from agriculture, to optimize ex-mining land, an integrated farming system is needed where agriculture on ex-mining land must also optimize livestock and fisheries. The manure from livestock will be used as organic fertilizer for agriculture. Water from fisheries will be used for irrigation water in agriculture. We can refer to this Integrated Farming System base on The European Initiative for Sustainable Development in Agriculture (EISA). The European Initiative for Sustainable Development in Agriculture (EISA) is pleased to present the revised version of their European Integrated Farming Framework as a definition and in detail description of Integrated Farming (IF) as a guideline to sustainable development in European agriculture (EISA. 2012)

Farming is facing changing demands. The challenge for a farmer is to respond to these economic, environmental, social and welfare issues as well as the fundamentals of sustainable agriculture. These changing demands result from the continuously growing world population and the globally increasing demand for food, feed and renewable energy. They also result from climate change, which will increasingly threaten yields in southern countries due to higher temperatures, lower water availability and the invasion of new pests. In addition, environmental issues such as the conservation of biodiversity, the protection of ground and surface water and the conservation of soils are still considered as areas of global concern.

Integrated Farming contributes to solving these global challenges. It is a whole farm management system, which enables the farmers to identify opportunities and threats and act accordingly, and, at the same time, consider consumer interests in their business.

Picture 4. The EISA "Integrated Farming Wheel": The holistic all-farm approach

Sustainability Business Model

Convert ex-mining land into productive agricultural areas is not only reclamation process, but we can generate this opportunity to be the new green industry on coal mining Industry. In contrast to the agricultural industry which originates from agricultural land in general, the agricultural industry which originates from ex-mining land can be said to be starting from a minus. That is, before we plant plants, there are already costs for land reclamation from ex-mining land to agricultural land. This cost must be borne as initial capital in the agricultural industry on former mining land.

However, with land reclamation technology with bio stimulants can be saved up to 75% initial capital compared to reclamation costs without bio stimulant technology. Apart from

land, water sources are also an additional consideration for sources of life in the ex-mining agricultural industry. Clean water processing is also an important factor that must be considered to ensure the sustainability of this agricultural industry.

Sustainability Business Model for such rejuvenation projects refer to Collaboration and Community Based. The Sustainability Business Model can set up refer to Triple Botom Line Concept (John ElKington. 1997). Sustainable Business Model must prioritize all stakeholders (all parties involved and affected by the activities carried out by the business) rather than the interests of shareholders. The interests of these stakeholders can be summarized into three parts, namely interests from the profit sustainability side (Profit), the community sustainability side (People), and the environmental sustainability side (Planet).

Picture 5. Bomba Group Food Natural Sustainability Business Model

1. Government, Regulators: Provide policy support to achieve and sustain overall food security
2. Cooperatives, Farmers Groups: As the Core Team implementing Food Natural Sustainability operations
3. Academics, Laboratories, Research, Technology: Providing support for Technology and Innovation Solutions to achieve effective and efficient processes and results
4. Funders, Investors, Fintech, Banks, CSR: Provide capital support for the implementation of Food Natural Sustainability
5. Market, B2B, B2C, B2G: As a Sales Agent and Consumer of Natural Sustainability Food production
6. Bomba Group: As Collaborator, Facilitator, Management, Control, Supervision, Orchestrator and Conductor of all Food Natural Sustainability ecosystems

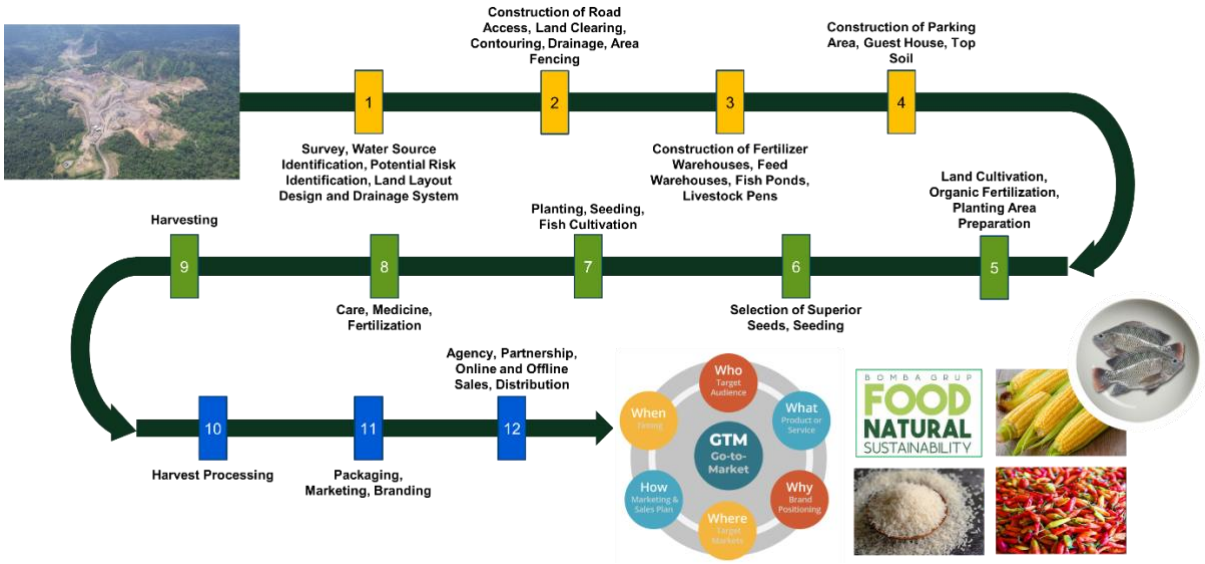
The business strategy implemented in 3 business lines and divided into 2 phases time domain. The first phase is agricultural products processing and agricultural products trading, and the second phase is agriculture itself. The aim of agricultural product processing and trading is to build markets and agricultural business portfolio. From this first phase we will have validated market data in terms of type, quality, quantity, price and market demand. Based on this validated data, it will be our reference in carrying out agricultural processes on this ex-mining land.

Discussion

To produce and run a sustainable business model in the ex-mining land agricultural industry, the business processes that must be carried out are not only in the process of land reclamation, land processing, or processing of agricultural products. However, it must also be carried out comprehensively from upstream to downstream, that is, it must lead to sales and marketing or go to market strategies.

If the process business is run separately, land reclamation costs, seed costs, garden costs, maintenance costs, harvest costs and harvest processing costs will not be covered. Business processes must culminate in sales and marketing, building markets both locally and internationally, with the best quality standards.

And in carrying out business operations, you must use the latest full technology which is continuously updated, namely with collaboration from academics, research institutions and inventors of the latest methods in the agricultural industry.



Picture 6. Bomba Group Food Natural Sustainability Business Operations

Plan Reclamation Services.

Transform Ex-Coal Mining Land to Plantation Land with Water Treatment and Green Electricity Power Plant System

Plantation Services.

Producing Food Natural Products with Organic Product and Green Plantation Operating System

Go To Market Services.

Build The Market Ecosystem, Sales, Marketing, Distributions and Agent Partners

CONCLUSION

The results of the literature review and case study that has been carried out, starting from an understanding of Land Reclamation Technology, Agriculture Framework and Sustainability Business Model, can be concluded that: Land reclamation technology is a necessity to reduce the cost of reclamation of ex-mining land into agricultural land, the method of reclamation of ex-mining land by moving top soil from another place is not recommended because this is a step to solve the problem by creating other new problems, acceleration of carbonate rock weathering by microorganisms is an appropriate and environmentally friendly method and does not create new problems in reclamation of ex-mining land.

Sustainability Business Model for such rejuvenation projects refer to Collaboration and Community Based and must be prioritize all stakeholders (all parties involved and affected by the activities carried out by the business) rather than the interests of shareholders. The business strategy implemented in 3 business lines and divided into 2 phases time domain. The first phase is agricultural products processing and agricultural products trading, and the second phase is agriculture itself. The business processes that must be carried out are not only in the process of land reclamation, land processing, or processing of agricultural products. However, it must also be carried out comprehensively from upstream to downstream, that is, it must lead to sales and marketing or go to market strategies.

With the limitations of research that has been carried out and the passage of time that continues along with technological developments, it is recommended to continue collaboration with academics and research institutions related to land reclamation technology must continue throughout the journey of agricultural business on ex-mining land due to this investment cost for this part is the highest cost compared to all the hole process.

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