Empowerment of Togong-Tanga indigenous people through the development of apiculture-based conservation villages

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ABSTRACT

The Kokolomboi Lestari Program is a community empowerment initiative aimed at empowering the Togong-Tanga Indigenous Peoples in Central Sulawesi Province. It focuses on developing sustainable apiculture systems in Leme-Leme Darat Village, aiming to increase forest resource productivity and improve ecosystems and habitats for endemic animals. The program provides employment opportunities and income from forest bee management and environmental services. A study found that solid waste treatment from PT Pertamina EP Donggi Matindok Field operations contributes to global warming potential (GWP), with CO2, N2O, and CH4 emissions being major contributors. The program also uses non-B3 waste from fire truck tires as a conservation medium, and biosulfur slurry as fertilizer for agricultural activities. This program has achieved sustainability goals, improving social life, economic and environmental standards, and strengthening the economy of indigenous peoples.

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INTRODUCTION

PT Pertamina EP Donggi Matindok Field is an oil and gas operator located in Banggai Regency, Central Sulawesi Province. Operating since April 2016 marked by the commissioning of the Donggi Central Processing Plant (CPP) and followed the following year in April 2017 CPP Matindok, with an area of 13,017 Ha covering the Matindok and Donggi Gas Blocks. Gas from production wells is processed at 2 units of Central Processing Plant (CPP) facilities, namely CPP Donggi and CPP Matindok. CPP Donggi processes gas from 8 production wells (DNG 1,2,3,5,6,7,8,9) while CPP Matindok processes gas from 7 production wells (MTD 2,3,4,5,6,7,8). CPP Donggi is located in Dongin Village, Toili District. While CPP Matindok is located in Nonong Village, Batui District.

PT Pertamina EP Donggi Matindok Field which consists of 2 CPP units, has a Production Capacity (Base Design) of 125 MMSCFD, namely 65 MMSCFD for CPP Matindok and 60 MMSCFD for CPP Donggi. However, based on the Gas Sales Agreement (GSA), the plateau production capability is 105 MMSCFD. As of 2020, Donggi Matindok Field's total gas production is 101 MMSCFD, with 47.32 MMSCFD produced from CPP Donggi and 53.68 MMSCFD produced from CPP Matindok.

In addition to producing Main Products in the form of Gas, PT Pertamina EP Donggi Matindok Field also produces Side Products in the form of Condensate, with a production capacity in 2020 of 909.64 BOPD, namely 194.13 BOPD from CPP Donggi and 715.51 BOPD from CPP Matindok. PT Pertamina EP Donggi Matindok Field has 2 Central Processing Plant (CPP) Units to process Natural Gas from gas wells. In addition to processing gas, the CPP Unit is also equipped with a Utility Process to process Side Products resulting from the separation process of Raw Gas phases such as Produced Water and Condensate.

The following is the division of process units within the CPP Unit:

Administratively, PT Pertamina EP Donggi Matindok Field is located in Batui and West Toili Districts, Banggai Regency, Central Sulawesi Province, while Donggi CPP is located in West Toili District and Matindok CPP is located in Batui District. The working area of PT Pertamina EP Donggi Matindok Field is spread across several villages including Dongin Village, Kaniwangi Village, Sindangsari Village, Bukit Makarti Village,
Pandanwangi Village, Uwelolu Village, Tohitisari Village, Tirta Kencana Village, Rusa Kencana Village, Piondo Village, Samalore Village, Each Village, Nonong Village, Kayowa Village, and most recently Momo Village located in the North Morowali area.

PT Pertamina EP Donggi Matindok Field carries out operations according to the vision of becoming a world-class national energy company, with a mission to run oil, gas, and new and renewable energy businesses and integrated based on strong commercial principles. As a company engaged in the extractive industry, the Company strives to carry out Social and Environmental Responsibility (TJSL) programs based on the Sustainability Policy issued by PT Pertamina Hulu Energi (PHE) as a holding in the upstream oil and gas business within Pertamina's business scope, where this Sustainability Policy is also a derivative of PT Pertamina (Persero) as the parent company. This policy is a guide to drive compliance with laws and regulations and create long-term value for stakeholders through the development of sustainability practices across the business.

Sustainability policy better integrates the Company’s strategies and activities especially in the context of Environmental, Social and Governance (ESG) and contributes to the achievement of the international agenda of Sustainable Development Goals (SDGs). The Social and Environmental Responsibility Program of PT Pertamina EP Donggi Matindok Field is in line with the Company’s vision and mission which is internalized through TKO Management of Corporate Social Responsibility (CSR) No. B.13-006/PPC01110/2021-S9 Rev-01 PT Pertamina EP Cepu Regional 4 where the existing Social and Environmental Responsibility Program is designed to improve community welfare both in terms of social, economic as well as environmental. Thus, creating a harmonious relationship between the Company and the communities around the Company’s operational areas. In addition, as a form of social investment, it is expected to provide added value or added value for the Company in the form of:

1. Provide a positive impact (appropriate and beneficial) for society and the environment.
2. Maximally support efforts to improve the Company’s image and reputation.
3. Growing cooperation and building the independence of communities around the Company’s operational areas through CSR / TJSL programs.
4. To obtain support, foster mutual understanding and create synergy between the Company and Stakeholders.
5. To prevent/anticipate the occurrence of cultural value clashes, social and economic conflicts between companies, communities, and other stakeholders.

METHOD

Data collection methods are crucial in a study, including qualitative methods like observation, interviews, and documentation. Observation involves systematic observation and recording of the target object's behavior. Interviews involve direct communication between researchers and respondents, using one-way oral questions and answers. Documents are written records of past activities or events, providing a comprehensive understanding of the subject matter. Descriptive analysis is used in research reports, which contain citations, quotes, and data to describe existing circumstances. Overall, data collection methods are essential for a comprehensive study.

RESULTS AND DISCUSSION

Kokolomboi Lestari Program

The Kokolomboi Lestari program aims to change the pattern of community behavior in managing forests through education, community-based conservation, and empowerment activities. This program also provides alternative income for communities around forest areas and increases community income. In addition, this program also increases productivity and added value of forest resources through sustainable management, as well as improving the quality of ecosystems and habitats of endemic animals in the Kokolomboi Area through area improvement.

Leme-Leme Darat village is located on the western part of Peleng Island which is 2 meters above sea level. However, there is one hamlet located at an altitude of 600 meters above sea level, namely Kokolomboi Hamlet. The village has a total area of 600 hectares with a residential area of 8.5 hectares. Most of the area of Leme-Leme Darat Village is agriculture and forest. The forest that is used as a kehati park is one of the potentials in this village. This kehati park is located in Kokolomboi Hamlet which is above the mountains, the distance from the center of Leme-Leme Darat Village is about 5 km with steep access.

The Kokolomboi Lestari program began to be implemented in 2020 (3 years 7 months) and has helped the community in the development of stone honey bee cultivation using palm stems. This innovation provides economic, social, and environmental benefits, which support the cultural change of the community from previously encroaching on forests to meet the needs of life, now the community as restoration actors and utilizing forests in meeting the needs of life in a sustainable manner. This program also assists the community in developing special interest tourism in Taman Kehati, managing forest bees, and also forest restoration.
actors who support the improvement of the ecosystem of the Kokolomboi area and strengthening the economy of indigenous peoples.

The implementation of this program integrates three main approaches, namely ecology, socio-economics, and socio-culture. The ecological approach is carried out through increasing and maintaining vegetation cover, zoning forest areas, and monitoring biodiversity. Supporting infrastructure such as landmark construction and the use of renewable energy are also considered. The socio-economic approach is carried out by providing alternative income through apiculture and eco-edu tourism. Honey bee cultivation is used as one solution to maintain the ecosystem and increase community income (Bariyah, 2020; Kassa Degu & Regasa Megerssa, 2020; Papa et al., 2022; Schouten, 2020; Schouten et al., 2020). The socio-cultural approach is carried out through the revival of local culture, such as traditional dances, and the internalization of conservation values in education (Fahruddin et al., 2022; Runa et al., 2020; Syafrini et al., 2020).

This program successfully involves a number of parties and provides direct and indirect benefits to the local community. By actively involving indigenous and local communities, the program has succeeded in creating a strong spirit of conservation in the region.

**Kokolomboi Lestari as Social Innovation**

**Capital Investment**

Kokolomboi Lestari's social innovation program has been running for 3 years and 7 months (since 2020) and has succeeded in creating systemic changes in society with various aspects, including:

1. **Changes in Organizational Structure and Community Culture:**
   - The establishment of environmentally concerned community groups that manage forests sustainably.
   - Communities are moving from encroaching on forests to becoming restoration actors and forest managers for sustainability.

2. **Fulfillment of Sustainable Living Needs:**
   - Managing Non-Timber Forest Products (HHBK) based on apiculture (bee cultivation).
   - Changes in bee cultivation technology from rock cliffs to palm stem waste.

3. **Changes in Community Livelihood Patterns:**
   - Acting as an environmental service provider, special interest tourism development, forest bee manager, and forest restoration actor.
   - Interact across sectors for the development of the Kokolomboi area.

4. **Efforts to achieve the goal:**
   - Community capacity and skills building.
   - Economic strengthening through forest bee cultivation and educational tourism.
   - Policy reforms, including bans on logging and poaching.

This program produces significant and sustainable impacts, such as community capacity building, cross-sectoral cooperation, the establishment of kehati areas, and policy advocacy. Investment in various types of capital such as intellectual capital, individual capital, social capital, infrastructure capital, natural capital, and cultural capital has resulted in concrete achievements in supporting environmental and community sustainability.

**Impact**

The Kokolomboi Lestari program has had a significant impact on the community since its inception in 2020. The following are the results of the analysis of the impact of systemic change on various aspects:

1. **Intellectual Capital:**
   - Training and technical guidance improve community knowledge and skills in managing assets, such as herbarium activities and forest bee cultivation.
   - Diversification of community work from forest encroachment to forest restoration and new jobs as bee farmers and tourism services.
   - Palm stem waste management as a medium for bee cultivation.
   - Local education for early environmental understanding.

2. **Individual Capital:**
   - Empowering Togong-Tanga and local indigenous communities in managing the environment.
   - Development of the kehati area outside Kokolomboi.
   - Formation of institutionality for beekeepers and the construction of nature schools.
   - Development of honey grower skills in production and marketing.
3. **Social Capital:**
   - The active role of the community in environmental conservation.
   - Mutual assistance and participation in village development.
   - Partnerships with local governments and organizations in managing kehati areas.
   - Publication of the rules on the prohibition of logging and poaching.

4. **Built/Infrastructure Capital:**
   - Infrastructure improvements to support tourism and environmental preservation.
   - Construction of kehati information center and security post.
   - Support for the development of honey product branding.

5. **Natural Capital:**
   - Community-based conservation area designation and land restoration.
   - Planting local trees to support ecosystems and animal livelihoods.
   - Take advantage of natural resources without damaging the environment.

6. **Cultural Capital:**
   - Development of local arts as a medium to support conservation.
   - Exposure to conservation efforts through local art.

This program not only has an impact on environmental and economic aspects, but also on the social and cultural aspects of the community, forming a sustainable mindset and action for environmental conservation.

### Social Innovation Answers the Needs of Vulnerable Groups

**Description of Vulnerable Group Identity**

Kokolomboi Hamlet, a hamlet in Leme-Darat Village which is located quite remotely, faces a number of challenges that cause vulnerable groups in it to need social assistance to meet their living needs. This category of vulnerable groups includes the poor, children, the elderly, and pregnant women.

1. **Kokolomboi Poor:** The majority of the inhabitants of this hamlet are poor people who depend on forest resources for their livelihoods. Limited access and infrastructure, such as inadequate roads, make it difficult for them to escape poverty.

2. **Children:** Many children in Kokolomboi Hamlet face difficulties in education due to long school distances and family economic limitations. Many of them are engaged in farm work with their parents rather than going to school. Access to schools is also difficult especially during the rainy season.

3. **Elderly and Pregnant Women:** The elderly and pregnant women in this hamlet face difficulties in accessing health services due to the long distance to the nearest health facilities. In the rainy season, they are forced to use simple stretchers to reach health services, which hinders prompt medical help. They also find it difficult to find food sources in the forest.

To overcome this challenge, the Kokolomboi Lestari Social Innovation Program implemented by PT Pertamina EP Donggi Matindok Field helps answer the needs of vulnerable groups in Kokolomboi Hamlet. This includes assistance programs such as the Family Hope Program (PKH), Non-Cash Food Assistance (BPNT), and Direct Cash Transfer (BLT) provided to the poor to help meet their basic needs.

### Changes in the Fulfillment System

Social innovation in Kokolomboi Hamlet has brought significant changes in meeting the needs of vulnerable groups, especially the poor, children, the elderly, and pregnant women. Here is a summary of the changes before and after the social innovation:

**Kokolomboi’s poor:**

**Before Innovation:**
- Depend on forest products without regard for ecosystem sustainability.
- The main source of income is forest products, animal hunting, and clearing agricultural land with a shifting field system.
- Lack of skills in managing a sustainable environment.

**After Innovation:**
- Communities manage community-based conservation areas, limit illegal deforestation, and develop alternative skills such as being honey farmers or environmental service providers.
- Involved in environmental management and providing natural school assistance for students around the area.
- Utilizing palm stem waste as a medium for bee cultivation.
Kokolomboi Hamlet Community (Access to Education and Health Services):

Before Innovation:
- Neighborhood road access is difficult, especially in the rainy season.
- Children have to walk long distances to get to school.
- The elderly and pregnant women have difficulty accessing health services.

After Innovation:
- Active community participation improves roads, making access easier by two-wheeled vehicles or double cabins.
- First aid kits and stretchers are available for first aid in emergencies.

Conclusion:
- Through social innovation, people understand the importance of nature and environmental conservation.
- Diversification of income sources such as honey bee cultivation and tourist services reduces dependence on a single resource.
- The increased mobility of tourists provides attention and support from local governments.
- Infrastructure improvements such as roads reduce the isolation of hamlets and increase community confidence.

This social innovation program has brought significant positive impacts, not only in meeting the needs of life but also in environmental conservation and improving the welfare of society as a whole.

The Novelty of Top of Form

The Kokolomboi Lestari program is an innovation involving indigenous people in Kokolomboi Hamlet, Leme-Leme Darat Village. This is new because it involves the development of Community Conservation Areas directly managed by Indigenous Peoples, increasing environmental awareness. The program integrates ecological, socioeconomic, and socio-cultural approaches. The positive response from the authorities shows the success of this program, with the Kokolomboi conservation area recognized as the best Kehati Insitu Park in Central Sulawesi Province.

The element of novelty and uniqueness lies in the shift of society from deforestation and poaching practices to pioneers of conservation by diversifying work into honey farmers and providers of environmental services. The use of palm stem waste as an apiculture medium provides significant added value, saves carbon stocks, increases honey production, and increases community income. The program also utilizes local culture, such as traditional dances, to raise environmental awareness and nature conservation among the community.

The Effectiveness of Social Innovation

Change Through Compass Sustainability

The Kokolombai Lestari program has used a sustainability compass to measure its success and effectiveness. This concept is inspired by four elements: Nature, Economy, Society, and Well-Being.

Nature:
- This program has restored the ecosystem through planting 2,500 trees and restoring an area of 4 hectares.
- Biodiversity is increasing, with the flora and fauna diversity index rising significantly.
- The use of palm trunk waste as a bee house has reduced GHG emissions, saved land from logging, and saved trees and carbon stocks.

Economy:
- The incomes of groups of honey farmers and environmental service providers increased significantly.
- The utilization of waste from companies, such as fire truck tires and sign boards, as well as the use of clean energy through the installation of solar power plants, has helped reduce the burden on the environment.

Well-Being:
- Honey products are utilized in health programs, and access to health services and education has been improved.
- The program also provides additional economic opportunities through product marketing and tourist visits.

Society:
- The program has provided direct benefits to 29 beneficiaries and indirectly to 1,063 people.
The establishment of three institutions and internalization activities for environmental conservation activities in seven schools showed significant social impacts.

New norms in society, such as the creation of Lakasinding dance as a medium of invitation, are also the result of this program. Thus, the Kokolomboi Lestari Program has succeeded in achieving various sustainability goals in efforts to preserve the environment and empower the community.

Columbobi's community empowerment programs have a significant economic impact and improve social welfare and sustainability. In an economic context, this program not only increases individual incomes, but also changes the overall economic structure of the community. The increase in income occurred through forest honey bee cultivation and forest honey reselling business, with sales increasing from year to year. In addition, the program creates new jobs and increases the added value of local products.

In the welfare aspect, this program has succeeded in attracting foreign tourists and gaining wide media support. Honey products are also used in health programs for undernourished and stunted toddlers. Improved access to the Kokolomboi Area also helps make it easier for people to access health and education services.

Socially, this program provides direct benefits to the local community and the formation of new institutions that assist in environmental management and ecotourism. Conservation education has also been internalized into the curriculum of schools around the Kokolomboi Area. This program also gave birth to new norms in the community, such as the obligation to plant trees for newcomers in the Kokolomboi Region.

Partnerships with various stakeholders, including local governments, educational institutions, and community organizations, are key to the success of this program in achieving empowerment and sustainability goals.

**Driving Social Transformation Top of Form**

This program aims to realize social transformation in the community of Kokolomboi Hamlet, Leme-Leme Darat Village by improving the ability of human resources to manage their strengths and take advantage of opportunities in development for welfare. This social transformation involves the intervention of change agents from the government, the private sector, and the active participation of the community, which results in positive changes in people's competence and accessibility to development programs.

At the individual level, there are changes in perception, behavior, and life habits. The previous community that did not care about the environment, now pays more attention to its preservation. They switched from forest hunting to forest honey bee farmers and implemented regenerative farming systems.

At the collective level, new social practices have been created, such as the development of conservation areas by communities to limit illegal logging and the development of forest honey bee cultivation. The community is also active in nursery and tree planting and socializing the importance of nature conservation.

In the system/legal aspect, this program involves key stakeholders from the government and the private sector, resulting in regulations such as protection of springs, species, and prohibition of poaching of endemic animals. This aims to ensure the legality and sustainability of the program in maintaining forest ecosystems.

Through this social transformation, the people of Kokolomboi experienced positive changes that impacted their well-being and environmental preservation.

**Local Hero**

The Kokolomboi Lestari program involves local actors with strong intelligence skills as local heroes to support the sustainability and sustainability of the program. The two main local heroes are Ibu Yermin Yanggolo, an indigenous Togong-Tanga community, and Pak Labi Mopok, the coach and coordinator of a honey farmer group in Kokolomboi.

Yermin Yanggolo and Labi Mopok initially faced poverty problems and carried out environmentally destructive activities, such as illegal deforestation and poaching. PT Pertamina EP Donggi Matindok Field together with the government and key stakeholders are engaging them in the Sustainable Kokolomboi Program, which provides employment opportunities and income from forest bee management and environmental services. Through this program, Yermin Yanggolo succeeded in mobilizing the indigenous people of Togong-Tanga to participate in environmental conservation and the development of special interest tourism. Labi Mopok also plays an important role in developing forest bee management and improving the economy of residents.

Yermin Yanggolo and Labi Mopok became local heroes because of their persuasive abilities, learning abilities, and contributions to environmental conservation. This program also regenerates local heroes for Uun Madus and Esmun, members of the Togong-Tanga indigenous community, by involving them in
community activities, improving skills, and becoming coordinators in events and knowledge sharing activities.

Through the role of local heroes such as Yermin Yanggolo, Labi Mopok, Uun Madus, and Esmun, the Kokolomboi Lestari Program has succeeded in mobilizing the community in environmental conservation and sustainable local economic development.

Social Innovation Enhances Individual Capabilities

Social innovations carried out in the Kokolomboi Lestari Program have succeeded in increasing individual capabilities in Kokolomboi Hamlet, Leme-Leme Darat Village. There are significant changes that can be felt by the people of Kokolomboi in terms of knowledge and skills:

1. **Knowledge:**
   - Prior to the program, many individuals were less aware of the importance of preserving the environment, with most involved in logging and poaching.
   - Through socialization and education about the dangers of logging and poaching, individual perceptions are changing to be more concerned about conservation.
   - A large number of individuals are switching from logging and poaching activities to beekeeping and manage the Cocolomboi Area as an eco-edu tourist destination.

2. **Skills:**
   - Prior to the program, individuals lacked skills in developing conservation areas and as bee farmers and environmental service providers.
   - Through training on land use mapping, education on forest bee cultivation and environmental services, and marketing technology for honey products, individual skills are significantly improved.
   - Now, individuals have skills in recognizing and classifying flora and fauna according to geographical conditions, as well as in becoming bee farmers and environmental service providers.
   - Kokolomboi honey products have been successfully marketed at 7 merchants both online and offline.

Thus, social innovation in the Kokolomboi Lestari Program has succeeded in increasing individual capabilities in Kokolomboi Hamlet, having a positive impact on the community, environment, and local economy.

Social Innovation Enhances Organizational Capabilities

The Kokolomboi Lestari program has had a positive impact in improving organizational capabilities, especially the Togong-Tanga Customary Institution. Here are the significant changes before and after the program:

1. **Legal Aspect:**
   - Previously, although there was already legality for the Togong-Tanga Indigenous people, the focus was only on places of worship. After the program, the institution joined conservation efforts and received legal support from DLH Banggai Islands Regency.

2. **Organizational Structure:**
   - Prior to the program, there was no organizational structure that focused on the environment or management of the Columbobi area. After the program, there is a division of tasks and roles in customary institutions for environmental handling.

3. **Number of Members:**
   - Prior to the program, there was minimal participation from indigenous peoples. After the program, the number of members involved increased, including from communities around Kokolomboa.

4. **Variety and Number of Activities:**
   - Prior to the program, there were minimal activities to increase community capacity in environmental management. After the program, there was capacity building through various education, socialization, land use mapping, and other activities.

5. **Sharing Capabilities:**
   - Before the program, there was no group cash and concern for others was still low. After the program, part of the profits from the management of the kehati area are allocated as social funds to help people in need.
Thus, through social innovation, the capabilities of organizations, especially the Togong-Tanga Customary Institution, have increased significantly, supporting environmental conservation efforts and management of the Kokolomboi area.

**Social Innovation Increases Social Cohesion**

The Kokolomboi Lestari program has had a significant positive impact on social cohesion among Kokolomboi residents. Previously, illegal logging and poaching activities only added to the economic gap between communities around the forest. However, after this program, there were positive changes:

1. **Reducing Inequality and Marginalization:**
   - Solidarity between community members increases through various economic and social empowerment projects. Now, people are more aware of the importance of working together to achieve positive change.

2. **Reconciliation/Joint Action:**
   - The program has raised collective awareness among the people of Kokolomboi about the importance of working together and supporting each other. They are now more connected, solid, and engaged in a concerted effort to advance their communities.

In addition, this program has also provided opportunities for communities to be actively involved in decision-making related to the development of their areas. Thus, the Kokolomboi Lestari program not only has a positive impact on the environment, but also increases social cohesion and solidarity among the citizens of the Kokolomboi community.

**Core Competency Element**

**Transfer of Knowledge and Skills**

1. **Market - Interface Capabilities: Sales and Marketing (CRC):**
   - Core Knowledge: Communication, Empowerment, and Community Engagement
   - Contribution of Empowerment Activities: Branding of honey products and eco-edu tourism Kokolomboi, opening markets through offline and online retail, strengthening community capacity in serving tourists.

2. **Market - Interface Capabilities: Sales and Marketing (SCM):**
   - Core Pengetahuan: Supply Chain Management
   - Contribution of Empowerment Activities: Product promotion in national capacity exhibition forums, product promotion at several company events, group involvement in the procurement of company souvenirs through the products produced.

3. **Infrastructure Capabilities (HSSE - Health, Safety, Security, Environment):**
   - Core Knowledge: Health & Safety
   - Contribution of Empowerment Activities: Building awareness for communities in several vulnerable locations through socialization and installation of safety signs, assistance and work safety training when farming honey.

4. **Infrastructure Capabilities (HSSE - Health, Safety, Security, Environment):**
   - Core Knowledge: Safety
   - Contribution of Empowerment Activities: Increase the sense of crisis of the community regarding the importance of protecting the environment through the installation of media conservation campaigns from company waste.

5. **Technological Capabilities (HSSE - Health, Safety, Security, Environment):**
   - Core Pengetahuan: Environment
   - Contribution of Empowerment Activities: Assistance in seeding and planting endemic plants, monitoring the liver index and monitoring environmental conditions, assistance in the use of biofertilizer fertilizers.

6. **Technological Capabilities (HSSE - Health, Safety, Security, Environment):**
   - Core Knowledge: Health
   - Contribution of Empowerment Activities: Assistance in honey management and production in accordance with halal standards and SNI-8664:2018 Forest Honey Quality Requirements.

7. **Infrastructure Capabilities: Manufacturing (RAM - Reliability, Availability, Maintenance):**
   - Core Knowledge: Electrical, Mechanical, Civil
   - Contribution of Empowerment Activities: Utilization of palm stem waste as a medium for forest bee cultivation.
LCA Relevance and Social Innovation

**Developed Based on the Results of Life Cycle Interpretation**

The LCA (Life Cycle Assessment) study of PT Pertamina EP Donggi Matindok Field in 2023 has a cradle to grave limit in accordance with PCR Crude Petroleum and Natural Gas, 05: 2023 Version 1.0 UN CPC 120. This limitation covers the production system from the drilling and wellhead process to oil and gas as the final product. In this study, the normalization and weighting stages were ignored, so it only came to the process of calculating impact characterization.

The limitations of the LCA system in 2023 cover various stages of production and waste management, such as drilling, wellhead, condensate system, separation system, and others. In addition, there are social innovations in waste management carried out in Kokolomboi, including the use of waste for breeding activities and planting local plants as well as the use of waste as a conservation medium in the area.

Some of the social innovations carried out include the use of biosulfur slurry as fertilizer for agricultural activities in Kokolomboi, as well as the use of fire truck tire waste and sign boards as conservation media and equipment manufacturing for community activities. This innovation provides benefits to local communities, such as increased availability of natural food for endemic animals, making seats and safety signs from waste, as well as higher environmental awareness for the people and visitors of Kokolomboi.

**Responding to Hotspot**

The results of the LCA study show that solid waste treatment from PT Pertamina EP Donggi Matindok Field operations contributes to the potential impact of global warming potential (GWP). Contributions to GWP come from activities such as waste treatment, composting, land haulage, and final disposal. CO2, N2O, and CH4 emissions are major contributors to GWP impacts, with CO2 coming from waste decomposition in landfills, CH4 from composting processes and land transportation, and N2O from composting processes and land transportation.

Innovations, such as processing Non B3 waste into biosulfur fertilizer to support local plant growth for forest bees, can reduce the impact of GWP on BSRU hotspots. The reduction in waste generation can reduce the impact of GWP on BSRU by 1.39E-04 kg CO2eq/MJ. In addition, the use of Non B3 waste from fire truck tires as a conservation medium can also reduce the impact of GWP on the Solid Waste Treatment Unit by 1.11E-06 kg CO2eq/MJ.

**Elements of Sensitivity and Responsiveness to Disasters**

**Natural Disasters**

Over the past 10 years, frequent disasters in Colombo have included landslides, droughts, forest fires, and floods. The conservation program also responded to the disaster that struck in the Kokolomboi area. Activities carried out in responding to disasters are at the stage of prevention and recovery. The activities carried out are improving the ability of soil absorption to rainwater through seeding and tree planting activities.

**Climate Change Adaptation**

Climate change adaptation in Leme-Leme Darat Village before 2021 and after 2021 until now is carried out with the following steps:

1) Before 2021: Provide alternative jobs for the community as environmental service providers and develop eco-edu tourism to overcome the impact of the less than optimal honey harvest season due to climate change.

2) After 2021: Conduct drought, flood, and landslide control with spring protection through: a. Manufacture of protective structures of springs. b. Planting vegetation around the location of springs. c. Making local rules that ensure the sustainability of the springs, including the requirement for tourists coming to Colombo to grow at least one type of plant.

**Disaster Mitigation**

Kokolomboi Hamlet Leme-Leme Darat Village has a distinctive ecosystem containing potential natural resources. However, the karst ecosystem there is vulnerable to disturbance because it depends on the relationship between people, water, land, vegetation, and soil. The Climate Village Program is integrated with the natural potential, biodiversity, and culture of the community to preserve the environment, especially addressing climate change.

Prior to 2021, climate change mitigation measures in Leme-Leme Darat Village included forest and land fire prevention, increased vegetation cover, and the use of renewable energy. After 2021, the program was upgraded and integrated with the Kokolomboi Conservation Village Program.
The award was given to Pertamina EP Donggi Matindok Field for its role in supporting the climate program, especially in empowering the Togong Tanga Indigenous people. These include bans on logging, planting endemic plants, forest restoration, and installing solar panels in Kehati Kokolomboi Park.

CONCLUSION
The Social and Environmental Responsibility Program (TJSL) by PT Pertamina EP Donggi Matindok focuses on awareness, sensitivity, and concern for the environment. The company implements this through various activities, including charity, infrastructure development, capacity building, and community empowerment. Community empowerment is a priority model, as it combines charity activities, infrastructure development, and capacity building. It has a long-term impact and is based on careful analysis and planning. The Kokolomboi Lestari program, aimed at empowering the Togong-Tanga Indigenous Peoples through apiculture-based conservation villages, has positively impacted social life and improved economic and environmental standards in Kokolomboi Hamlet and its surroundings. The report highlights the challenges and shortcomings in the implementation and preparation of the program, aiming to serve as a reference for future improvements.

REFERENCES