Unraveling the Impact of Social Innovation Based on Biocycle Farming: The Path to Sustainable Development

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Abstract. Social innovation is a community empowerment activity based on the community’s social needs to encourage the improvement of capabilities and social relations, as well as better utilization of assets and resources. Social innovation based on bio cyclo farming system aims to introduce the community to environmentally friendly agricultural businesses. This study aims to 1) analyze social innovations based on bio cyclo farming, 2) measure the impact of bio cyclo farming on social, economic, and ecological aspects, including contributions to achieving the SDGs. This research was conducted using qualitative methods supported by quantitative data. The social innovation analysis method includes aspects of the fulfillment of community needs, the element of novelty as a solution to community problems, the existence of social change, and the increase in community capacity. The research location is in Majalengka Regency. The results showed that bio cyclo farming was implemented through agricultural waste and household waste into agricultural inputs, optimization of the use of vacant land, and development of a business-oriented agricultural system. The economic impact of this community empowerment program includes producing several organic products that provide additional assistance to the group. The social impact of the program can be seen in the formation of new institutions, the change in science and skills, and the increasing cohesiveness of society. The perceived environmental impact is in the form of using agricultural waste and household waste as well as optimizing the use of vacant land. Bio cyclo farming-based community empowerment also contributes to achieving the SDGs, especially waste management and food security.

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1 Introduction

Indonesia faces challenges in achieving the target of 2030 SDGs. Two of the challenges are related to waste and food security. Indonesia has an issue with waste because the amount of waste is growing. According to MoEF data, Indonesia produced 67.8 million tons of waste in 2020, which is anticipated to rise to 70.8 million tons in 2025. It was discovered that domestic activities accounted for about 42.1 percent of waste. Sustainable Waste Indonesia (SWI) studies show that up to 24 percent of Indonesia's waste needs to be managed.

Indonesia confronts a major threat from the high conversion rate of agricultural land to non-agricultural land in addition to waste. An overview of the conversion of paddy fields from 7.75 million hectares in 2013 to 7.1 million hectares in 2018, or the equivalent of 130 thousand hectares each year, is given using satellite photography data.

Waste management innovations connected with agricultural output are required to tackle these two challenges. One of the best options is innovative bio cyclo farming, which combines farming in the yard with managing domestic waste. The sustainable agriculture paradigm, which employs the principles of ecologically friendly production, is consistent with bio cyclo farming [1]. Bio cycle farming is an agricultural method that uses the biological cycle and integrates and uses the outputs of recycling domestic waste with livestock and fish waste produced by the community; this is called an integrated organic farming system [2]–[3]. Yard farming by applying bio cyclo farming innovations has economic and environmental benefits. Biocycle farming innovation is an effort to realize a waste management system based on reducing, reusing, and recycling (3R) by realizing a clean and waste-free area while increasing family food security. In order to primarily address the needs of urban residents, yard farming activities include the production, processing, and distribution of products and the generation of biofuel [5]; [6]; [7].

Based on the above problems, Pertamina EP develops social innovation through community empowerment based on bio cyclo farming as an implementation of CSR programs. Social innovation is developing and implementing new ideas (products, services, and models) to meet social needs [8]. Social innovation is a way to overcome social problems experienced by humans [9]–[11].

Social innovation has four elements (Portales, 2019): (1) The satisfaction of needs: It is important to meet unmet or fulfilled needs in an inefficient, unfair, or worthless way. This component outlines the primary causes of innovation, discusses how it came about, and describes the good or benefits it will bring to society. (2) The novel aspects of the solution: This component pertains to novel ways of filling needs. The method of satisfying demands must differ from the conventional method. This element of novelty can be added by creating or including new elements in existing products or services. This section outlines the innovative features of the solution and how it is implemented. (3) Change in social connections and structures: This component concerns the notion that social innovation leads to societal transformation through structural adjustments. Social innovation aims to change how people interact with one another in order to introduce new players into the social dynamics. (4) Increasing society's ability to act refers to the idea that social innovation should support the empowerment of many actors, particularly those marginalized. This factor is required to access the resources required to address needs. This empowerment helps build a society that is more adaptable and better able to meet the demands it places on it. Based on this background, this research aims to 1) analyze social innovations based on bio cyclo farming and 2) measure the impact of bio cyclo farming innovations on social, economic, and ecological aspects, including contributions to achieving SDGs.
2 Methods

The research was carried out at the program implementation location in Bongas Wetan Village and Cidenok Village, Sumberjaya District, Majalengka Regency, West Java, because this location is one of the communities with issues managing household garbage. Additionally, this hamlet is a part of PT Pertamina EP's operating Ring 1 communities, which received support from an empowerment program focused on organic farming. The corporation finances private extension workers who do mentor activities. Qualitative descriptive research methodologies are being used in this study. Primary and secondary data are the two types of data that are employed. Field observations and interviews provided most of the primary data utilized—secondary data in program-related publications and activity reports. Research informants are beneficiaries or parties involved in the program. Social innovation analysis is related to the fulfillment of community needs, elements of novelty as a solution to community problems, social change, and community capacity building.

3 Result

3.1. Community Empowerment Based on Bio Cyclo Farming

The bio cyclo farming empowerment program is a program initiated by PT Pertamina EP in 2018. In addition to seeing the potential of agriculture as one of the main potentials in the area around the company, this program also aims to increase public awareness of the importance of organic waste processing for integrated bio cyclo farming and urban farming, increase land productivity and increase farmer income. The finger program focuses on two villages: Bongas Wetan Village and Cidenok Village, Sumberjaya District, Majalengka Regency.

The target beneficiaries are the residents of Bongas Wetan and Cidenok Villages, accounting for 9,678 people. In the first year of 2018, the research focused on two groups of peasant women with a total of 30 people. The selection of group members is based on the activeness of PKK cadres and the community who support the organic waste processing program for agriculture. The expansion of beneficiaries was carried out in 2019, namely, ten cadets who like agriculture and the environment in Bongas Wetan Village.

The program's implementation, from socialization to the launching of the Agricultural Education Center, is targeted to be carried out in 5 years. Through group assistance and socialization, activities are carried out in the product marketing stage. The concept of bio cyclo farming was also introduced through training in this activity. The training activities included the manufacture of Local Microorganisms (MOL), Liquid Organic Fertilizers (POC), compost, and planting horticulture. This program is a joint initiative between the company, the village government, and several community cadres of Bogas Wetan and Cidenok Villages that focus on empowering peasant women and youth. Through this program, three main groups were formed to drive the program, namely the Bongas Wetan Indah and Mulya Denok Peasant Women's Group and the Pepeling Gembos Farmer Youth Group.

Five factors contribute to community empowerment in bio cyclo farming, including advocacy, network development, capacity building, communication, information, and education (Lubis 2010). The bio cyclo agricultural empowerment program will be examined as a social innovation in this discussion based on three key aspects of community empowerment: capacity building, network development, and community organization.

Community organizing aims to provide a forum for discussion and decision-making on relevant topics within the community. In community development, groups are formed as a
platform for reflection and cooperative action of community members. If structured, the community will also be able to identify resources that they may employ. Organizing develops at the village level, between villages at the sub-district level, and so on, up to the regional and national levels. Program assistants in this program take on the role of community organizers, starting with strengthening groups, separating tasks and responsibilities, establishing member structures, and facilitating group norms. These processes are conducted in a collaborative and dialogical way.

In order to construct networks, other parties (individuals, groups, and/or organizations) must be persuaded to cooperate. Since networks and trust are crucial components of social capital, they play a crucial role in community development. The organization involved in this program has a network, particularly in marketing fresh and processed vegetables. Through exhibition activities, Pertamina EP, in this instance, aids in developing group networks and introduces groups and their products to various parties, including through internet networks.

The purpose of capacity building is to improve the community's capabilities. Capacity building is an effort to increase a person's, a group's, or an organization's ability, as demonstrated by the growth of their abilities, skills, potentials, and talents, as well as their mastery of competencies, to survive and successfully navigate the challenges of change that come quickly and unexpectedly. The context of an object or person's performance, aptitude, capability, and qualitative potential is provided by capacity. The ability of a person, group, or system to carry out specific tasks effectively, efficiently, and sustainably is referred to as capacity in Millen's definition. Capacity also relates to the performance set and the precision in carrying out functions and tasks, for example, the degree to which a person contributes to achieving the goals set. UNDP (1998) defines capacity as the propensity of a person, group, or society to execute its duties, deal with issues, and arrive at long-term objectives[12]–[14]. Capacity building of group members is carried out through various pieces of training.

Aspects of information management, community education, and information dissemination, which support the four aforementioned components, are concerned with communication, information, and education. Finding and storing information is another aspect of information management that ensures it is constantly accessible to those who require it. It is necessary to carry out educational activities to improve people's abilities and provide them with the tools to solve their difficulties whenever the challenges arise. Creative use of diverse communication media (modern and traditional; mass, individual, and group) is required to assist the communication process. This component also seeks to improve the community's ability through the stages of being aware, paying attention, making decisions, and taking action. Some group members have used digital technology to support their business, for example, through Whatsapp and marketplaces to sell honey products. This is in line with the opinion of [16]-[17]; [15] that to accelerate the community development process, it is necessary to take advantage of digital technology.

### 3.2. Analysis of Biocyclo Farming-based Empowerment Programs as Social Innovation

Social innovation has four elements [9]: fulfillment of community needs, the existence of an element of novelty as a solution to community problems, the existence of social change, and the increase in community capacity. The biocyclo farming system is present to answer the need to optimize agricultural land use and increase production. Activities initiated by the company and the community to overcome the environmental crisis by applying environmentally friendly technology have significant economic benefits for village institutions and communities. This
program also increases the social cohesiveness of the community through gathering activities carried out during monitoring and the production of processed food.

The novelties in bio cyclo farming–based empowerment are (1) Land optimization through planting in greenhouses, hydroponics, and aquaponics (integration of vegetable cultivation and fish farming in ponds). (2) Making Local Microorganisms (MOL), Liquid Organic Fertilizer (POC), and compost with raw materials from agricultural waste and household waste. The innovation of the bio cyclo farming system application is a pioneer in the Sumberjaya District area. The majority of farmers in Sumberjaya are still pursuing conventional agricultural activities. Development of the concept of zero waste agriculture to optimize household waste and agricultural waste, such as rotten fruit and stale rice, to be used for making MOL, while dry leaves and household organic waste for materials make POC or compost. Pest control is also carried out using vegetable pesticides whose ingredients are found around the village environment. (3) Bio cyclo farming and urban farming aim to introduce the community to business-oriented agricultural businesses by optimizing narrow land management, selecting high-value products, and post-harvest handling to network and market development.

This bio cyclo farming–based empowerment program is also able to encourage the capacity building of group members. Various activities carried out through this program also contribute to increasing the social capacity of the community. This program has helped people better understand agricultural cultivation and other aspects such as marketing, environment, and ecotourism. In the future, with the development of this program, as well as consistent training and monitoring, it is hoped that the people who have knowledge related to organic agricultural cultivation, as well as benefiting the economy and other factors, will be wider. In the end, not only does this program provide benefits for individuals but also for groups, environments, and villages.

Bio cyclo farming–based empowerment has been successful in bringing about social change. First, developing bio-cyclo farming for organic food items would transform unhealthy food. A non-organic agricultural product, conventional food is grown with artificial pesticides and fertilizers. In addition, organic urban farming is a consumer good produced using a bio-cyclo farming innovation that uses residential organic waste. People are now consuming organic urban agricultural products such as veggies like kale, spinach, mustard greens, and chilies. Mango, crystal guava, blueberries, oranges, srikaya, mulberry, and star fruit are only a few examples of the various fruit trees. Along with fruits and vegetables, there are also plants that have therapeutic properties, including bitter, mint, red, white, and lemongrass gingers. The money from some of the products’ sales is used to purchase market-fresh animal foods like fish, eggs, and meat.

The second is the innovation of bio-cyclo technology in the backyard, which transforms organic urban farming. As a result of the adoption of bio-cyclo farming advances, the change takes the form of formerly unproductive yards that are now threatened by pollution since they are not used for food goods. This invention uses organic waste from eating vegetables, fruit, and rice, as well as domestic home trash in the form of rice washing water. The advantage is the presence of oxygen-rich clean air from organic plant products in the surrounding yards and unproductive regions of the towns.

Third, community empowerment based on bio-cyclo farming is able to change people's knowledge, attitudes, and skills. This condition aligns with the primary goal of community empowerment, which is to change community behavior regarding knowledge, attitudes, and skills. This result is in line with the research [18]–[20], which states that organic farming behavior can be seen from the aspects of knowledge, attitudes, and skills of farmers. The training conducted both to group members and outside the group has brought changes in the mindset and behavior of the Bongas Wetan and Cidenok
community in optimizing vacant land into productive land.

3.3. Impact of bio cyclo farming-based empowerment programs

Community empowerment through bio cyclo farming-based empowerment programs has an impact on aspects of (1) economic (profit), (2) social (people), and (5) environmental (planet). This bio cyclo aligns with the opinion on the sustainability of development [21]. The sale of processed foods, solid organic fertilizers, fresh organic produce from the group's plots, the price of liquid organic fertilizers, and the value of local microorganisms utilized by the group for horticulture cultivation all contribute to the program's economic impact. All indicators combined result in a group income of IDR 30,086,850.

The social impact of the program can be measured through both direct and indirect beneficiaries. The direct beneficiaries of this program are members of the peasant women's group and peasant youth who originally did not have a job and now have a job to supplement the family income. In addition, direct beneficiaries also gain horticultural cultivation skills. Meanwhile, indirect beneficiaries are community members involved or who receive counseling socialization from members of peasant women's groups and peasant youth.

The environmental impact of this program is obtained from the total liquid organic waste processed into local microorganisms and liquid organic fertilizers, solid organic waste processed into solid organic fertilizer, and the total area of vacant land utilized. The reduction of organic waste by 750 kg has the potential to reduce the amount of pollution caused by methane gas (CH4) by 0.0004 Gg/yr or equivalent to 7.88 tons of eqCO2 / year [22].

The use of bio cyclo farming for community empowerment in Bongas Wetan Village has demonstrated a propensity to affect the accomplishment of several SDG objectives. Nine of the total 17 SDG achievement factors are covered in this study. Table 2 has further information. Changing from conventional agriculture to an urban organic farming system with a choice of commodities that are familiar to people's food intake has a positive impact on the transition from rural to peri-urban areas. The community has decided on this strategy for peri-urban residents' long-term food security.
Table 1. The impact of community empowerment through bio cyclo farming on the attainment of SDGs in Bongas Wetan Village and Cidenok Village, Majalengka

<table>
<thead>
<tr>
<th>SDGs Number</th>
<th>SDGs Indicator</th>
<th>Empowerment Impact Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No poverty</td>
<td>Efforts to eradicate poverty</td>
<td>17% growth in earnings</td>
</tr>
<tr>
<td>2</td>
<td>Zero hunger</td>
<td>Efforts to achieve food security and nutrition improvement, and promote sustainable agriculture</td>
<td>Enhancing organic farming production</td>
</tr>
<tr>
<td>3</td>
<td>Good health and wellbeing</td>
<td>Promote healthy lifestyle and support welfare for all ages</td>
<td>• Application of bio cyclo farming innovation • Produce organic food</td>
</tr>
<tr>
<td>8</td>
<td>Decent work and economic growth</td>
<td>Produce products needed by the market</td>
<td>Additional revenue for members</td>
</tr>
<tr>
<td>11</td>
<td>Sustainable cities and communities</td>
<td>Utilization of the yard to produce products for market needs</td>
<td>Urban organic farming that respects the environment</td>
</tr>
<tr>
<td>12</td>
<td>Responsible consumption and production</td>
<td>The product is safe because it is applied organic farming</td>
<td>Uses no hazardous chemicals, and produces wholesome food</td>
</tr>
<tr>
<td>13</td>
<td>Climate Action</td>
<td>The air in the home environment is cooler</td>
<td>Increased oxygen</td>
</tr>
<tr>
<td>15</td>
<td>Life on Land</td>
<td>Zero waste by bio-cyclo farming</td>
<td>Integrated farming system and free organic waste</td>
</tr>
<tr>
<td>17</td>
<td>Partnerships for the Goals</td>
<td>Internal Synergy and external partnership</td>
<td>Improving internal and external social capital</td>
</tr>
</tbody>
</table>

4 Conclusions

The bio cyclo farming-based empowerment program has become a social innovation in Sumberjaya District. This innovation answers the need for optimizing the use of agricultural land as well as increasing production. The novelty of the bio cyclo farming system lies in its role in the utilization of waste that is integrated with urban farming. This program has a high sensitivity when facing the COVID-19 pandemic. The innovation of the bio cyclo farming system application is a pioneer in the Sumberjaya District area. This activity has encouraged social change in the form of changes in community habits in optimizing land use and using organic waste. The economic impact of this program is to provide additional income for the mothers of group members. Social impacts include the formation of new institutions, the development of science and skills, and the increase in community cohesiveness. The perceived environmental impact is in the form of changes in community habits in optimizing land use and using organic waste. The program has also encouraged changes in people's behavior. Changes at the individual level are changes in behavior, including knowledge, attitudes, and skills of society. Change at the community level is using new social practices in society. The new practices are (1) Bio-cyclo farming innovations and (2) Using yards for food production. These changes are conditioned through a participatory empowerment process, with a dialogue and convergent communication approach involving the program facilitator.
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