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The Implementation of Green Economy in Increasing the Achievement of Sustainable Development Goals (SDGs) in the Tempe Industry in Sanan Malang

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Abstract — The application of green economy principles is one of the important strategies in encouraging sustainable development, especially in the small and medium industrial sector. This study aims to analyze the level of application of green economy principles in the tempeh industry and its contribution to the achievement of the Sustainable Development Goals (SDGs). The research method used is a descriptive quantitative approach by collecting data through questionnaires to 30 tempeh industry players. The analysis was carried out using descriptive statistics and Pearson correlation tests. The results of the study showed that the level of green economy implementation was in the "adequate" category with an average score of 3.04 on the Likert scale of 1–5. The highest indicator is in the aspect of economic impact on the community, while the lowest aspect is the use of environmentally friendly technology and waste management. Correlation analysis showed a significant positive relationship between the length of business and the level of green economy implementation (r = 0.45; p= ¡ 0.05), which indicates that business experience also influences sustainability awareness and practices. Although the tempeh industry has a positive contribution to the achievement of SDG 8 (decent work and economic growth), its contribution to SDG 12 (responsible consumption and production) and SDG 13 (handling climate change) is still limited. Policy interventions in the form of training, incentives, and adoption of clean technologies are needed to increase synergy between green economy practices and SDGs goals.

Keywords – Green Economy, SDGs, Industry, Sustainability, Environmentally Friendly Production

I. INTRODUCTION

Sustainable economic development is a major challenge in this modern era, especially in dealing with the issue of climate change and limited natural resources [9][24]. The concept of green economy emerged as one of the strategic solutions to realize environmentally friendly and socially inclusive development [18][30]. The green economy does not only focus on economic growth, but also on reducing negative impacts on the environment and improving people's quality of life [2][17]. The implementation of the green economy has an important role in achieving the Sustainable Development Goals (SDGs) that the United Nations has established as a global agenda until 2030 [25][29]. The SDGs integrate economic, social and environmental aspects, so the green economy approach is very relevant to support the achievement of these goals, such as poverty alleviation, improvement of welfare and environmental conservation [10][13]. The tempeh industry in Indonesia, especially in the Tempe Sanan Malang area, is one of the small and medium industries (SMEs) that has great potential to apply green economy principles. This industry not only contributes economic value, but also contributes to cultural preservation and job creation [16][26]. However, environmental challenges such as the management of fermentation waste and energy consumption are still obstacles that must be overcome to support sustainable development [8][32].

The implementation of a green economy in the tempeh industry can take the form of environmentally friendly waste management, energy efficiency, and sustainable use of local resources [6][19]. These efforts are expected to drive the achievement of the SDGs, especially in terms of decent work and economic growth (SDG 8), innovation and infrastructure industries (SDG

9), and responsible consumption and production (SDG 12) [5][34]. This study aims to analyze how the implementation of green economy in the tempeh industry in Sanan Malang can increase the achievement of the SDGs, as well as identify supporting and inhibiting factors in the process. Thus, the results of the study are expected to provide strategic recommendations for industry players, governments, and other stakeholders to strengthen the synergy between economic development and environmental sustainability [4][20]. This implementation is expected to increase overall efficiency and productivity, as well as create a more structured production process with minimal waste, to increase the competitiveness and profitability of SMEs [23].

II. Theoritical Studies

A. Green Economy

Green economy is an economic development paradigm that emphasizes the efficient use of resources, reducing negative impacts on the environment, and improving people's welfare in a sustainable manner [31]. The main principle of the green economy is the integration between economic growth, environmental conservation, and social equity [2][18]. This concept encourages environmentally friendly technological innovation, energy efficiency, and sustainable waste management as part of the industrial development strategy [17].

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Fig. 1. Green Economy

Figure 1 in Small and Medium Industries (SMEs), tempeh plays an important role in supporting the green economy. Through the implementation of environmentally friendly production—such as the use of local raw materials, the processing of liquid waste to organic fertilizers, and energy and water efficiency—tempeh SMEs can increase added value while reducing negative impacts on the environment. In this way, tempeh SMEs not only maintain the preservation of nature, but also create sustainable and highly competitive business opportunities.

B. Sustainable Development Goals (SDGs)

The SDGs are a global agenda launched by the United Nations to address various social, economic, and environmental problems until 2030 [29]. There are 17 main interrelated goals, including poverty alleviation, inclusive economic development, and environmental preservation [13]. The implementation of the green economy is considered one of the effective strategies to accelerate the achievement of the SDG, especially in goals related to the environment (SDG 13: Climate Action), the economy (SDG 8: Decent Work and Economic Growth), and sustainable production (SDG 12) [10][25].

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Fig. 2. Sustainable Development Goals (SDGs)

Figure 2 Sustainable Development Goals (SDGs) are 17 global goals set by the United Nations to end poverty, reduce inequality, protect the environment, and ensure prosperity and peace for all by 2030. The SDGs invite all countries, sectors, and individuals to work together to build a more just, inclusive, and sustainable future.

C. Tempeh Industry and Sustainable Development

The tempeh industry is part of the small and medium industry sector that has an important role in the local economy in Indonesia [27]. However, tempeh production activities have the potential to have environmental impacts, such as solid and liquid waste from the fermentation process which if not managed properly can pollute the environment [33]. Therefore, the application of green economy principles in the tempeh industry is needed to optimize the use of raw materials, minimize waste, and improve energy efficiency [6]. The tempeh small and medium industry (SMEs) has great business opportunities to be developed, because its existence is very beneficial in terms of distributing community income [22].

D. Synergy of Green Economy and SDGs in the Tempeh Industry

The management of the tempeh industry based on green economy is expected to make a real contribution to the achievement of the SDG, especially in creating decent jobs and inclusive economic growth (SDG 8), ensuring responsible production and consumption (SDG 12), and protecting terrestrial and aquatic ecosystems (SDG 15) [5][34]. The implementation of environmentally friendly technology and sustainable business practices is the key to creating a tempeh industry that is not only economically productive, but also environmentally and socially sound [20].

III. RESEARCH METHOD

This research uses a qualitative descriptive approach with the objective of obtaining an in-depth picture of the implementation of the green economy in the tempeh industry in Sanan Malang and its impact on the achievement of the Sustainable Development Goals (SDGs). This approach was chosen because it can explore contextual data and understand the social processes that occur in the implementation of the concept of the green economy [3][15].

A. Location and Research Subject

The research was conducted in the industrial area of Sanan tempe, Malang, which is the largest traditional tempeh production center in the area. Research subjects include industry owners, workers, and related parties, such as the environmental agency and local cooperative offices that play a role in the supervision and assistance of small and medium industries [28].

1) Data Collection Techniques

Data are collected through several techniques, namely **In-depth interviews** with industry players and stakeholders to explore information related to the green economy practices implemented and the obstacles faced [11].

Participatory observation is carried out to directly observe the production process, waste management, and resource use in the tempeh industry [21].

Documentation studies in the form of relevant reports, regulations, and statistical data to strengthen the analysis and validity of the data [14].

2) Data Analysis Techniques

The data obtained was analyzed using **thematic analysis techniques**, where the researcher identified the main patterns and themes related to the implementation of the green economy and the achievement of the SDGs. The analysis process was carried out repeatedly with the stages of data collection, coding, and interpretation to produce a comprehensive understanding [1][3].

3) Data Validity

To ensure the validity of the data, this study uses source triangulation techniques and triangulation methods by combining interviews, observation, and documentation data. In addition, member checks were performed on the resource persons to verify the interpretation of the data produced [12].

IV. Results and Discussion

A. Description of Respondent Data

This research involved 30 players from the industry in the [Location Name] area. The characteristics of the respondents included age, length of employment, number of workers, and level of education. The majority of the respondents were in the 35-50 age range (60%), with more than 5 years of business experience (70%). Most of the respondents are micro business actors with a workforce of less than 5 people. The last level of education is mainly high school/equivalent (63%), followed by junior high school (27%) and tertiary education (10%).

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Fig. 3. Last Education Level of SMEs Actors

Table 1. Data indicator

No	Indicator	Average	Category
1	Energy use efficiency	3.2	Enough
2	Solid and liquid waste management	2.8	Less
3	Use of environmentally friendly technology	2.5	Less
4	Economic impact on the surrounding community	3.8	Good
5	Awareness of the SDGs goals	2.9	Less
	Total average	3.04	Enough

B. Implementation Rate of Green Economy Principles

Interpretation:

Based on the results above, the level of application of green economy principles in the tempeh industry is in the "adequate" category. The highest indicator is the **economic impact on the community** (3,8), which shows that the tempeh industry has contributed to the local welfare. However, low scores in **waste management** and **environmentally friendly technologies** indicate that environmental aspects are still underpaid.

C. The Relationship between Business Length and Green Economy Implementation

A correlation analysis was carried out to see the relationship between **the length of business** and **the level of implementation of the green economy**. The results of the Pearson correlation test showed a value of **r = 0.45** with **p ¡ 0.05**, which means that there is a **significant positive relationship** between the duration of business and the application of the principles of the green economy.

Interpretation:

Business actors who have been running their business for longer tend to have a better implementation of the green economy. This may be due to greater experience and exposure to environmental training or policy than new business actors.

D. Discussion

The results of the study show that **the tempeh industry has great potential to support the sustainable development agenda**, especially in the local economic aspect (SDG 8: Decent Work and Economic Growth). However, **the environmental aspect remains a major challenge**, especially in waste management and the application of environmentally friendly technology (SDG 12 and SDG 13). This result is in line with the findings of [33] that many tempeh business actors do not have a good waste treatment system. Meanwhile, [7] emphasized that the adoption of environmentally friendly technology is still low due to limited costs and knowledge. In general, **the synergy between the principles of the green economy and the SDGs has not been optimal**. Efforts must be made to increase the capacity of business actors through training, clean technology subsidies, and environmental incentives so

that the tempeh industry can develop productively and sustainably.

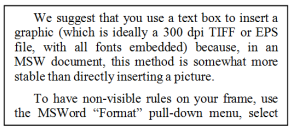

Fig. 4. Research results of tempeh industry.

Figure 4 The results of research on the tempeh industry SMEs contribute to the local economy (SDG 8), waste management, and the application of environmentally friendly technologies (SDG 12 & 13), especially in waste management and environmentally friendly technology. Training, subsidies, and incentives are needed to be in line with the principles of the green economy and the SDGs.

V. CONCLUSSION

Based on the results of the research, the application of green economy principles in the tempeh industry is quite sufficient (average score of 3.04 on a scale of 5). Industry plays an important role in supporting the local economy, but it is still weak in terms of the use of environmentally friendly technology and waste management. This means that the economic aspect is already going well, but environmental sustainability is not yet a top priority. Industry players' awareness of the Sustainable Development Goals (SDGs) is also still low to moderate. As a result, business practices have not fully referred to the principles of global sustainability, especially SDG 8 (decent work), SDG 12 (responsible production), and SDG 13 (climate change). The results of the analysis show that there is a positive relationship between the duration of business and the application of principles of the green economy. The longer the business runs, the better the understanding and practice of industry players in terms of resource efficiency and waste management. This indicates that experience helps shape awareness of sustainability. However, in general, the synergy between the implementation of the green economy and the achievement of the SDGs in the tempeh industry is still not optimal. Key challenges include limited funding, limited access to clean technology, and lack of technical training. Therefore, support is needed through environmental education, government incentives, and collaboration with NGOs and academics to encourage the transformation of the tempeh industry in a more sustainable direction.

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