A SYSTEM DYNAMIC APPROACH TO A COMMUNITY-BASED CIRCULAR ECONOMY IN BANYUWANGI DISTRICT

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Abstract:
The circular economy was formed because of a change in concept from a linear economy, this was intended to solve the world crisis related to environmental degradation. One of the activities that contribute to environmental degradation is economic activity. The purpose of this research is to find out how big the contribution of waste management is to the economy and the environment in Banyuwangi Regency. The method used in this study is the system dynamics qualitative method and uses the causal loop diagram approach. The data analysis technique used is the triangulation method, namely interviews with informants, participant observation and documentation. Based on research, the Banyuwangi government has prepared an Integrated Waste Management Site, Reduce, Reuse, Recycle (WMST3R) for waste management but there needs to be constructive action between the government and stakeholders in implementing a circular economy in the environmental sector, this is to form an attitude of community participation and responsibility against environmental degradation.

Keywords: *Dynamic system, circular economy, causal loop diagram, waste management*

INTRODUCTION

Banyuwangi Regency or commonly nicknamed the sunrise of Java is a district located on the eastern tip of the island of Java, and is located in the Horseshoe area which is directly connected to Bondowoso Regency and Situbondo Regency to the north and, to the south it is directly adjacent to the Bali Strait, in to the west it is directly adjacent to Jember and Bondowoso Regencies and to the south the Indian Ocean. (BPS, 2023). Banyuwangi consists of 25 districts, 28 villages and 189 villages with a population of 1,731,731 people in 2020 with an area of 5,782.40 km2 and a population distribution of 292 people/km2.
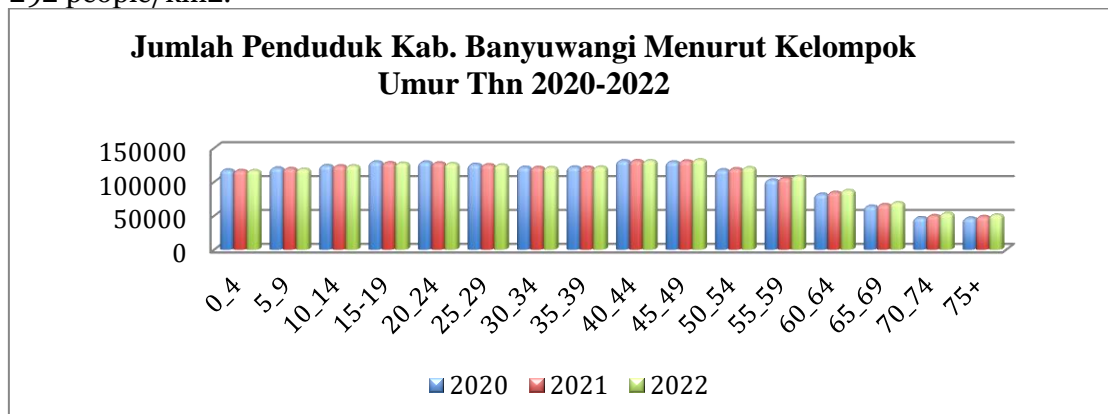

Figure 1. Total Population of Banyuwangi Regency by Age Group in 2020-2022 (Bps, 2023)

Based on the figure above, the increase in public consumption and production is reflected in the increase in aggregate regional income (GRDP). The increase in community consumption and production has had a negative externality impact on the population of Banyuwangi Regency according to the age group fluctuating from 0-4 years to 75 years, but overall the population level has increased, this is directly proportional to the environment, especially waste. In line with Maltus's understanding which explained that increasing population will also affect people's consumption and production behavior. If the population increases and the carrying capacity of land is not directly proportional to both agriculture and housing, it will be difficult for many people to fulfill their food needs. In addition, in the long term it will damage the environment (Yustitia, E., Thoriq, A. M., & Ardiansyah, 2022).

At this time the Government of Banyuwangi is working on waste management to protect the environment, where the government provides services and education on how to use and manage waste to become organic fertilizer and castor (fertilizer processed from leftover food) which can later be used by the community itself for farming besides that can be sold to farmers, and can also reduce the negative impact of the remaining production waste generated by the community, this approach can be called a circular economy approach (Agus Supriyadi, Waste Bank Coordinator).

Circular Economy is a concept of sustainable development that is implemented with a green economy. Its aim is to synergize economic growth and environmental sustainability through the 3R principles (Reduction, Reuse and Recycling) by minimizing natural exploitation in implementing the concept of a sustainable economy (Kasztelan, 2017).

This circular economy concept provides solutions to waste problems due to community production, with a circular economy new products from waste processing can have economic value, both in their original form and in other forms (Ilmiyati, 2022). The more people participate in environmental degradation, the faster the realization of the SDGs target is sustainable, namely the circular economy (Yustitia, E., Thoriq, A. M., & Ardiansyah, 2022).

In 1990 Simon Kuznet put forward a hypothesis, namely the Environment Kuznet Curve (EKC). This hypothesis explains the relationship between income and environmental damage from technological advances (Kurniawati, 2022). This hypothesis is known as the first theory that describes the relationship between economic growth and environmental degradation. Kuznet argues that countries with low per capita prioritize their attention in the production sector, this happens because the investment they get can boost their economy, indirectly reflecting the accumulation of state income by setting aside natural and environmental sustainability (Ardianingsih, A., & Meliana, 2022). Kuznet's hypothesis is in line with (Busu & Trica, 2019) that dynamic environmental asset management can increase productivity and even provide investment aspects in the deployment and development of new technologies that can increase economic growth.

Mao, et al, 2018 explained that GRDP is an indicator to measure the implementation of a circular economy both regionally and macroeconomically. While the circular economy level index is calculated by the number of landfills, the number of recycling rates, the amount of waste disposal capacity at TPA (Final Disposal Sites) and the level of emission load produced. The government builds public awareness not only on the circular economy side, it also builds green management indicators that refer to the level of environmental quality, environmental performance and not only that, the government also encourages ecological construction and the potential for improving the ecological environment to achieve sustainable development targets.

The results of research conducted by Ghisellini and Ulgiati (2020) show that the circular economy system implemented in several companies in Italy, a business model based on sustainable investment in eco-innovation in the environment can provide long-term benefits and benefits because waste is a valuable resource. valuable. This is based on the scarcity of natural resources, asymmetrical geographic distribution and worsening environmental problems. The concept of a community-based circular economy in Bengkayang City is mainly related to change behavior. There needs to be collaborative

action between stakeholders such as the general public, local governments, entrepreneurs and environmental activists in implementing a circular economy system (Handayani, I. T., Prasetyanto, P. K., & Hutajulu, 2021).

The application of a circular economy system tends towards waste productivity and ways to minimize waste in landfills (TPA). Where the Garbage Bank makes policies for environmental restoration, one of the ways is by managing waste from the community itself before it is taken to the TPA which can be processed for organic fertilizer and castor (fertilizer made from food waste), besides that the government provides adequate public service facilities for the recovery of waste resources in the long term in the form of services and education so that the community with education can process waste that has economic value (Tomić and Schneider, 2020).

Based on this explanation, this research explicitly identifies waste management problems in Banyuwangi Regency using a community-based circular economic system with a causal loop diagram approach. With the solution offered by the Banyuwangi Government, a policy is made by providing waste management facilities as well as education and community services to utilize waste into products that have benefits and added value.

RESEARCH METHODS

This study uses a qualitative method of system dynamics (System Dynamics) and the tools used to explain it using Causal Loop Diagrams. The data used comes from 3 databases, namely mental data (observation experience), written data and numeric data. Data analysis with triangulation method: interviews, observation and documentation. With a purposefully select object selection technique where the researcher directly identifies individual or group information sources in a planned and deliberate manner (Creswell, 2014). Mental data was carried out by means of in-depth interviews, selected based on the comparison of informants consisting of a waste bank coordinator 1 informant, the general public consisting of 5 informants. Observations were carried out at TPS, TPA and several community settlements and checked the location of the river flow and community land which is usually used for burning garbage. Documentation is done by taking several photos of field conditions, in this case the research provides several questions but are relevant to the research theme (Creswell, J. W., & Creswell, n.d.).

The system dynamics method was introduced in the 1950s by Jay Forestster (Steman, 2002). System dynamics is a method that is closely applicable to the question of some tendencies in complex systems, namely the patterns of behavior generated by the system. itself with increasing time.This model is made based on simplified real world conditions in the form of objects, situations or processes of complex systems and has a causal relationship (Forrester, 2009).

The causal loop diagram (CLD) approach states a causal relationship between a set of elements running in the system. The basic elements of a causal loop diagram consist of variables (factors) and arrows (links). Variables are conditions, situations, actions or satisfactions that influence and can be influenced by other variables. Variables can be both quantitative and qualitative. This method is used to explain interdependence in various situations and is effective for understanding mental models (Kim and Andersen, 2012). The causal relationship between these variables shows two possibilities that occur, namely: the possibility of the relationship moving in the same direction (+ / R = Reinforcing) or moving in the opposite direction (- / B = Balancing).

Circular Economy is a concept that is applied to create sustainable waste management by utilizing waste sources into products that have economic value. This concept provides recycling-based business opportunities which in turn can increase employment opportunities, investment, economic growth, reduce poverty and increase regional income. This can be seen in Figure 1 in the research conceptual framework (Busu, M., & Trica, 2019).
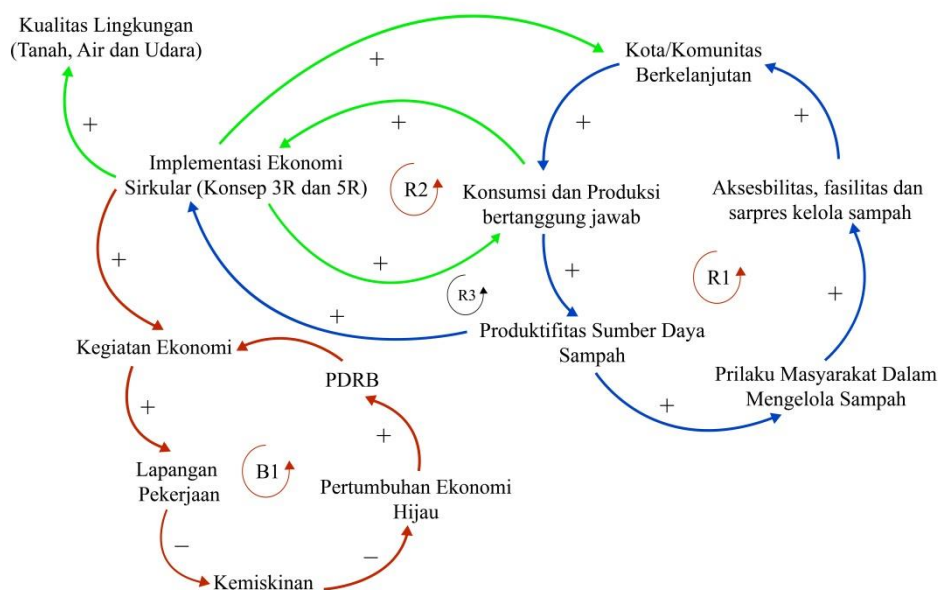
Kualitas Lingkungan
(Tanah, Air dan Udara)

Kota/Komunitas
Berkelanjutan

Implementasi Ekonomi
Sirkular (Konsep 3R dan 5R)

R2

Konsumsi dan Produksi
bertanggung jawab

Aksesbilitas, fasilitas dan
sarpres kelola sampah

R1

Kegiatan Ekonomi

R3

Produktifitas Sumber Daya
Sampah

PDRB

Prilaku Masyarakat Dalam
Mengelola Sampah

Lapangan
Pekerjaan

B1

Pertumbuhan Ekonomi
Hijau

Kemiskinan

Figure 2 Research Concept Framework

RESULTS AND DISCUSSION

In implementing a circular economy in Banyuwangi Regency is not easy, it requires a fairly long and complicated process, apart from that the preparation of this policy requires identification of the problem first and needs to be studied before it is applied in a circular economy. In implementing the circular economy, the government requires the role of the community in facilitating the implementation of the circular economy in the environmental sector, especially waste management. This discussion will explain the related problems and the policy model applied.

Problems related to waste management in Banyuwangi Regency concern accessibility, facilities and infrastructure; Public awareness of the importance of waste management is minimal; the public still lacks knowledge of the industry or waste recycling and the lack of government or private intervention in waste management.
The problems that occur in the Banyuwangi Regency community are related to accessibility, facilities and infrastructure in disposing of garbage, namely:
1. Not all villages in Banyuwangi Regency have adequate TPS (Temporary Discharge Sites).
2. There is no waste disposal in both organic and inorganic waste bins.
3. Not all villages in Banyuwangi Regency have cleaning staff.
4. Lack of Banyuwangi District Government Providing education or training to the community to process waste into goods that have added value.

The current behavior of the people of Banyuwangi Regency in disposing of garbage is mostly burned, especially in villages where there is still a lot of garbage dumped on the banks of rivers. This behavior is due to the lack of public knowledge in proper waste management, where the community does not know how to use this waste into valuable and beneficial products. Regarding the lack of knowledge of the people of Banyuwangi regarding waste management related to the 3R concept, namely (reduce, reuse, recycle) and even the 5R concept (reduce-reused-recycle-recovery-repair). Community behavior that occurs is due to the lack of access, facilities and infrastructure, which makes people not yet apply the 3R and 5R concepts.

In Banyuwangi Regency there is a Garbage Bank as a waste collection institution. Where the garbage bank will sort out the waste from the community, which later the sorted waste will be deposited or taken by collectors to make crafts. Apart from that, the

Banyuwangi Garbage Bank also manages the manufacture of organic fertilizers and kasgot to be marketed to consumers who need it. However, this garbage bank in Banyuwangi only has 1 location so only urban areas can access it, so many villages or hamlets cannot access the garbage bank because it is far from where they live. The following is the condition of the Garbage Bank and TPS in Banyuwangi Regency.

Figure 3. Conditions of TPS and Waste Banks in Banyuwangi Regency

4.2 Policy Model
In implementing a circular economy in Banyuwangi Regency, the Government needs help from all parties, including (local government, the general public, environmental activists, entrepreneurs, and academics) to realize a community-based circular economy in Banyuwangi Regency. The following policies are described using a Causal Loop Diagram (CLD), namely:
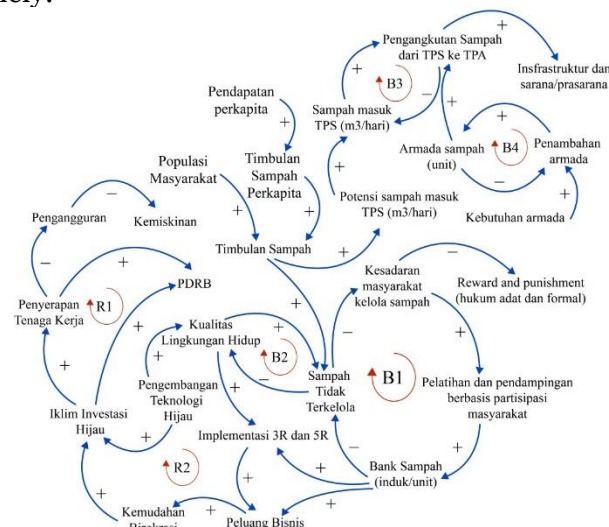

Figure 4. Circular Economy Policy Model of Banyuwangi Regency.

Based on the Policy Model Image above, the Banyuwangi Regency Policy is as follows:

1. In Figure CLD-B1 it can be explained that the high amount of waste in TPS and in the Garbage Bank is due to low public awareness of proper waste management. The Banyuwangi government needs to take a massive approach, namely providing socialization or education related to waste management related to work programs besides building motivational resources to create new products from the utilization of household waste in the form of compost or cast-off which can be used for fertilizer for the community's own plants or in the community. sell to those who need it in their own yards. Apart from that, it can also be sold to those who need it (Noviana L, et al, 2020). Community participation in waste management influences the achievement of a green economy. The concept of a green economy leads to environmental quality, increased human welfare and social justice which together will reduce ecological deficits (Ismail, et al, 2023). The green economy leads to energy markets, environmental management (Water, Air and Land), and increased community participation in waste management coupled with science and technology and the availability of adequate information for the public, can create a green economy that is in line with the SDGs.

2. In Figure R2 it can be explained that implementing 3R and 5R can increase business opportunities by exploring the potential of the remaining resources as well as turning household waste into goods that have economic value in accordance with the green economy concept (Ardiansyah, et al, 2022). To regenerate the results of waste processing, a new recycling processing technology that is environmentally friendly is needed which is able to facilitate the waste processing process, so in addition to creating renewable products, technology can improve environmental quality (soil, water, air). The entry of new technology and accompanied by bureaucratic efficiency attracts investors to invest in environment-based capital (Nadapdap, 2021)

3. In Figure R1 it can be explained that the impact of technology development is an increase in the investment climate. Investment activities allow a society to continuously increase economic activity and employment opportunities, increase national income and increase the level of prosperity (Panelewen, et al, 2020). The positive impact obtained from increasing investment other than the government can expand business in development can also absorb labor (Meilasari D, 2020). The availability and accessibility of jobs contribute to the level of employment which can reduce the unemployment rate (Yustitia, et al, 2022). Economic activity resulting from the existence of an investment climate apart from providing employment, reducing unemployment also alleviates poverty and ultimately increases the gross regional domestic product (GDP) (Handayani, et al, 2021)

4. Figure CLD B2 explains that environmental quality (water, soil, air) is achieved when the community wants to participate in household waste management prior to TPS. Community participation can reduce environmental pollution, reduce waste and emissions resulting from economic activities by implementing 3R and 5R.

5. Figures CLD B3 and B4 describe infrastructure, facilities and infrastructure in assisting community waste management. Landfills of waste resulting from an increase in population coupled with an increase in people's per capita income affect the increase in landfills per capita. When viewed from the amount of waste that enters the TPS and Garbage Bank per day, it is necessary to improve socialization to the community regarding waste management besides adding a transport fleet for the village "so that people no longer throw garbage in rivers.

CONCLUSION

The importance of the role of the Banyuwangi Regency government in waste management and the need for collaboration between stakeholders such as the general public, local government, entrepreneurs, environmental activists, elementary to high school/vocational school students can be involved in implementing a circular economy system independently. In addition to providing education that is equitable and on target to increase public knowledge about new products resulting from waste processing to increase the recycling industry and green investment as a business potential that can ultimately improve the quality of public health, quality of the environment and reduce the number of unemployed and reduce poverty.

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