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PLASTIC RECYCLE IN CIRCULAR ECONOMY : ECONOMIC & ENVIRONMENTAL IMPROVEMENTS

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Abstract

Environmental issues have become a global concern regarding the increasing impact of damage by company operations such as greenhouse gas emissions and toxic toxins, piles of plastic waste etc. This research aims to test the implementation of the circular economy concept which is influenced by the effects of the supply chain, green environment and economic growth through the recycled plastic industry. This research is based on a quantitative methodology with population data coming from members of ADUPI within the scope of plastic recycling industry activities in the DKI Jakarta area and its surroundings. The respondent sample data collection technique used the purposive random sampling method which was calculated using the SmartPLS statistical application program. The findings of this research indicate that the application of the circular economy concept in the research area has had little impact on environmental change for the better, reducing the burden of environmental pollution only. Apart from that, the length of the plastic recycling process for the output process is not commensurate with the significant economic added value to increase the community's economic growth. However, the overall effect of supply chain activities has a positive contribution to the implementation of the circular economy concept of 50.5%.

Keywords: Green economy, economic growth, supply chain effect, plastic value chain, circular economy.

INTRODUCTION

Since the industrial revolution was initiated in the mid-17th century, the concept of a linear economy (unidirectional economy) has been running (Johansen et al., 2022). This means that the production cycle starts from extracting natural resources to provide raw materials for factories, factories mass producing goods, goods are purchased by consumers and, usually, thrown away after they are damaged or used once. Planet Earth has become a cycle of life, “take – create – throw away . According to Geissdoerfer (2017), the circular economy concept is a form of correction of the linear economic cycle into a regenerative system with resource input, waste, emissions

and energy leaks being minimized by slowing down, closing and narrowing energy and material cycles. This can be achieved through durable design, maintenance, repair, reuse, remanufacturing, re-repairing and recycling. The main principles in the circular economy concept are Reduce, Reuse, Recycle, Recovery and Repair, better known as 5R. The 5 R principle can be implemented by reducing the use of raw materials from nature (Reduce) through optimizing the use of materials that can be reused (reuse) and the use of materials resulting from the recycling process (recycle) or from the recovery process (recovery) or by carrying out repairs (repairs). Post-use products that usually become waste can be recycled or become raw materials for new products. This method also has an impact on cultural and economic improvements. Reducing the habit of wasting natural resources and reducing or slowing down environmental damage by utilizing goods that would normally become waste has become a new source of income for many people involved in economic circulation. One of the main environmental problems faced by the world, including Indonesia, is plastic waste which pollutes the land, rivers and sea. The nature of plastic is not easily decomposed, it takes hundreds of years to decompose naturally. Plastic contains substances that can cause the growth of cancer cells (carcinogenic). Thus, dealing with plastic waste through the recycling process not only reduces environmental pollution, but is also beneficial for health.

Plastic recycling in some cases has led to a circular economy. This circular economy system allows plastic waste to be recycled into new products. In fact, this concept is claimed to be able to encourage environmentally friendly economic growth. Several sources explained that Sweden is one of the countries that has implemented a circular economy through developing plastic waste management. The percentage of recycling of plastic materials in Sweden has reached 53 %. Apart from Sweden, plastic waste management in Denmark is also going well through taxes on companies that dispose of waste and government support for a circular economy. This support takes the form of creating a market for waste and used goods as well as developing data in related fields. Meanwhile in Indonesia, there is still very little recycling of plastic waste. Executive Director of the Indonesian Plastic Bag Diet Movement, Tisa Mafira, explained that the recycling rate for plastic waste in Indonesia is still very small. The value is less than 11 %, only around 9-10 %. Meanwhile, around 90 % of the plastic waste has not been recycled and is scattered everywhere. As much as 30 % of the city's plastic waste is thrown into drainage systems which flow into the sea and pollute the sea. The rest disrupts water flow, pollutes the soil and accumulates in residential areas. However, if managed well, plastic waste has economic value. On the other hand, based on research by Jenna R Jambeck from the University of Georgia (2010), there are 275 million tons of plastic waste in the world. Around 4.8 – 12.7 million tons of this are wasted and pollute the sea. Jambeck ranked Indonesia second after China, as the country that pollutes the sea the most with plastic waste. The Ministry of

Environment and Forestry (KLHK)'s National Trash Management System (SIPSN) data indicates that by 2023, the nation's overall trash volume will reach 72.4 million tons, with approximately 18.9%, or 14.2 million tons, coming from plastic garbage. Even though the population of Indonesia's coast is not much different from India. India's marine plastic pollution only ranks 12th in the world. It is far from the ranking of Indonesian marine plastic waste pollution. This means that the plastic waste management system in Indonesia is very poor, when compared to other coastal countries. The commitment to implementing a circular economy in dealing with plastic waste in all regions in Indonesia is a solution to prevent plastic waste from entering the ocean and finding other environments. This circular economy cycle will make the Indonesian government's determination to reduce plastic waste by 70 % by 2025, and must be realized in the form of real work and have an impact on community welfare and environmental preservation.

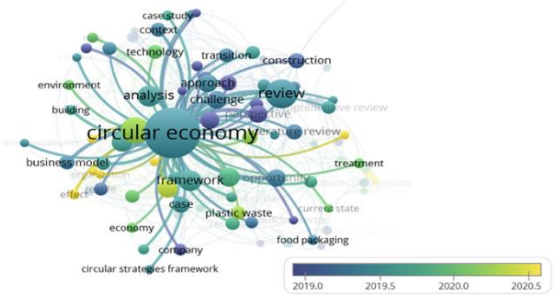

Figure 1. Meta Data Analysis (Overlay Bibliometric)
Source: Data proceed by researcher

Based on the research network above, Circular Economy (CE) is a trending research topic, focusing on Green Environment, Economic Growth, and Supply Chain Effect. Environmental issues are a global concern, and based on a livable environment, economic growth is crucial for development. Systemic SCE is also important. Indonesia has a large number of textile industries that are naturally associated with waste issues that have the potential to cause negative impacts on the environment. Indonesia's textile industry faces challenges due to poor production processes and poor language. Plastic waste management has potential to boost company growth through plastic waste management and recycling. Management should consider plastic waste as a commodity, enhancing economic growth through waste management and recycling.

(Darmastuti et al., 2021) and (Filya et al., 2023) illustrate that CE's concept of plastic waste handling can stimulate environmentally friendly economic growth and build green supply chain management. This process helps SCE and provides understanding to customers in increasing environmental awareness. However, some studies, such as (Listyadewi, 2023) and (Subekti, 2023), hold a different view, which argues that the technology and process of plastic waste management are complicated and require a relatively large number of workers starting from the process of

separating types of plastics that require special handling, shredding to the pelletizing process (Subekti, 2023). So that some companies are reluctant to adopt the CE concept because it is considered to have a high level of risk management and has the potential to increase production costs in the supply chain process.

Some businesses still take this risk to achieve the goal of minimizing problematic process items. In addition, GE has become a necessity by ensuring that all plastic waste can be reused, recycled, or decomposed, so that all plastic items remain within the economic scope and do not pollute the environment (Khairunnisa, 2021). (Masruroh, Nikmatul, 2022) explain that, GE can form CE standards in creating a more efficient system for economic, environmental, and community aspects including cost assessment and greenhouse gas emissions. (Bag, 2022) added that, the implementation of the CE concept in plastic waste management aims to reduce environmental pollution. Therefore, the CE concept can improve the competitiveness of the company by promoting GE. Researchers (De-la-Torre, 2020) also revealed that the CE concept can create an economy and reduce the presence of microplastics in the environment. However, (Syberg et al., 2021) and (Johansen et al., 2022) argue that the implementation of the CE concept has a lot of impact on the presence of plastic waste that cannot be processed or recycled, causing environmental contamination and not bringing significant economic impact. The study reveals a lack of research findings, specifically inconsistency in the study on SCE from a waste management system that does not improve the environment and economy, making it crucial for researchers to address this issue. Therefore, this study examines the Analysis of Plastic Waste Management Opportunities in the Plastic Value Chain from a Circular Economy Perspective.

RESEARCH METHOD

In this study, a survey is used to collect quantitative data, and questionnaires and statistical analysis are used to measure and determine survey results. Utilizing Likert scales (1–5), respondents react to questions posed as options on surveys, which are the primary means of collecting data. The model used in this study was the causal or influential connection model. The analytical technique employed to assess the study's hypothesis is called structural equation modeling, or SEM. The analytical approach is the quantitative technique; the analytical equipment is the SEM. A quantitative and descriptive technique is used in this study.

The quantitative approach, on the other hand, is concentrated on determining the correlations between variables, numerically expressing values, and numerically processing data using statistical formulae and mathematical techniques. A sample is the portion of the population that is being tested; the population is all individuals whose attributes may be approximated. There are 250 members of the Indonesian Plastic Recycling Association that make up the population of this study. Conversely,

the study sample addresses inquiries related to the size and makeup of the population. This model's outputs may be applied to the population as a whole and utilized to inform choices. The sample approach employed in this study was purposeful sampling; 143 respondents were identified using the Slovin algorithm.

Research Framework

1. **Relationship between Green Environment and Circular Economy.**

Environmental sustainability and circular economy are two key concepts that significantly impact the use of plastic waste in the plastic value chain. Environmental sustainability encourages the use of plastic, as well as the promotion of plastic-based materials or bioplastics. This promotes the use of plastic waste in production processes by the government and environmental activists. According to (Khan, 2018) the concept of a sustainable environment and CE has a positive impact on the potential for plastic waste management within the framework of the plastic value chain. This opens the door for the plastic recycling and manufacturing industry to initiate innovative new products from plastic waste or plastic recycle seeds. Integrated CE implementation can provide substantial economic and environmental benefits (Sheldon & Norton, 2020); (Kazancoglu, 2018); (Liu, 2018); (Confente, 2020). Based on the explanation, first hypothesis reads

H1 : Green environment affects circular economy.

2. **Relationship between Economic Growth and Circular Economy.**

Economic growth according to (Androniceanu et al., 2021) is one of the main factors driving the increase in plastic use. Because plastic has an important role in various sectors such as industry, packaging, and consumer products. This increase in plastic use causes an increase in the amount of plastic waste. Economic growth has a major impact on the plastic value chain, which includes the extraction of plastic raw materials, production, use, and waste management (Johansen et al., 2022). So the second hypothesis says:

H2 : Economic Growth affects circular economy

3. **Relationship between Supply Chain Effect and Circular Economy.**

The impact of waste management on plastic waste in plastic waste management systems has two main effects: increasing plastic production and consumption, and reducing plastic waste issues. Implementing waste management in plastic waste management systems can help reduce plastic waste negative impacts on the environment and promote a more sustainable economy. Optimizing plastic waste management involves ensuring the quality of raw materials, components, and products, reducing waste and reducing plastic waste issues for the environment and human health (Claureina Diana Anastasia, 2019). In addition, it is important to consider the impact of plastic waste problems on the environment and human health. The implementation of plastic waste management in the CE concept has the opportunity to form an economic cycle in the community (Um, 2019).

H3 : Supply Chain Effect affects circular economy

4. **Relationship between Green Environment, Economic Growth and Supply Chain Effect with Circular Economy.**

The concept of CE encourages continuous work to increase plastic recycling and recycling efforts, aiming to reduce plastic waste and increase economic value (Wu et al., 2021). This can be enhanced by addressing environmental issues, economic challenges, and interaction in the waste management sector (Tsiamis et al., 2018). Collaboration between various stakeholders is crucial in developing innovative solutions for plastic waste management, as it can influence plastic waste in the waste management sector. Therefore, it can be concluded that green environment, economic growth, and supply chain effects have the potential to influence plastic waste opportunities in the plastic value chain, when viewed from a circular economy perspective (Khan, 2018).

H4 : Green environment, economic growth and supply chain effects simultaneously affect circular economy.

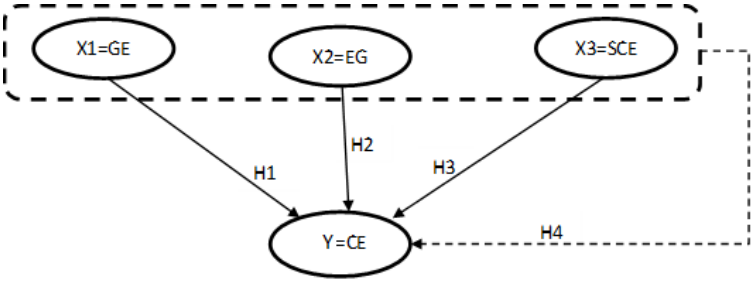

Figure 2. Research Framework

Source: Data proceed by researcher

RESULT AND DISCUSSION

RESULTS

Instruments Test

1. Construct Reliability and Validity Test

Table 1. Construct Reliability and Validity Test

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
CE	0.792	0.791	0.865	0.616
EG	0.837	0.838	0.881	0.552
GE	0.871	0.880	0.900	0.563
SCE	0.796	0.800	0.859	0.550

Source: Data processing with SmartPLS 3.3

Based on the results of the construct reliability and validity test from the analysis of X1 = GE, X2 = EG, X3 SCE and Y = CE, it shows Cronbach's Alpha, Composite Reliability, and

Average Variance Extractance (AVE) on each variable looks valid and reliable, because it has met the prerequisite test of research data as follows:

a) Convergent Validity: indicators are considered valid if the Cronbach's Alpha coefficient value is> 0.70, and the research indicator test results show> 0.70.
b) Discriminant Validity: indicators are considered valid if the Average Variance Extracted (AVE) on each variable is> 0.50.
c) Composite Reliability: indicators are considered reliable if the Composite Reliability on each variable is> 0.70.

2. Multicollinearity Test

Table 2. Multicollinearity Test

Inner VIF Values	VIF	Description
GE → *CE*	3.649	No multicollinearity
EG → *CE*	2.662	No multicollinearity
SCE → *CE*	2.233	No multicollinearity

Source: Data processing with SmartPLS 3.3

Based on table 2. above, the results of the collinearity statistics (VIF) test where the VIF test requirements <5, it can be seen that the three independent variables on the dependent variable have met the test requirements so that it can be explained that there are no symptoms of multicollinearity. The test results of the variable value of Green Environment on Circular Economy amounted to 3,649, the variable value of Economic Growth on Circular Economy amounted to 2,662 and the value of Supply Chain Effect on Circular Economy amounted to 2,233.

Furthermore, the coefficient of determination (R-square) is used to assess how much the dependent variable is influenced by the independent variables together. The R2 value obtained is 0.505, meaning that the effect of the independent variables together on the dependent variable is 50.5%, while 49.5% of the dependent variable is still influenced by other variables. The coefficient determination (R2) test results can be seen in Table 3. below:

Table 3. Coefficient Determination (R2)

	R Square (R^2)	R Square Adjusted
CE	0.505	0.494

Source: Data processing with SmartPLS 3.3

Hypothesis Test

After conducting a series of prerequisite tests above, proceed with the analysis of the research hypothesis by checking the t statistics and p values partially. The results of hypothesis analysis can be seen in Figure 3. Path Analysis and Table 4. Path Coefficient as follows:

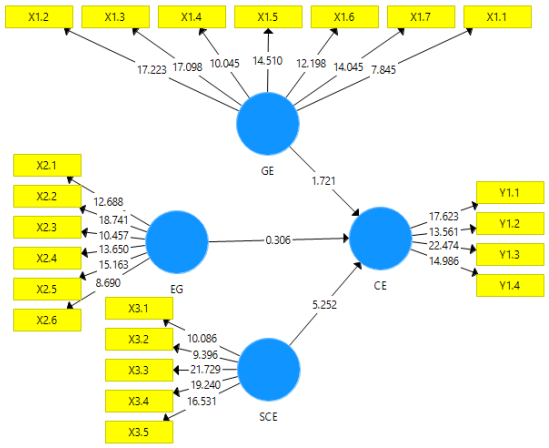

Figure 3. Path Analysis (Analyze data with SmartPLS 3.3)

Table 4. Hypothesis Test

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	t statistics (O/STDEV)	p values	Conclusion
GE → *CE*	0.041	0.046	0.134	0.306	**0.760**	Rejected
EG → *CE*	0.178	0.188	0.103	1.721	**0.086**	Rejected
SCE → *CE*	0.552	0.548	0.105	5.252	**0.000**	Accepted

Source: Data processing with SmartPLS 3.3

Based on the hypothesis analysis above, it can be explained that the partial statistical t value of 0.306 and p value 0.760 > 0.05 means that the Green Environment relationship does not positively affect the Circular Economy, so H1 is rejected. Meanwhile, the hypothesis analysis with a partial statistical t value of 1.721 and a p value of 0.086 > 0.05 means that the Economic Growth relationship does not positively affect the Circular Economy, so H2 is rejected. However, the hypothesis analysis with a partial statistical t value of 5.252 and a p value of 0.000 < 0.05 means that the Supply Chain Effect relationship positively affects the Circular Economy, so H3 is accepted.

DISCUSSION

In the results of the analysis of hypothesis one above, where it was found that there was no influence between GE and CE, this is contrary to the purpose of implementing the CE concept as expected. This means that the implementation of the CE concept carried out in the research area is still less effective or has less significant impact on green environmental change. If reviewed further, the plastic recycling management business actors have so far only carried out collection activities from various regions and sorting of plastic waste according to its type then continued with the shredding process and the pelletizing process (new plastic seeds from recycling) (Beccarello & Foggia, 2018). This CE concept has only been implemented to reduce the

burden of environmental pollution. Because some plastic waste that cannot be processed is then burned or becomes stockpiled material in an area which is usually in the form of plastic clots (Millette et al., 2019). This result is a research finding as well as an evaluation for stakeholders to further motivate businesses to minimize process residues, for example with tax incentives.

Furthermore, the test results on the second hypothesis also explain that there is no influence between EG and CE. After evaluating the researcher found that the length of the plastic waste management process with the output or process results was not proportional to the significant economic added value to increase community economic growth. This can be an incentive to increase the added value of plastic waste management results, so that people are motivated to manage plastic waste to improve their economic life (Tsiamis et al., 2018).

Meanwhile, the results of the third hypothesis test which prove that there is an effect of SCE on CE reinforce that, the impact of the supply chain can be an important role in building CE, this is in line with the results of previous studies such as, (Giudice, 2020) ; (Li, 2021). However, if the implementation of GE, EG and SCE variables is carried out together, the research proves that 50.5% of the circular economy concept can be implemented properly.

CONCLUSION

This study focuses on the implementation of the circular economy concept in Jakarta, highlighting its benefits. The study reveals that the plastic waste management process does not provide optimal environmental benefits, it only reduces the environmental footprint of plastic waste as shown by the results of the analysis of the rejected hypothesis. The occurrence of high economic growth is also not expected, due to the length of the plastic waste management process which means the cost of the stages of the process is high and this is not proportional to the economic added value generated. However, the economic value added from the plastic waste management process can create jobs to support the daily economic life of the community. The supply chain effect, if integrated and coordinated with other stakeholders, can create a sustainable economic system. Overall, all these factors together positively contribute to the development of a circular economy.

LIMITATION AND IMPLICATION

This research suggestion is aimed at business practitioners and other stakeholders as well as further researchers who can be explained For business practitioners and stakeholders, researchers suggest that, can use these findings as scientific insights and references in decision making in business and public policy. Furthermore, for future researchers, this research still has the potential to be

developed with other variables that can be sought through meta data analysis, so as to further refine the implementation of the circular economy concept in Indonesia.

Research limitations, researchers realize from the size of the area, the lack of research samples and the accuracy of the selection of research variables. Hopefully, research on this topic can lead to better results.

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