

## Circular Economy Policy of Shrimp Waste as an Effort to Implement Green Economy

Suning <sup>1\*</sup>, Djoko Adi Walujo <sup>2</sup>, Linda Dwi Rohmadiani <sup>3</sup>, Prihono <sup>4</sup>

<sup>1,3</sup> Urban and Regional Planning Study Program, Universitas PGRI Adi Buana Surabaya, Indonesia

<sup>2,4</sup> Industrial Engineering Study Program, Universitas PGRI Adi Buana Surabaya, Indonesia

\*Corresponding author: [suning@unipasby.ac.id](mailto:suning@unipasby.ac.id)

**ABSTRACT** The treatment of hazardous wastes have been a key issue in the circular economy. This challenge is obvious in the fish factory of Bulak Kenjeran, which is located in the coastal area of Surabaya city, East Java. One of its major problems is waste produced by the hazardous disposal of shrimp scrap around the neighborhood drainage. The purpose of this study was to determine the condition and characteristic of shrimp waste, its economic potential and the policy directions for implementation of the circular economy as an alternative to the green economy. The research method uses descriptive quantitative with economic analysis technique R/C ratio, and process hierarchy analysis (AHP). The method of data collection was done by distributing questionnaires and in-depth interviews to the selected respondents. The results showed that the characteristics of shrimp waste in the form of shrimp heads and shells were still not used for activities that had economic value, people disposed them in careless manner such as littering at ditches around their homes and in the sea. The results of the economic calculation with the R/C ratio shows, the circular economy of shrimp waste for chitosan production is not yet profitable from a financial perspective because the shrimp that fishermen get per day still does not meet the capacity for large-scale chitosan production. This paper recommends a few priority of the policies including; 1) providing innovation and technology for economic-based shrimp waste treatment; 2) improving environmental health by not disposing shrimp waste around the neighborhood environment; and 3) the government provides shrimp processing industry for fishermen. This implicate that the results of this study recommend the existence of synergy between the Surabaya City government, industry and fishermen's associations to apply the circular economy concept from various potential sources of coastal waste. Thus the waste will be treated properly and able to generate financial benefits in a sustainable manner without having to bear the costs of environmental risks due to indiscriminate disposal of waste.

**KEYWORDS** *Circular Economy; Coastal Area; Green Economy; Shrimp Waste; Sustainable Environment.*

### INTRODUCTION

Land space which is closely related to ocean space is the definition of a coastal area. The development of coastal areas can not be separated from the development of the area broadly, which can be seen because the coastal area is a system. In addition, the coastal area in terms of spatial planning provides a function as a cultivation area, protected area or as a certain area. Adisasmita (2006)

explained that the direction of structuring and utilizing space for the development of coastal areas must be able to provide welfare for the community, therefore environmental sustainability must be maintained.

Spatially, people living on the coast actually have various life problems, especially environmental problems, where the coast is the downstream position that receives the impact of upstream activities. One of

the unavoidable upstream activities is the existence of industry and other population activities that dispose of their waste into river bodies and go to the coast or downstream. Indifference to waste problems in this case waste management, especially waste or waste from shrimp, both shrimp heads, shrimp shells and others from shrimp that are no longer used. This condition can lead to environmental quality degradation if it is not managed properly, for example a strong stench, clogged drains or drainage and lots of flies, these conditions have an impact on the quality of public health.

One of the pillars of the national economy in Indonesia is the sea and coastal areas and their natural resources have strategic significance for economic development. Socially, the coastal area is inhabited by not less than 110 million people or 60% of the Indonesian population who live within a radius of 50 km from the coastline, and this area is the forerunner of the development of Indonesia's urbanization in the future. The regional autonomy policy makes each region have broader authority in the management and utilization of coastal areas (Menteri Permukiman dan Prasarana Wilayah, 2003).

Coastal communities have little knowledge about the negative impacts of community activities in the upstream or urban areas, such as the accumulation of garbage in the ocean as a result of discharge from the upstream, coupled with the waste from the coastal communities themselves. These problems unconsciously pollute the environment and affect the health of people living in coastal areas.

Green economy is an idea that aims to improve social welfare without the risk of

environmental damage (Antasari, 2019). This is in line with the concept of green economy according to United Nations Environment Programme (2011) that there are three pillars in the application of a green economy, namely an economy that is low in carbon or an economy that does not produce emissions and environmental pollution; an economy that uses natural resources sparingly; and an economy that pays attention to social justice issues.

The three pillars are targets to be achieved in the sustainable development goals. Nababan et al., (2014) in his research concluded that economic transformation can be pursued by implementing a green economy. This is due to changes in the economic structure of non-renewable natural resources into renewable resources. The transformation from exporters of raw materials for local products into finished or processed materials that are competitive, have added value and are able to provide a more significant multiplier effect for people's welfare to become the ultimate goal of a green economy. Fauzi et. al, (2014) discusses green economy in view of green economy policy in Indonesia, namely poverty reduction and internalization of environmental costs, which are one form of green economy application.

Seeing the existing condition of shrimp waste that has not been utilized, especially in the Coastal Area of Bulak Village, Kenjeran District, Surabaya City, it is necessary to mitigate environmental pollution which causes high environmental risk impacts, by implementing the circular economy concept of shrimp waste with the aim of improving the community's economy by without damaging the environment, namely achieving

a green economy policy. Green economy policy can be implemented simultaneously with the implementation of the blue economy (BE) based marine and fisheries development concept, which is a strategic step in the implementation of marine and fisheries development. The concept of BE aims to create an environmentally friendly industry, so that sustainable and sustainable management of natural resources can be created (Radiarta et al., 2016).

Gladek (2017) explains that there are 7 (seven) pillars in the circular economy, namely; 1) Materials are cycled at continuous high value, 2) All energy is based on renewable sources, 3) Biodiversity is supported and enhanced through human activity, 4) Human society and culture are preserved, 5) The health and wellbeing of humans and other species are structurally supported, 6) Human activities maximize generation of societal value, 7) Water resources are extracted and cycled sustainably. The seven pillars definitively Gladek (2017) explains that the circular economy is a new economic model to meet human needs and distribute resources fairly without destroying the function of the biosphere or crossing any planetary boundaries.

In the long term, the circular economy provides opportunities and is a source of social innovation that prioritizes social economic aspects and solidarity with the fulfillment of community needs that are not fully fulfilled by conventional companies konvensional (Ministry for Ecological and Solidary Transition, 2018). Gallaud, & Laperche (2016) stated that implementing a circular economy also means building more virtuous consumer behavior and being able to

save resources. This statement is supported by the results of research that has been carried out by Blomsma & Brennan (2017) that the circular economy is applied in order to extend the productive life of resources so that there are no longer communities or industry parties to waste resources. The main goal of the circular economy is for economic prosperity followed by environmental quality that has an impact on social justice for future generations, and this concept can be carried out by businesses and consumers who implement a circular economy (Kirchherr et al., 2017).

Based on the description above, the importance of this research is that the green economy model of circular economy activities can solve environmental problems where shrimp waste that is not utilized has an impact on environmental pollution, both greenhouse gases (GHG), unpleasant odors, and the number of flies, which are reduced by implement a circular economy. Thus, this study provides a novelty about environmental pollution mitigation efforts by applying the circular economy concept, especially from shrimp waste which can improve the community's economy without damaging the environment.

The application of the circular economy in this study is the sustainability of shrimp waste produced by fishermen in Bulak Village, Kenjeran District, Surabaya City. Several studies use shrimp waste for economic activities with the aim of producing higher economic value, for example Oktaviani et al., (2012) conducted a study by providing additional shrimp waste for the production of salted duck eggs. The results obtained were a decrease in the water content of raw

duck eggs, the ash content of salted boiled duck eggs increased, the fat of boiled duck eggs increased, the protein of raw salted duck eggs increased and the carbohydrates of salted boiled duck eggs decreased and the process was influenced by the salting process which was given the addition of shrimp waste. Oktaviani, et al concluded that animal feed produced from shrimp waste has a high nutritional value at a lower price when compared to fish meal as a protein source.

Circular economy research was also conducted by George et. al (2015) using the variables of recyclable products, recycling ratio, and environmental pollution costs. The results show that environmental quality cannot be maintained or improved through economic growth. However, the improvement of environmental quality can only be measured by reducing pollution and renewing the environment from the ratio of product recycling that can be done. Meanwhile, Sukarniati & Khoirudin (2017) examined the blue economy in terms of institutional aspects in fisheries management, especially shrimp ponds. The results show that the blue economy concept has not been fully implemented in the community because there is no full support for facilities and infrastructure from the government and other institutions, however, applying the blue economy concept is very important in order to minimize environmental pollution.

Shrimp resources are seen as renewable resources, so management to ensure the sustainability of these resources must be interpreted as an effort to utilize resources whose extraction rate should not exceed the rate of their ability to recover. The status of

the utilization of shrimp resources is currently at the overfishing stage and this shows that the current management policies have not been able to guarantee the sustainability of the resource. Therefore, it is necessary to change the management paradigm towards utilization based on stock and area units by implementing appropriate management options by considering biological aspects, population dynamics, fishing technology and socio-economics (Suman & Satria, 2014).

The initial stage of the research was carried out with a primary survey process, namely identifying the existing conditions and characteristics of shrimp waste. The resulting output identifies the existing conditions and characteristics of shrimp waste. The second phase of research calculates the potential of shrimp waste based on the Circular Economy as an alternative to the Green Economy, using an analysis of economic calculations using Return-Cost (R/C Ratio) analysis. This R/C analysis is a comparison between total income and total costs incurred for the production of a business. Mathematical formula analysis The R/C ratio refers to (Kasmir & Jakfar, 2009) that:

$$\text{Profit } (\pi) = \text{TR} - \text{TC} \dots \dots \dots (1)$$

$$= (p \cdot C) - (\text{FC} + \text{VC}) \dots \dots \dots (2)$$

$$\text{Rasio R/C} = \text{TR/TC} \dots \dots \dots (3)$$

Description:

$\pi$  : profit (Rp)

TR : total revenue (Rp)

TC : total cost (Rp)

FC : fixed cost (Rp)

VC : variable cost (Rp)

p : chitosan price (Rp/kg)

C : total production chitosan (kg).

The criteria for calculating the R/C ratio are:

1. If the R/C ratio  $> 1$ , it means that the business being run is profitable or economically feasible to continue.
2. If the R/C ratio  $< 1$ , it means that the business being run suffers a loss or is not feasible to operate next.
3. If the R/C ratio  $= 1$ , it means that the business being carried out is in a position of no profit and no loss (Break Event Points).

The second stage calculates the potential of shrimp waste based on the Circular Economy with the conversion method of the percentage of chitosan production that has been carried out by Istiqomah (2011) which is 4.6% of the total production of shrimp heads and shells, and 2.3% of chitosan can be produced from total shrimp production, so that obtained the economic feasibility value of chitosan production. The output of the analysis of economic calculations is to obtain economic feasibility for chitosan production activities.

The third stage of research determines the policy direction for implementing the Circular economy of Shrimp Waste as an Alternative to the Green Economy, at this stage using process hierarchy analysis (AHP) method which is processed with expert choice 11 software, by comparing the criteria and sub-criteria used as research variables, and the output obtained is the existence of policy directions regarding Green Economy through Circular Economy Waste Shrimp.

## DISCUSSION

The existing condition of the coastal community of Bulak Village in Kenjeran,

Surabaya shows that on average the people have a livelihood as fishermen. Physically, there are coastal settlements in alleys, in each alley there is a group of fishermen who have different sea catches from one another. For example, in alley I-II, the sea catches are fish and sea cucumber species, in alley III-IV the sea catches are shrimp and small fish. The catch obtained is marketed according to the community where it is caught. Post-fishing activities, the community carries out processing activities

For their catches, and this activity affects environmental conditions, namely people throwing garbage into the sea, into the gutters around the house including shrimp and fish skin waste. The activities of fishing communities are shown in **Figures 1** and **2**, while the data and calculation results of shrimp production and shrimp waste for chitosan are shown in **Tables 1** and **2**.

In this study, only the economic potential value of shrimp waste in the form of one production activity will be calculated, namely Chitosan production. Leceta et. al, (2013) explained that chitosan can be found in the gills of fish, trachea, intestinal wall and on the skin of squid. The main source of chitosan lies in the shells of animals subphylum Crustaceae 17 sp, such as shrimp, lobster, crab, and other shelled animals, especially marine products. Physically, chitosan is odorless, in the form of a yellowish white amorphous solid. The distinctive characteristic of chitosan is that it is easy to form into sponges, solutions, gels, pastes, membranes and fibers which are very useful and easy to practice (Manjang, 2013).

In addition, chitosan can also be practiced in agriculture and food. The uses of chitosan include a mixture of animal feed

rations, antimicrobials, antifungals, dietary fiber, stabilizers, carriers of food additives, flavors, nutrients, pesticides, herbicides, plant viruses, and de-asedification of fruits, vegetables and fruit juice purifiers.



**Figure 1** Empirical Conditions Garbage and Shrimp Waste Behind Residents' Houses

Source: Primary survey and analysis results, 2021



**Figure 2.** Empirical Conditions Drying Shrimp Process

Source: Primary survey and analysis results, 2021

Data and calculation results of shrimp production and shrimp waste for chitosan are shown in Tables 1 and 2.

**Table 1** Shrimp Production RT 07  
Bulak, Kenjeran , Surabaya

Shrimp Production	1.920 kg
Shrimp waste production	88,32 kg
Production capacity of chitosan	190 kg
Chitosan Production	44,16 kg/bulan

Source: Result of Analysis, 2021

**Table 2** Calculation of the Planned Cost of Production of Shrimp Chitosan Waste Bulak Kenjeran Surabaya

<b>Chitosan Production Cost/month</b>		
<i>Employee salary</i>		
15 day x 2 people	Rp30.000/ people/day	<b>Rp900.000</b>
<i>Electricity and water</i>		
15 day	Rp30.000/day	<b>Rp450.000</b>
<i>HCL, water &amp; NaOH</i>		
1.920 kg	Rp. 4.000/kg	<b>Rp7.680.000</b>
<i>Packaging</i>		
15 plastic	Rp500/plastic	<b>Rp7.500</b>
<i>Shrimp head and shell raw materials</i>		
1.920 kg	Rp2.700/kg	<b>Rp5.184.000</b>
<i>Total production cost</i>		<b>Rp14.221.500</b>
<i>Amount of chitosan produced (kg)</i>		<b>44,16</b>
<i>Cost of selling chitosan/HPP (Rp/kg)</i>		<b>Rp322.044</b>

Source: Result of Analysis, 2021

Table 1 is the existing data on shrimp production and shrimp waste in Bulak Kenjeran Village, Surabaya, especially RT 07 Gang III and Gang IV. The shrimp catch or shrimp production obtained by fishermen every month is + 1,920 kg and shrimp waste produced both heads and shells every month is + 88.32 kg and for the manufacture of

chitosan production capacity of 90 kg, the chitosan production produced is 44, 16 kg/month. The data is processed by referring to the results of research by Istiqomah (2011) for the conversion of chitosan production to 4.6% of the total production of shrimp heads and shells, and 2.3% of chitosan can be produced from total shrimp production.

Table 2 is the result of the calculation of the economic analysis of the R/C Ratio which has been modified with the Excel program with the aim of making reading easier. Table 2 explains the calculation results of the planned production cost of shrimp waste chitosan, it is found that the total value of the total production cost is Rp14,221,500 with a total amount of chitosan produced 44.16 kg, so the cost of selling chitosan/HPP is Rp322,044. The calculation results show that the total cost of production is greater than the cost of selling chitosan/HPP or value is at position -1, then economically the circular economy activities of shrimp waste for chitosan production have not yet made a profit, this is linear with Ritzén & Sandström (2017) who explains that in practice the circular economy requires financial, structural, operational, attitude and technology so that operationally there are no longer obstacles in implementing the circular economy. Therefore, to achieve the benefits from the economic aspect, the shrimp catch must be increased.

Based on the results of the analysis and empirical studies, it is not economically feasible for chitosan production due to the small number of shrimp obtained by fishermen, gradually the circular economy activities in this study are focused on how

shrimp heads and shrimp skins are not disposed of in gutters or garbage dumps around people's homes. However, the shrimp waste can be used for other activities that generate simple economic value but the community is able to do it without high capital.

The average community does not want to process shrimp waste into finished goods but it is immediately dumped in the gutters around the house, and this is an expensive environmental cost because the environment becomes smelly, shabby and lots of flies which in turn greatly affect the health of the community and children. The application of a circular economy can still be done by utilizing shrimp waste in a simple way, namely for a mixture of making crackers and shrimp paste so that absolutely no shrimp waste is thrown away and polluting the environment.

Fheng & Yan (2007) also explained that the main principle of the circular economy is how to apply the 3R principles, namely reduce, reuse, recycle in every production activity. Further explained by Su et. al (2013) that reduce in principle is the use of energy inputs and raw materials with minimal waste, for example, seen from how to simplify product packaging, use cost-effective equipment and use the right technology. To use. Therefore, the Ellen MacArthur Foundation (2013) states that the circular economy is designed in a restorative and regenerative manner, namely "end-of life" in which products and energy systems are transferred using renewable technologies, eliminating the use of toxic chemicals, eliminating waste by making improvements to materials, products and services. and systems designed to be as efficient as possible.

Circular Economy of shrimp waste as an alternative to Green Economy in the Coastal Zone is measured based on several criteria aspects including Economic Aspects, Environmental Aspects and Socio-Cultural Aspects. The results of the Circular Economy analysis in the Coastal Zone begin with analyzing the criteria for Economic Aspects, Environmental Aspects and Socio-Cultural Aspects. The results of the analysis are then strengthened by a process hierarchy analysis (AHP) in order to determine strategic priorities. The priority of the strategy referred to is the policy of implementing the Circular Economy of shrimp waste as an alternative to green economy, especially in the coastal area of Bulak Kenjeran, Surabaya City.

Based on the formulation of the second problem of this study, namely Circular Economy, it is planned for chitosan production activities, but empirically at the research location the shrimp yields obtained by fishermen are still less than the total chitosan production capacity if chitosan production is on a small or medium industrial scale.

Therefore, the policy direction that can be recommended regarding the application of a circular economy as an alternative to green economy, especially in the Bulak Kenjeran Coastal Area, Surabaya is that by analyzing the policies expected by the community, community leaders and stakeholders based on questionnaire data and grounded theory that has been carried out. The identification of each variable answered by the respondent is described in Table 3 the hierarchical structure of AHP.

**Table 3** Identification of Criteria and Sub Criteria AHP

CRITERIA	SUB CRITERIA
ECONOMIC ASPECT	AE.1. Fisherman's Income AE.2. Shrimp Waste Contribution to Economic Growth AE.3. Technological Innovation
ENVIRONMENTAL ASPECT	AL.1. Smelly and Dirty Environment AL.2. Environmental Health AL.3. Global warming
SOCIAL CULTURAL ASPECTS	ASB.1. Fishermen Sell Shrimp to Middlemen ASB.2. Processing industry prepared by Government

Source: Result of Analysis, 2021

Table 3 is an aspect of the criteria used to determine the circular economy policy direction as an alternative to the green economy. According to Saaty, (1993) hierarchy is defined as a representation of a complex problem in a multi-level structure where the first level is the goal, followed by the factor level, criteria, sub-criteria, and the last level is the strategic priority. With a hierarchy, a complex problem can be broken down into groups which are then arranged into a hierarchical form so that the problem will appear more structured and systematic.

Tongco (2007) explains that the determination of AHP respondents was carried out by purposive sampling. The selected respondents must meet the criteria, namely knowing existing conditions, understanding policies regarding coastal environmental



conditions, having experience in dealing with coastal issues related to hierarchical goals. The number of respondents was 30 from various groups ranging from fishermen, traders, fishermen housewives and related agencies. In this research, there are three (3) aspects including economic, environmental and socio-cultural aspects. Each aspect has a sub-criteria aspect. The criteria and sub-criteria aspects were then coded according to the respondent's answer into the expert choice 11 software to obtain the expected policy direction results according to the expectations of the community, namely;

First, pairwise comparison at the criterion level, it is known that the value of Economic Aspects has a higher level of importance compared to other criteria of 0.535 with an inconsistency ratio of 0.05 less than 0.1. Second, pairwise comparison at the sub-criteria level for Economic Aspects by comparing fishermen's income, contribution of shrimp waste to economic growth and technological innovation. The comparison results show that the highest value with the level of importance is more important, namely technological innovation, which has a value

of 0.548 and an inconsistency level of 0.01 is smaller than 0.1. Third, pairwise comparisons at the sub-criteria level for environmental aspects, namely comparing between smelly and dirty environments, environmental health and global warming. The comparison results show that the level of importance is higher in environmental health with a value of 0.474 and an inconsistency level of 0.0007 less than 0.1.

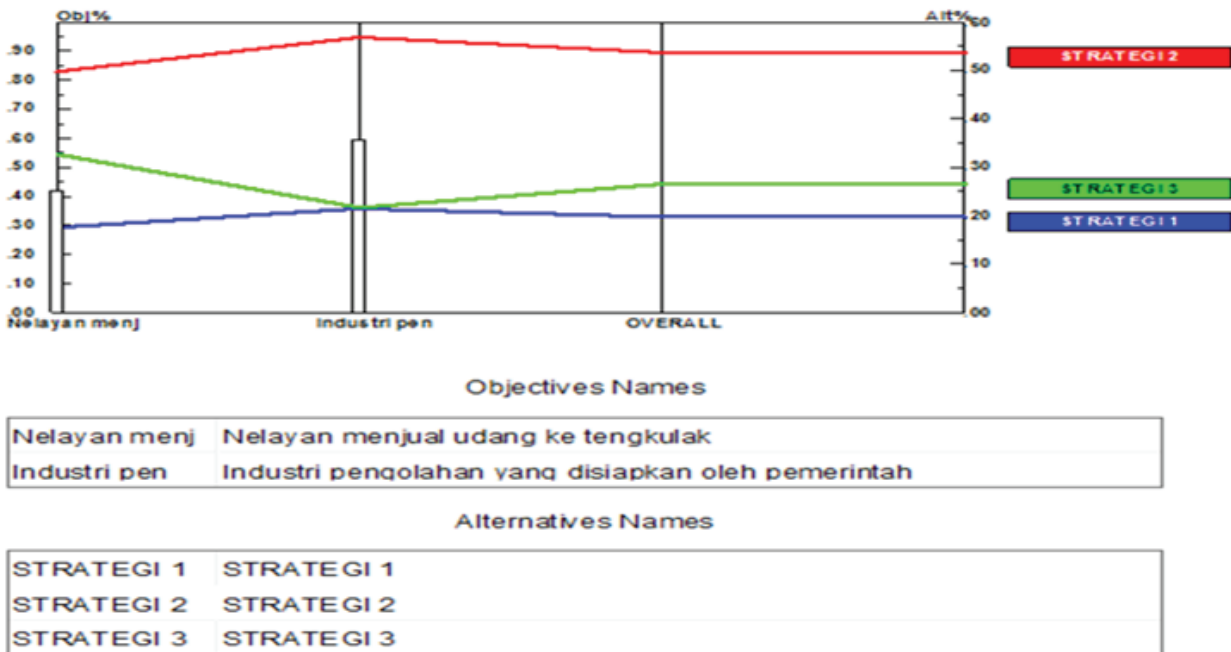
Fourth, pairwise comparisons at the sub-criteria level for the socio-cultural aspect, namely comparing which ones have a higher level of importance between fishermen selling shrimp to middlemen with the processing industry prepared by the government, the comparison results show that the processing industry prepared by the government has a greater value, namely 0.589 and the inconsistency level of 0.0 is smaller than 0.1. To get the expected policy priority value, the next step is to add the weighted average rating of all respondents between the criteria levels that have been compared previously (Permadi, 1992). The sum of the average weights is shown in Table 4 and Figure 3.

**Table. 4.** Compilation of Strategic Priority Calculation Results

	CR 1 (goal)	CR 2 (economy)	CR 3 (environment)	CR 4 (socio-cultural)	Quantity	Priority
Strategy 1	0.284	0.252	0.394	0.197	1.127	2
Strategy 2	0.466	0.483	0.392	0.537	1.878	1
Strategy 3	0.250	0.265	0.214	0.265	0.994	3

Source: Results of Analysis, 2021

**Performance Sensitivity for nodes below: Goal: Circular Economy Limbah Udang sebagai Alternatif Green Eco > Aspek Sosial Budaya (L: .210)**



**Figure 3** Strategic Priorities for Policy Direction  
 Source: Result of Analysis, 2021

Table 4 and Figure 3 show the sequence of strategies related to the Circular Economy of shrimp waste as an alternative to the Green Economy in Coastal Areas, namely:

- a. Strategy 2: Economic aspects with a strategy of providing innovation and technology for shrimp waste treatment
- b. Strategy 1 : Environmental aspects with a strategy to improve environmental health, namely not disposing of shrimp waste around the home environment
- c. Strategy 3 :Socio-cultural aspects with the government’s strategy to provide a shrimp processing industry for fishermen.

The results of AHP analysis can be concluded that the application of circular economy of shrimp waste as an alternative to Green Economy in Coastal Areas is to prioritize strategy 2 as the main priority, in which the economic aspect is the main

factor of circular economy activities so that shrimp waste is utilized without polluting the environment. Therefore, the recommended strategy is to provide innovation and technology for shrimp waste treatment. In the future, this innovation and technology can be implemented by producing chitosan for the home industry, small industry and medium industry. Furthermore, fishermen, in this case can be represented by the community (fishermen association), can collaborate with government and private parties who are interested in the establishment of a chitosan factory / industry, of course with various conditions. Strategy 1 as the second priority is the environmental aspect, where empirically the head and shell of the shrimp are dumped in the ditch around the house, this habit carried out by fishermen will be

detrimental to the environment. Therefore, a policy strategy is needed to improve environmental health by utilizing shrimp waste in a simple way first, namely shrimp waste can be used as a mixture of crackers, shrimp paste and paste.

Whereas strategy 3 is the socio-cultural aspect with the direction of government policies that must be ready to provide a shrimp waste processing industry in accordance with the shrimp potential obtained by fishermen without prioritizing the value of economic benefits, but rather public services where the government facilitates public services with the aim of making the community culturally not throwing waste anywhere, but socially having high concern for the environment.

Thus the policy direction for implementing a circular economy of shrimp waste as an alternative to a Green Economy in Coastal Areas, policies that can be done are to implement each policy strategy according to the highest value of recommended policy priorities, namely strategies 2, 1 and 3. namely the Economic Aspect with a strategy of providing innovation and technology for processing shrimp waste, the Environmental Aspect with a strategy to improve environmental health, namely not disposing of shrimp waste around the home environment, and the Socio-Cultural Aspect with the government's strategy of providing a shrimp processing industry for fishermen.

## CONCLUSION

The characteristics of shrimp waste, both in the form of shrimp heads and shells, are still not used for economic value activities, people throw them in gutters around homes and at sea. Based on empirical studies that

are not economically feasible for chitosan production due to the lack of shrimp obtained by fishermen, gradually the circular economy activities in this study are focused on how shrimp heads and shrimp skins are not disposed of in gutters or garbage dumps around people's homes. However, the shrimp waste can be used for other activities that generate simple economic value but the community is able to do it without high capital.

The application of a circular economy can still be done by utilizing shrimp waste in a simple way, namely for a mixture of making crackers and shrimp paste so that there is absolutely no waste from shrimp that pollutes the environment. The policy direction for implementing the Circular Economy of Shrimp Waste as an Alternative to a Green Economy is to implement each policy strategy in accordance with the highest value of the recommended policy priorities, namely strategy 2 with a total value of CR 1.878, which is to provide innovation and technology for processing shrimp waste. Strategy 1 has a total CR value of 1.127, namely improving environmental health by not disposing of shrimp waste around the home environment and strategy 3 with a total CR value of 0.094, namely the government provides a shrimp processing industry for fishermen.

The policy implications that can be recommended are; 1) The Surabaya City Government should coordinate with the fishermen's association so that fishermen who catch more shrimp are not only fishermen in gangs III and IV, so that the production of shrimp is more and it is possible to establish a chitosan factory; 2)

The private sector can provide capital to the fishermen's association for shrimp waste processing activities, in accordance with the capacity of the private sector, both the innovation model and the technology used; 3) Institutions as an evaluator and controlling team for the environment, especially in coastal areas, can be immediately formed by the Surabaya City Government so that the green economy from various alternative sources of coastal economic potential can be processed properly, producing sustainable economic value without having to bear the costs of environmental risks due to waste disposal.

### Acknowledgement

Gratitude is delivered to Universitas PGRI Adi Buana Surabaya, LPPM and the Urban and Regional Planning Laboratory for funding and facilitating this research.

### BIBLIOGRAPHY

- Adisasmita, R. (2006). *Pembangunan Kelautan Dan Kewilayahan*. Yogyakarta: PT. Graha Ilmu.
- Antasari, D. W. (2019). Implementasi Green Economy Terhadap. *Jurnal Ekonomi Pembangunan*, 5(2), 28-36.
- Blomsma, F., & Brennan, G. (2017). The Emergence of Circular Economy: A New Framing Around Prolonging Resource Productivity. *Journal of Industrial Ecology*, 21(3), 603-614. <https://doi.org/10.1111/jiec.12603>
- Ellen MacArthur Foundation. (2013). *Towards the circular economy*. *Journal of Industrial Ecology*, 2, 23-44.
- Fheng, Z., & Yan, N. (2007). Putting a circular economy into practice. *Journal of Sustainability Science*, 2(1), 95-101
- Fauzi, A., Sugiyanto, C., Gumiri, S., Patria, D., Kuncoro, I., & Jaya, K. (2014). Strategi implementasi pembangunan di Heart of Borneo (HoB) melalui pendekatan ekonomi hijau. *Kelompok Kerja Nasional (Pokjanas) Heart of Borneo (HoB)*. Jakarta: Kementerian Koordinator Bidang Perekonomian Republik Indonesia
- George, D. A., Lin, B. C. A., & Chen, Y. (2015). A Circular Economy Model Of Economic Growth. *Environmental modelling & software*, 73, 60-63
- Gallaud, D., & Laperche, B. (2016). *Circular Economy, Industrial Ecology And Short Supply Chain*. John Wiley & Sons.
- Gladek, E. (2017). *The Seven Pillars of the Circular Economy* (p. 1). <https://www.metabolic.nl/news/the-seven-pillars-of-the-circular-economy/>
- Istiqomah (2011). *Pra Perancangan Unit Pengolahan Kitosan dari Cangkang Udang Windu di Sidoarjo*. Skripsi, Universitas Brawijaya Malang.
- Leceta, I., Guerrero, P., & De La Caba, K. (2013). Functional Properties Of Chitosan-Based Films. *Carbohydrate polymers*, 93(1), 339-346.
- Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127(April), 221-232. <https://doi.org/10.1016/j.resconrec.2017.09.005>
- Kasmir dan Jakfar. (2009). *Studi Kelayakan Bisnis*. Kencana, Jakarta.
- Manjang, Y. (2013). Analisa Ekstrak Berbagai Jenis Kulit Udang Terhadap Mutu Khitosan. *Jurnal Penelitian Andalas*, 12(5), 138-143.

- Ministry for Ecological and Solidary Transition. (2018). Circular Economy Roadmap of France: 50 Measures for a 100% Circular Economy. <https://www.ecologique-solidaire.gouv.fr/sites/default/files/FREC%20anglais.pdf>
- Nababan, Y. J., Syaukat, Y., Juanda, B., & Sutomo, S. (2014). Tantangan Bagi Pembangunan Berkelanjutan Di Kalimantan Timur: Menuju Inclusive Green Economy. *Masyarakat Indonesia*, 40(2), 211–228.
- Permadi, B. (1992). AHP Pusat Antar Universitas–Studi Ekonomi. Jakarta : UI.
- Oktaviani, H., Kariada, N., & Utami, N. R. (2012). Pengaruh Pengasinan terhadap Kandungan Zat Gizi Telur Bebek yang Diberi Limbah Udang. *Life Science*, 1(2).
- Radiarta, I. N., Erlania, E., & Haryadi, J. (2016). Analisis Pengembangan Perikanan Budidaya Berbasis Ekonomi Biru Dengan Pendekatan Analytic Hierarchy Process (Ahp). *Jurnal Sosial Ekonomi Kelautan Dan Perikanan*, 10(1), 47. <https://doi.org/10.15578/jsekp.v10i1.1247>
- Ritzén, S., & Sandström, G. Ö. (2017). Barriers To The Circular Economy–Integration Of Perspectives And Domains. *Procedia Cirp*, 64, 7–12.
- Sukarniati, L., & Khoirudin, R. (2017). Analisis Kelembagaan Penerapan Konsep Blue Economy Pada Tambak Udang (Studi Kasus Di Dusun Ngentak Desa Poncosari Kecamatan Srandakan Kabupaten Bantul). *Jurnal Ekonomi Pembangunan STIE Muhammadiyah Palopo*, 3(2), 52–65. <https://doi.org/10.35906/jep01.v3i2.198>
- Suman, A., & Satria, F. (2014). Dinamika populasi udang jerbung (*Penaeus merguensis de Man*) di perairan Arafura dan alternatif pengelolaannya. *Jurnal Kebijakan Perikanan Indonesia*, 2, 97–104.
- Su, B., Heshmati, A., Geng, Y., & Yu, X. (2013). A review of the circular economy in China: moving from rhetoric to implementation. *Journal of Cleaner Production*, 42, 215–227
- Saaty, T. L. (1993). Pengambilan Keputusan Bagi Para Pemimpin, Proses Hirarki Analitik Untuk Pengambilan Keputusan Dalam Situasi Yang Kompleks. Pustaka Binama Pressindo, 100.
- Tongco, M. D. C. (2007). Puposive Sampling as a Tool for Informant Selection. *Ethnobotany Research and Applications*, 5, 147–158.
- United Nations Environment Programme (2011). *Towards A Green Economy: Pathways To Sustainable Development And Poverty Eradication*. Nairobi, Kenya: UNEP.
- Menteri Permukiman dan Prasarana Wilayah (2003). *Tinjauan Aspek Penataan Ruang Dalam Pengelolaan Wilayah Laut Dan Pesisir*. In Seminar Umum Dies Natalies ITS Ke (Vol. 43).