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# The Application of Blue Economy Principles to the Salt Sector in the Province of East Java, Indonesia

**Wiwik Handayani[1], Roudlotul Badi'ah[2]**

[1,2]Master of Management Study Program, Faculty of Economics and Business, Universitas Pembangunan Nasional "Veteran" Jawa Timur, Surabaya, Indonesia

**ABSTRACT:** Implementing the salt production process is often counterproductive with the reuse of "bittern" for production, which affects quality. But some throw away the "bittern", which can cause pollution of the ecosystem, thus contradicting the concept of the blue economy. This study aims to determine the implementation of the blue economy concept in the salt sector in East Java Province. The research approach uses qualitative methods. Data collection through interviews, observation, and audio and visual materials. Qualitative data analysis from Creswell includes processing and preparing data, reading data, coding, connecting themes/descriptions, describing themes, and interpreting data. The study results a show that implementing the blue economy concept in the salt sector in East Java Province includes zero waste, social inclusion, innovation and adaptation, and multiplier economic effects.

**KEYWORDS:** Blue Economy, Sustainability, Salt Production, People's Salt, Atlas.ti

## I. INTRODUCTION

Indonesia is known as an archipelagic and maritime country because its territorial waters are wider than the mainland and are located in a very strategic position. In addition, Indonesia has around 17,504 islands with a coastline of 99,083 km (Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia, 2019). A country with the longest coastline in the world does not guarantee that it is the biggest salt producer, either. This is like Indonesia, which has the second longest coastline in the world but is not the world's largest salt producer. Even today, salt production in Indonesia can still not meet domestic needs in quantity and quality.

In implementing the stages of salt production, salt farming communities often do counter-productive things. The salt production process, besides producing salt, also produces liquid waste called "Bittern". The content contained in "bittern" is in the form of minerals and salts which do not crystallize during the evaporation process on the salt table, so this liquid waste is in the form of a saturated solution which has a concentration level of 26-30$^{o}$ Be and is rich in minerals and minor elements in it (Nuzula et al., 2020). The mineral content in macro ions in "bittern" includes Magnesium ($Mg^{2+}$), potassium ($K^{+}$), sodium ($Na^{+}$), chloride ($Cl^{-}$), sulfate ($SO_4^{2-}$), and other minor compounds (Pratiwi et al., 2021). According to Wibowo et al. (2014), high concentrations of Magnesium (Mg) in waters can affect the growth of aquatic organisms and cause environmental problems indirectly. The high or low hardness of Magnesium will have an impact on biota and aquatic ecosystems. However, based on the results of interviews, it is true that most salt farmers reuse it for the aging process of young water if it is still possible to reuse it, while the rest still have salt farmers who will throw the "bittern" back into the sea. This is, of course, contrary to the blue economy concept, which has become the direction of Indonesian Marine Policy as stipulated in the Law of the Republic of Indonesia Number 32 of 2014 concerning Maritime Article 12 Paragraph (1), which reads that the Government and Regional Governments following their authority carry out Marine Management for the greatest possible the great prosperity of the people through the utilization and exploitation of Marine Resources by using blue economy principles (Law of the Republic of Indonesia Number 32 of 2014 concerning Maritime Affairs, 2014). In addition, putting "bittern water" (above 30 oBe) back into the production process, which is done to speed up the cleaning process, can produce poor-quality salt (Widjaja et al., 2021).

Indonesia's abundance of biological and non-biological potential contained within its oceans, the country's blue economy strategy is a breakthrough seen as more efficient in utilizing its current marine resources. The Blue Economy, which focuses on economic growth and development while protecting marine resources, is becoming an increasingly popular strategy employed by many countries to support and safeguard their oceans and water resources in a manner that promotes both

economic growth and environmental sustainability (Grazianoa et al., 2019; Lee et al., 2020). This definition of the blue economy varies depending on the entity issuing the identification and its purpose. In Indonesia, based on the Law of the Republic of Indonesia Number 32 of 2014 concerning Maritime Affairs, the "Blue Economy" is an approach to improve sustainable Marine Management and conservation of the Sea and coastal resources and their ecosystems to realize economic growth with principles including community involvement, resource efficiency, minimizing waste, and multiple added value (multiple revenues) (Undang-Undang Republik Indonesia Nomor 32 Tahun 2014 Tentang Kelautan, 2014). The Blue Economy aims to achieve sustainable economic development by empowering its elements while also protecting the sea, thereby enabling it to accomplish its objective of overall national economic growth (Fahrurrozi, 2020). The Blue Economy will boost the long-term benefits of sustainable marine resource use by finding profitable ocean sectors and activities. These benefits have a worldwide annual value of trillions of dollars, are responsible for the maintenance of hundreds of millions of jobs, and are beneficial to all nations located in coastal zones, which are home to approximately half of the world's population (Vega-Muñoz et al., 2021).

Thus, based on the description of the problems described above, it can be seen that a balance between economic, social, and environmental aspects, especially in the salt sector, requires an appropriate strategy to increase economic growth, prosper the community, and continue to preserve the marine ecosystem in East Java Province. Therefore this study aims to find out the forms of implementing the blue economy concept, especially in the salt sector in East Java Province.

## II. LITERATURE REVIEW

### A. Blue Economy Definition

The Blue Economy is the sustainable use of marine resources to reduce ecological scarcity and environmental risks, improve food security, human well-being, quality jobs, poverty reduction, and economic growth, and ensure sustainable production and consumption that includes all stakeholders in the maritime sector (Akhir et al., 2021). According to the World Bank (2017), the blue economy is the sustainable use of marine resources for economic growth and increased livelihoods and jobs by maintaining the health of marine ecosystems. Meanwhile, according to Tverdostup et al. (2022), the term "blue economy" refers to an economic model that promotes economic expansion, societal inclusion, and the maintenance or improvement of livelihoods while promoting environmental sustainability.

Indonesia already has a legal basis for developing a Blue Economy, including Law of the Republic of Indonesia Number 32 of 2014 concerning Maritime Article 14 Paragraph (1) (Undang-Undang Republik Indonesia Nomor 32 Tahun 2014 Tentang Kelautan, 2014), and Presidential Regulation of the Republic of Indonesia Number 16 of 2017 concerning Indonesian Maritime Policy (Peraturan Presiden Republik Indonesia Nomor 16 Tahun 2017 Tentang Kebijakan Kelautan Indonesia, 2017).

### B. Blue Economy Principles

Four principles of management and utilization of resources, according to Pauli (2010), namely:

- Zero waste, this concept focuses on the cyclical system in the production process to make clean production. There is always waste or residual production in every production process or resource extraction. This waste can be used as raw materials or energy sources for further production, which is expected to have economic value.
- Social inclusion, the objective of managing natural resources should be to promote social inclusion by ensuring social justice and equitable access to sustainable job opportunities for people experiencing poverty.
- Innovation and adaptation take into account the principles of the laws of physics and the adaptive nature of nature.
- Economic multiplier effect, every extraction of natural raw materials should provide a multiplier effect, which means that an economy can generate further economic activities that are in chains and have broad impacts. The multiplier economic effect has a market that is relatively safe and not vulnerable to market price fluctuations. The blue economy is more oriented toward multiple products, so it doesn't depend on a single product.

The application of the Blue Economy principle to the type of salt pond business, according to Zamroni et al. (2018), includes:

- Minimize waste, salt-making waste is in the form of old water or essential water with Be levels. The old water has been used to make a tofu mixture. Salt farmers get additional income from selling the old water, around IDR 15,000 – IDR 50,000 per jerry can (15 liters).
- Social inclusion, social inclusion in the BE principle, is an activity that everyone can carry out without being limited to certain groups. For example, they can use liquid waste in the form of old water in salt ponds to make tofu water. This does not require complicated technology and is not expensive.
- Adaptation and form innovation, carried out by salt farmers, is to arrange a system of water flow that goes to the salt table to be doubled. This is done to obtain the best salt yields in quality and quantity. Comparison of quality and comparison of quantity (production volume).

- Multiple effects salt ponds have the opportunity to create multiple effects. This means that the business can generate alternative sources of income, which can positively impact the household economy.

## III. METHODOLOGY

This research was carried out in salt-producing areas in East Java Province, which are spread over 12 Regencies/Cities. East Java Province was chosen as the location of this research because East Java Province is a province that has the largest salt production contribution in Indonesia. A research approach with qualitative methods is used to achieve the objectives of this study. Qualitative research explores and understands the meanings that a number of individuals and groups of people ascribe to social or humanitarian issues (Creswell & Creswell, 2018).

Data collection in this study involved four strategies: observation, interviews, and audio and visual materials. Observations in this study were to obtain technical information on the production process of making salt. Semi-structured interviews were used to obtain information to determine the forms of blue economy principles implementation in the salt sector. Data collection by interview was obtained from the Head of the Utilization of Coastal and Small Islands Section of the Marine and Fisheries Office of East Java Province, the Salt Team Trainer of the Banyuwangi Fisheries Training and Extension, Marine Science Lecturer at Universitas Trunojoyo Madura, and Salt Farmers in East Java Province. At the same time, the form of data collection for audio and visual material is in the form of photos of the salt production process and YouTube videos from the Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia, BPPP Banyuwangi, and LINGKAR JATIM related to salt.

Data analysis techniques from Creswell & Creswell (2018) include processing and preparing data for analysis; reading all data; analyzing in more detail by coding the data; applying the coding process to describe the settings of the people, categories, and themes to be analyzed; indicate how these descriptions and themes will be restated in the narrative/qualitative report; and interpret or make sense of the data (Creswell & Creswell, 2018). Data analysis in this study was assisted by Atlas.ti 9 software.

## IV. RESULT AND DISCUSSION

The blue economy is defined as sustainable production in the marine sector, especially in the salt sector. The implementation of blue economy principles in the salt sector in East Java Province can be described as follows:

### A. Zero Waste

Dirt and waste generated from the people's salt production process in East Java Province include plankton, sludge, moss, calcium gypsum, and bittern. Based on the research data that has been done, the results of qualitative research data analysis with the help of Atlas.ti 9 software related to the principle of zero waste can be seen as follows:

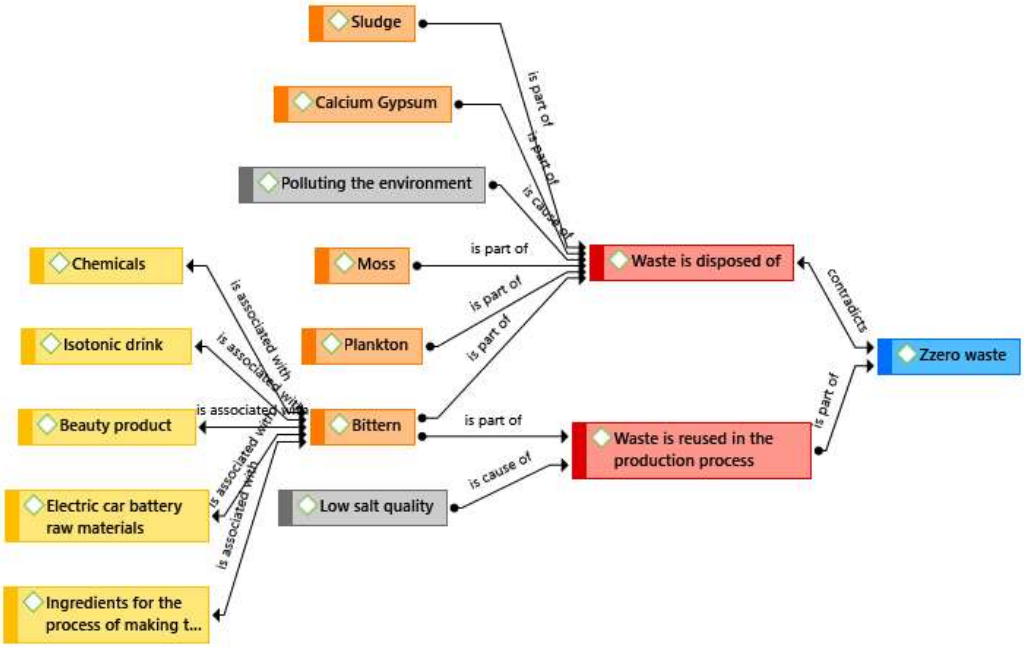


**Figure 1. Results of Zero Waste Principle Analysis**

Based on Figure 1 above, it can be explained that most of the dirt or waste resulting from the people's salt production process is thrown away without any further utilization. This is contrary to the blue economy principle without waste (zero waste). "bittern" is the most abundant among the various excrements and wastes generated. This "bittern" is the remains of old water on the

crystallization table with a concentration level of > 29$^{o}$Be, where this "bittern" contains high minerals Mg, Ca, and SO4. Most of the people's salt farmers in East Java Province reuse "bittern water" for the production process is mixed with young water. This is in line with the principle of zero waste but will impact the quality of the salt produced, which will become bitter, and the NaCl content cannot increase. Widjaja et al. (2021) also explained that putting "bittern water" back into the production process can speed up the cleaning process but can cause low-quality salt production. Meanwhile, salt farmers do not reuse it for the production process but throw it away without any further management, and if this is done continuously and in large quantities, it can also damage nature because this bittern has a high magnesium content. Waste that has the potential to affect the environment is old water left over from washing salt (Dewanti et al., 2021). According to Wang et al. (2015), improper treatment of concentrated salt discharge will inevitably cause severe environmental problems, and the most widely used approach is direct discharge into the sea, which causes a series of problems to the surrounding seawater bodies due to their effects on salinity, temperature, turbidity, dissolved oxygen and metal concentrations. The release of concentrated salts with high salt levels, usually twice that of seawater, will result in dramatic ecological degradation, such as substantial damage to seaweed, plankton, invertebrates, and fish.

Even though if it is directed at technology and basic scientific knowledge, "bittern water" waste can still be utilized and reprocessed into raw materials for other products, even the selling price of the waste generated from the production of this salt will also be far more expensive than the selling price of the salt. "Bittern" can be extracted into MgSO4, MgCl2, and CaCl2 for chemicals, extracted into lithium for raw materials for electric car batteries, and further processed to be used as fertilizer, isotonic drinks, beauty products, ingredients for tofu production, and many more. If the "bittern" waste is used and processed further, the selling price will be far more expensive than the price of the salt. Meanwhile, if the "bittern" is reused for the production process, it must be returned to the initial selection to follow the process stages.

Using waste from the people's salt production process in East Java Province for raw materials for other products can increase the potential for salt production. It can be an alternative for additional income for salt farmers. Zero waste means that nothing is wasted, waste for one is food for another, and waste from one process is a source of energy for another (Tegar & Gurning, 2018). This zero waste principle emphasizes the cyclical system in the production process to create clean production where waste can be used as raw materials or energy sources for further production, which is expected to have economic value (Ervianto, 2018). Apart from the blue economy concept, the utilization of "bittern" waste can also be used for reverse logistics, increasing the waste's productivity. According to Abidin & Leksono (2021), waste management by applying the reverse logistics concept is an alternative solution to minimize environmental pollution generated by the production process.

**B. Social Inclusion**

The form of social inclusion in the salt sector in East Java Province can be seen in the management system working on people's salt ponds. Based on the research data that has been done, the results of qualitative research data analysis with the help of Atlas.ti 9 software related to the principle of social inclusion can be seen as follows:

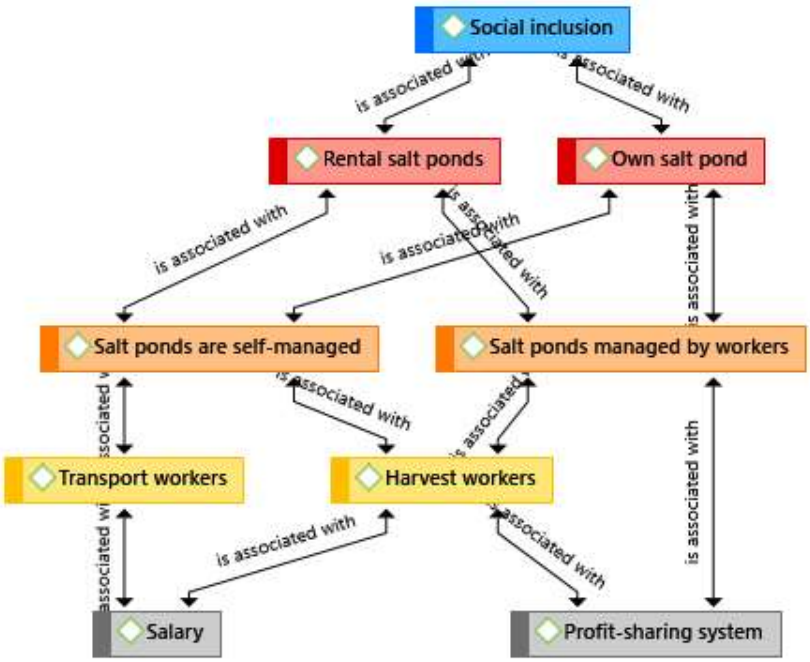


**Figure 2. Results of Social Inclusion Principles Analysis**

Based on Figure 2 above, it can be explained that in East Java Province, there are two types of people working on salt fields, namely doing it yourself or doing it with others (mantongan). This type of management can occur either from owned land or leased land. Even though the ponds are owned by themselves or rented land, they still need the help of harvesting workers and transport workers from the surrounding community to help during the harvesting process. The compensation obtained by transport workers is in the form of wages, while for harvesting workers, it can be in the form of wages or a production sharing system with an agreement with the party made. The number of wages given to workers in each region will vary. The wages for workers transporting crops vary; some are IDR 150,000/ton, and some are IDR 3,000/sack. Meanwhile, the wage for harvesting workers is IDR 30,000/ton, and for the profit-sharing system, the wages can be in the form of money or salt. The number of workers needed is not certain according to the crops produced. The more salt yields obtained, the more workers are needed.

As for the work on salt ponds done by other people or the term mantongan can be found in salt-producing regencies/cities outside Madura. Most of these workers are Madurese from Sumenep and Pamekasan Regencies, but there may also be workers from surrounding areas. The number of workers (mantongan) is not limited, usually consisting of 1 family or a married couple. Workers' compensation (mantongan) is usually in the form of profit sharing. This profit-sharing consists of the results divided by two and the results divided by three, depending on the agreement between the two workers and the landowner. The result is divided in two if the land owner only provides land capital and for other costs, it is the workers who bear it. Meanwhile, the results are divided by three if the land owner only hands over his land to the workers without incurring any costs. It is the workers who bear all the costs, the workers (mantongan) will get 2 (two) shares while the pond land owners only get 1 (one), and vice versa if the land owner finances everything and the workers only do the work, the pond land owner will get 2 (two) shares, and the workers get 1 (one) share. Even though the land has been worked on by other people, during the harvesting/gathering process, it still requires additional workers from the surrounding community. The compensation can be in the form of wages or profit sharing.

The existence of various forms of management of salt pond land development in East Java Province provides opportunities for many people to get opportunities to work both for the local community and from outside the area. Thus, this is in line with the principle of social inclusion in implementing the blue economy concept, where Wiratma & Nurgiyanti (2019) explain that social inclusion means social equity and many job opportunities for the poor. Job provision, development, and welfare are necessary for the blue economy concept. Inclusion and participation are very important in a sustainable blue economy because they can promote fair and sustainable practices (Germond-Duret et al., 2022).

### C. Innovation and Adaptation

The form of innovation and adaptation in the salt sector in East Java Province can be seen from the technological methods used in the people's salt production process. Based on the research data that has been done, the results of qualitative research data analysis with the help of Atlas.ti 9 software related to the principles of innovation and adaptation can be seen as follows:

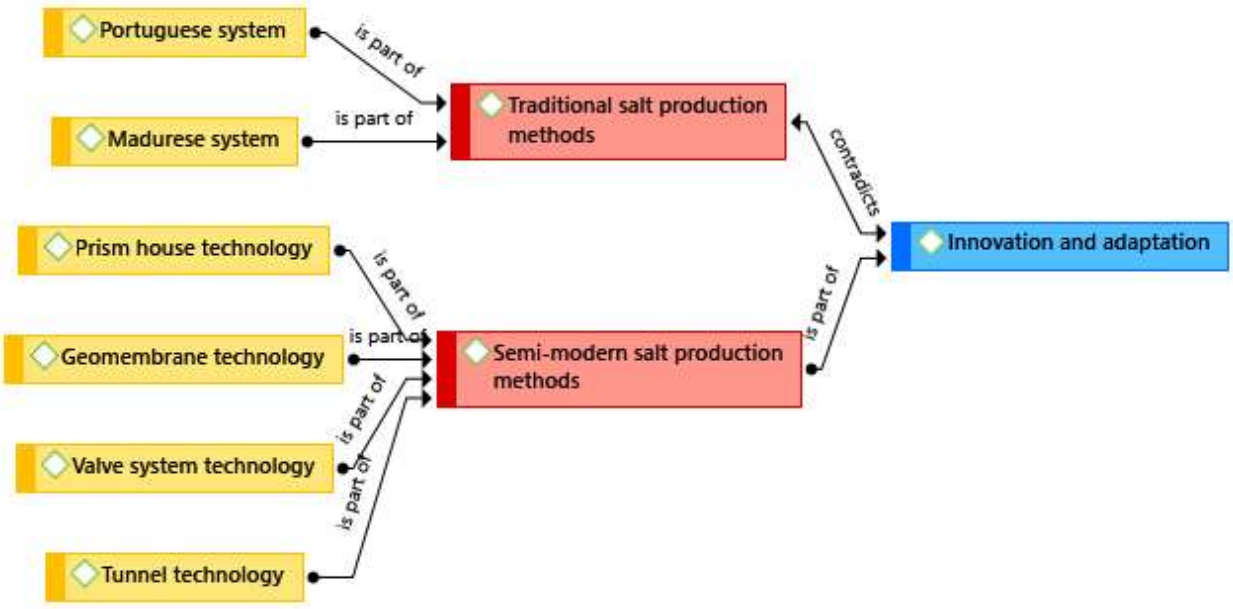


**Figure 3. Results of Innovation and Adaptation Principles Analysis**

Based on Figure 3 above, it can be explained that the salt production process methods of the people in East Java Province consist of traditional and semi-modern methods. Traditional methods of salt production in East Java Province include the maduris system and the Portuguese system, where both systems use the crystal table from the ground. The difference is that in the Portuguese system, the salt collection is carried out on a salt floor made of salt crystals that were made before. The salt collection maduris system is carried out directly on the ground so that it will affect the quality of the salt harvested. The quality of salt produced traditionally based on the results of laboratory tests obtained NaCl levels between 65.3979% to 86.3091% and Mg levels between 0.052% to 0.084%. This traditional salt production method is contrary to the principles of innovation and adaptation because, according to Zamroni et al. (2018), innovation is formed from an adaptation when wanting to do efficiency. The people's salt production process with this traditional method will require longer. Apart from that, in terms of productivity, salt production is only around 40-60 tons/hectare/per season when the weather is normal.

Meanwhile, the semi-modern people's salt production methods applied in East Java Province include geomembrane technology, prism housings, valve systems, and tunnels. These production technologies have their advantages and disadvantages, and the quality produced is far better than traditional methods. Explanation of each method of semi-modern folk salt technology as follows:

**1. Geomembrane Technology**

This geomembrane technology is one of the technologies that salt farmers in East Java Province widely use because it is a program created by the government in 2011 through the People's Salt Business Development Program (PUGAR) to increase the quantity and quality of people's salt. The difference between the geomembrane method and the traditional method is in the crystallization table, where in this geomembrane method, the crystallization table is coated with geomembrane plastic. Using a geomembrane on a salt crystallization table can speed up production time, reduce work, and produce more white and white salt. Based on the results of laboratory tests related to the quality of salt produced with geomembrane technology, it was found that NaCl levels were between 77.3735% and 95.3152%, and Mg levels were between 0.081% and 0.102%. In terms of quantity, salt production using geomembranes can increase the amount of salt production by 2 times compared to traditional methods, namely as much as 80-120 tons/hectare/season. This is in line with what was disclosed by Muliana et al. (2022) that the geomembrane method has several advantages in operation, such as producing large quantities of salt, speeding up the salt crystallization process, and easing the work of salt farmers. Even so, this method still has drawbacks. Namely, the production process still relies on weather/sunlight, so production activities only occur during the dry season. Salt farmers are not uncommon to harvest prematurely, ultimately affecting the quality of the salt produced. In addition, additional costs must be incurred to purchase geomembrane plastic. The technology for producing salt using geomembrane on a crystal table which salt farmers widely use, can be seen in the following figure:

**Figure 4. Salt Production with Geomembrane Technology**

**2. Prism House Technology**

The people's salt production method using prism house technology can produce salt production that has the best quality among other production methods because the production process with the prism house is closed so that the production results are clean and very minimally contaminated from the surrounding environment. Based on the results of laboratory testing for the quality of salt produced using prism house technology, the NaCl level was 96.7788%, and the Mg level was 0.080%. Kurniawan et al. (2019) revealed that the quality of salt produced through the prism house method is included in the K1 quality category and can produce quality salt that meets the standards set by SNI. In addition, the production process using prism house technology does not depend on the weather so it can produce salt all year round because, in this prism house, it is in the form of a 2-story stack where the lower floor is a bunker which functions to store young water and the top floor is a production table that functions to the crystallization process. Meanwhile, in terms of the productivity of the prism house method, it can reach 240-260 tons. The prism house method's weakness is that it requires additional costs to make prisms, and the level of difficulty in prism

construction is quite difficult, so special expertise is needed to make this prism house. The technology for salt production using a prism house can be seen as follows:

**Figure 5. Salt Production with Prism House Technology**

**3. Valve System Technology**

The valve system technology is a salt pond technological innovation created to overcome weather problems because there are infrastructure facilities that can provide shelter during the rainy season. If needed to be opened, then in the summer, it will be opened. This valve system technology method has a very high productivity, reaching more than 300 tons. However, in terms of quality, it is still inferior to the prism house method because the sides are still open in this valve system method. Based on the interview results, it was obtained information on the quality of salt produced with a valve system having a NaCl content of 96.4%. However, the drawback of this method is that there is an additional cost for the construction, and it can only be applied to salt production processes on a small scale. The technology for salt production using a valve system can be seen as follows:

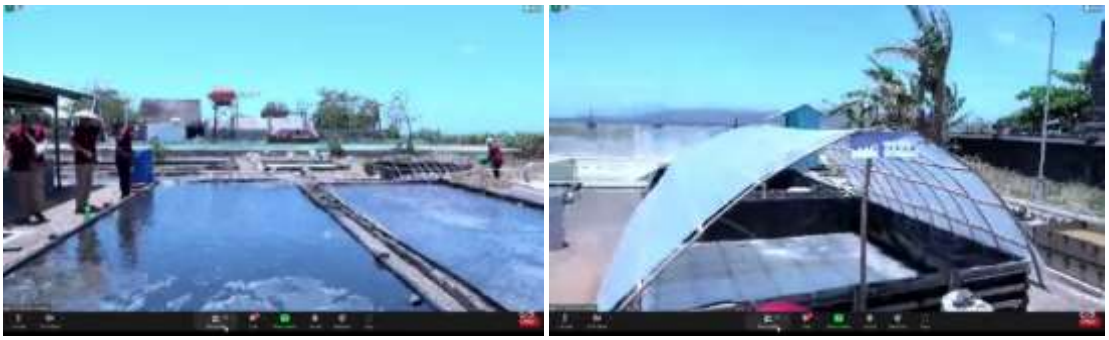

**Figure 6. Salt Production with Valve System Technology**

**4. Tunnels Technology**

This tunnel technology is shaped like a semicircular tunnel. The production process with tunnel technology is weather resistant and can produce all year round. The resulting quality is also better than traditional salt fields or geomembranes. It is also higher in terms of production quantity because the salt production period with tunnel technology is faster than with a more closed prism. Making land construction is also easier, but the drawback of this tunnel technology is that it has a curved shape like a tunnel, which makes heat spread out of focus. It won't be as strong when applied to a large area with strong winds because the tunnel framework is made of split bamboo. Which is covered with plastic without clamps, so it will be damaged more quickly when exposed to strong winds.

With the application of several semi-modern technologies to the people's salt production methods in East Java Province, salt farmers can increase the quantity and quality of the people's salt produced by implementing the principles of innovation and adaptation. Encouraging and implementing technological innovations within communities can result in increased economic growth by serving as an economic catalyst, generating added value, achieving competitiveness and quality standards for produced goods through innovative methods (Prayuda & Sary, 2019). Thus, this follows the blue economy's innovation and adaptation concepts, which use physics-based technology to adapt to natural conditions and local resources (Fahrurrozi, 2020). The blue economy gives importance to applying fundamental physics principles, specifically the law of gravity, to ensure that energy is distributed efficiently and uniformly without any external energy extraction (Prasutiyon, 2018).

**D. Economic Multiplier Effect**

The form of economic multiplier effect in the salt sector in East Java Province can be seen from the various kinds of salt produced apart from krosok salt, which is the main product. Based on the research data that has been done, the results of qualitative research data analysis with the help of Atlas.ti 9 software related to the principle of the economic multiplier effect can be seen as follows:

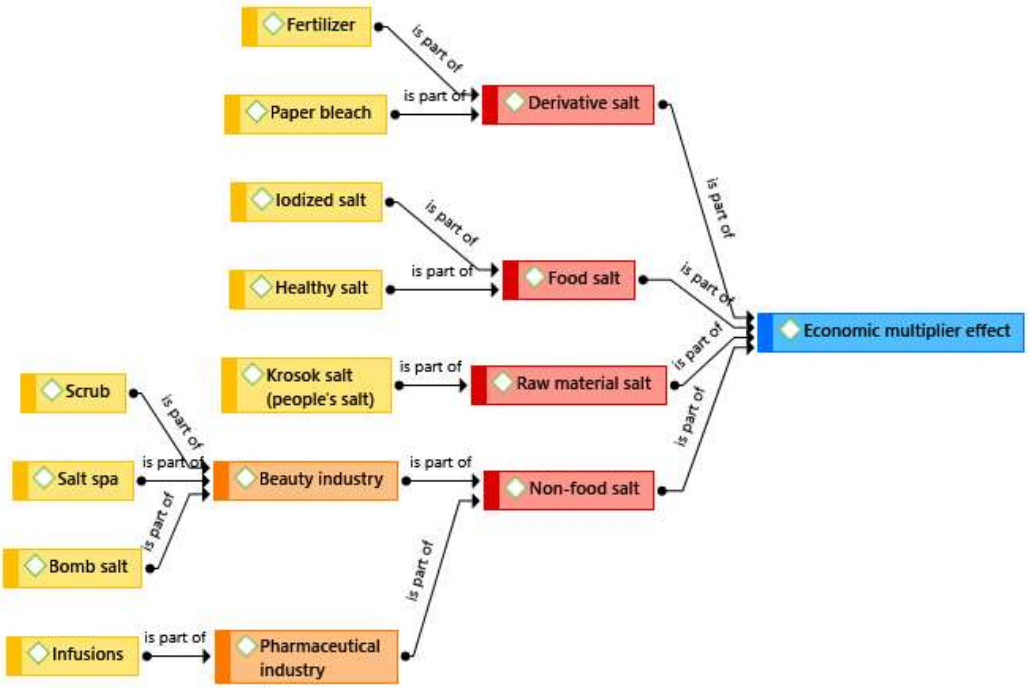


**Figure 7. Results of Economic Multiplier Effect Principles Analysis**

Based on Figure 7 above, it can be explained that the main product produced by salt farmers in East Java Province is krosok salt which can be referred to as raw material salt. Raw material salt is salt that salt farmers, in general, commonly produce. This raw material salt has the opportunity to carry out further processing to be able to produce food salt, non-food salt, and derived salt. Food salt is raw material salt as basic salt, which is processed into food salt. This food salt consists of iodized consumption salt and healthy salt (low NaCl salt). Non-food salt is used for industrial purposes in the pharmaceutical and beauty industries. In the pharmaceutical industry, this salt can be used as an ingredient in making infusions; in the beauty industry, this salt can be used as bomb salt, spa salt, and scrub products. Meanwhile, derived salt is a raw material that is further extracted or purified to become derived salt products which are usually used to manufacture fertilizers or paper-bleaching agents.

In East Java Province itself, the people's processed salt products produced by salt farmers are in the form of iodized consumption salt and spa salt. This is only limited to groups of salt farmers who have formed cooperatives and are advanced. However, academics, students, and lecturers from the Maritime Studies Program at Universitas Trunojoyo Madura are developing many innovations in processed salt products. The development of processed salt products is expected to empower the community and increase the selling price of the salt itself. The results of salt processing innovations produced by students of the Marine Science Study Program can be seen as follows:

**Figure 8. Processed Products of People's Salt**

Figure 8 shows the result of innovative salt products like Healthy Salt and Bath Spa. Healthy salt is healthy because it has a low NaCl level of only 60%, which is good for people with high blood pressure, while bath spa is salt that is used for bathing or bathing as well as scrubbing. The innovation of these salts is added with spices such as seaweed, moringa, cinnamon, oranges, etc. These innovations are expected to increase the selling price of people's salt.

The existence of further processing of krosok salt (raw material salt) produced by salt farmers in East Java Province into processed food salt, non-food salt, and derived salt is a form of implementation of the blue economy concept from the principle of the economic multiplier effect. According to Ervianto (2018), this economic multiplier effect means that every extraction of natural raw materials should have a multiplier effect which means that an economy can generate further economic activities

that are in chains and have wide-reaching impacts. The multiplier economic effect has a market that is relatively safe and not vulnerable to market price fluctuations. The blue economy is more oriented toward multiple products, so it doesn't depend on a single product. As such, it can help stimulate local business opportunities and job creation, ultimately driving a long-term positive economic multiplier effect (Jones & Navarro, 2018).

Based on the explanation that has been presented, the author can provide points for each of the blue economy principles and their implementation in the salt sector in East Java Province to make them clearer and easier to understand. These points can be shown in Table 1 below:

**Table 1. Implementation Of Blue Economy Principles In The Salt Sector In East Java Province, Indonesia**

| Blue Economy Principles | Explanation | Implementation | Information |
|---|---|---|---|
| Zero waste | The cyclical system is in the production process to create clean production where waste can be used as a material or energy source for continued production | Chemicals (MgSO4, MgCl2, and CaCl2)<br>Electric car battery raw materials (lithium extract)<br>Fertilizer<br>Isotonic drink<br>Beauty product<br>Ingredient for the process of making tofu | Salt farmers in East Java Province have not implemented waste treatment but are used for the production process again. Bittern waste treatment has been studied and developed by academics, both students and lecturers |
| Social inclusion | Social equity and lots of job opportunities for the poor | Salt pond management worker (mantongan)<br>Harvest workers<br>Transport worker | Salt farmers in East Java Province have implemented social inclusion |
| Innovation and adaptation | Innovation is formed from an adaptation when you want to do efficiency | Geomembrane technology<br>Prism housing technology<br>Valve system technology<br>Tunnel technology | Salt farmers in East Java Province have applied technology in the production process |
| Multiplier economic effect | They are more oriented to multiple products, so they don't depend on one product | Salt raw material: krosok salt<br>Food salt: consumption of iodized salt and healthy salt (low NaCl salt)<br>Non-food salt: pharmaceutical industry (making infusions) and beauty industry (bomb salt, spa salt, and scrubs)<br>Derivative salts: manufacture of fertilizers and paper-bleaching agents | Salt farmers in East Java Province only apply the processing of food salt (iodized consumption salt) and other processed non-food salt (spa salt) developed by academics, both students and lecturers |

## V. CONCLUSIONS

Implementing blue economy principles in the salt sector in East Java Province includes four principles: zero waste, social inclusion, innovation and adaptation, and multiplier economic effects. The principle of no waste (zero waste) is shown in the reuse of "bittern" for production. However, it will affect the quality of the salt produced, and some farmers still throw it away without any further processing even though "bittern" can be used as raw material for other products such as raw materials chemicals (MgSO4, MgCl2, CaCl2), raw materials for electric car batteries (lithium), fertilizers, isotonic drinks, beauty products, and ingredients for tofu production. The principle of social inclusion is shown when working on salt pond land still involves salt pond management workers (mantongan), harvesting workers, and transport workers. The principle of innovation and adaptation is shown by applying semi-modern production technology methods to increase the quantity and quality of salt produced, including geomembrane technology, prism housings, valve systems, and tunnels. The principle of multiplier economy is shown in the main product produced in the form of raw material salt or krosok salt. The opportunity to be further processed for food salt includes iodized consumption salt and healthy salt (low NaCl salt), non-food salt includes the pharmaceutical industry for infusion and industrial beauty for bomb salt, spa salt, and scrub), as well as derived salt for the manufacture of fertilizers and paper bleaching agents.

The results of implementing the blue economy principles in the salt sector in East Java Province can be used by the government as a basis for making policies following the Law of the Republic of Indonesia Number 32 of 2014 concerning Maritime Article 14 Paragraph (1) and Presidential Regulation of the Republic of Indonesia Number 16 of 2017 concerning Indonesian Marine Policy Article 14.

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