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Indonesia's Blue Economy Potential: Salt Pond in Nagekeo, East Nusa Tenggara

Salsabila Cherish Okcavia[1] Rudiyanto[2] Panji Suwarno[3] Pujo Widodo[4] Herlina Juni Risma Saragih[5]
Maritime Security Master's Degree, Universitas Pertahanan Republik Indonesia, Bogor City, West Java Province, Indonesia[1,2,3]
National Security Defense, Pertahanan Republik Indonesia, Bogor City, West Java Province, Indonesia[4,5]
Email: okcaviacherish@gmail.com[1]

Abstract
Allegedly, based on the diversity of the maritime by Indonesia, our country has a very potential wealth of marine resources. These resources can be utilized for its used as blue econommy approach. This country's marine resources that can be utilized as a national economic potential is a salt industry. With the wealth of the saline water that we have, Indonesia is still importing salt because there is an imbalance between demand and domestic production. The purpose of this journal is to find out the potential for briny ponds in Indonesia to be used to reduce the dependence on national imports. To handle this problem, there are several efforts to maximize our national productions of saline pond in Nagekeo District, East Nusa Tenggara (Nusa Tenggara Timur). Along with the modernization and technology, there is several branches of innovation and technology to increase the effectiveness of Indonesia's Sea Salt Industry such as Geomembrane Prism House, Vertical Axis Mill Pump, and the Smart House Salt Maker (SHASA). By adopting these technologies, it is expected that the production of marine salt farmers will be able to severely reduce salt imports and make Indonesia a successful and independent maritime country.
Keywords: Blue Economy, Salt, Technology & Innovation, Nagekeo, NTT, Salt Embankment.

INTRODUCTION

Indonesia consist of the largest maritime area in the world. With an extensive sea domain, in it, there are various kinds of abundant marine resources. Based on this marine diversity, our country has a wealth of marine sources that can be utilized for its usefulness. Marine resources can be properly utilized as a potential national economy. These sea-based resources is known as the blue economy, projected to have the potential of our oceans to be able to produce 1.772 trillion per year. This direct result is equivalent to 93% of the 2018 National Revenue and Expenditure Budget (APBN) (Laman Resmi Republik Indonesia, 2018).

Typically based on the economic potential of the sea that we naturally have, the key fact that until now Indonesia is still importing salt. Salt is used for almost all food and industrial requirements, causing an increase in salt demand every year. This phenomenon is unaccompanied by the availability of adequate salt, so to meet the national needs our country imports a big amount of salt every year. For a country that occupies the most massive maritime area in the world, this is an immense challenge that needs to be solved.

To reduce salt imports, Indonesia must clearly increase the national salt production. This effort can be marked from the establishment of the 2020-2024 National Medium-term Development Plan (RPJMN) regarding the optimization of salt production (Badan Pengawas Keuangan RI, 2020). Our specific goal by 2020 is genuinely to promptly produce 3 million gross ton of salt, which will progressively increase in 2021 to 3.1 million tons. In fact, until now, Indonesia has been barely able to produce as much as 1.3 million tons of salt.

The difficulty in achieving annual salt production is due to the fact that our salt manufacture process is nevertheless operating traditional and manual tools. As follows, the resulting product depends on climate change, with long production times and various qualities. Based on this problem, the government responded with the 2020 Kemenko Marves Annual Report aimed at the opening remarks in a salt embankment in Nagekeo Regency, East Nusa Tenggara (Kemenko Marves, 2020). This location was chosen with the best quality for national salt self-sufficiency efforts, and this land is considered to have the potential to increase national salt production.

Salt production in Indonesia is fluctuating, as the country still uses simple equipment and relies on sunlight to make salt. Salt is produced by the process of evaporation and deposition. Both of these processes are completely dependent on the climate and weather (KKP, 2019). Currently, one of the obstacles in salt production is the intense of rainfall. In the active presence of frequent rain, the potential evaporation and crystallization of salt can be ascertained not to run optimally. For a little while, the weather frequently changes randomly and is unseasonable to predict. If this is allowed, Indonesia will forever depend on salt imports and will be unable to optimize its blue economic potential.

Indonesia as the country with the longest coastline in the world has abundant blue economy potential. To recognize a sovereign and sustainable maritime, this country must be able to take advantage of the wealth of its marine resources. To optimize the potential of the blue economy in Indonesia, modern innovations are required that can resolve remaining barriers. By expanding a salt embankment in Nagekeo, NTT is eagerly expected that this effective policy can promptly lead Indonesia to become economically an independent and prosperous country with its own marine resources.

RESEARCH METHOD

This journal uses the method of Qualitative Research with Literature Research. According to John W. Creswell, the qualitative method is an approach to exploring and understanding interactions in social phenomena (Creswell, 2017). This research method presents arguments and analyzes with the aim of getting a thorough understanding. Literature Research is also often known as the Literature Study approach, by obtaining data from books, journals, reports or official statements submitted by national and international institutions or organizations. The information data collected is related to the Blue Economy and the Potential of Salt Farms in East Nusa Tenggara. These data can be obtained by accessing the official website. Based on the data collected, this study will use data analysis techniques with descriptive qualitative analysis. This model can be used to explain the understanding of the logical flow of data analysis while at the same time providing conclusions on the problems in the existing phenomena.

RESULT AND DISCUSSIONS

Indonesia's Salt Import

Salt is often found in daily life, with its maritime wealth making it a strategic commodity for Indonesia. With the sea area that we have, it is considered sufficient to meet the demand for national salt requirements. However, in reality our nation is still ranked 30th out of 60 salt-producing countries in the world (Jamil, 2017). This condition, in the end, has implications for inequality with high demand which cannot be accompanied by high production. This inequality is due to the fact that this country has not yet maximized the cultivation of salt embankments. Based on present data, Indonesia has not utilized the area of land that can be used as salt embankments (Ihsannudin, 2016). The salt produced by PT. Salt, is the only State-Owned Enterprise (BUMN) which produces salt by 30% of the combined national production (Tempo,

2015). The national production is obtained from land use of only 71% of the total available land, with the rest being undeveloped properly.

There is no effective effort that has been made to optimize the salt embankment area, which has the potential to be one of the reasons the national salt producing does not develop. Its manufacture is exacerbated by frequently changing climatic and weather conditions. Extreme weather changes can undoubtedly affect the production of salt fluctuating every year. Based on previous research, it was stated that high rainfall can cause low salt producing (Intan, 2020). Salt is made managing the processes of evaporation and precipitation, both of which are dependent on the weather and climate. Indonesia's salt production is becoming increasingly complicated enough because the current weather is unpredictable, by this phenomenon it will affecting the low national salt production.

The national salt is divided into two categories, for consumption and industry. The difference between the two lies in the subject matter of each compound sodium chloride (NaCl). Consumption salt typically has a NaCl material of more than 94%, while industrial salt ideally has a NaCl more than 97%. Until now, Indonesia has been unable to produce large amounts of industrial salt. So that the Chlor Alkali Plant (CAP) industry annually requires as much as 55% industrial salt with a NaCl content above 97% (Aligori, 2013). Thus, necessary salt is only used for national food needs, while industrial salt is properly obtained from imports.

The domestic salt production which is not able to meet this national need, has led to a fairly large imbalance. In a determined effort to promptly meet this economic gap, Indonesia instantly decided to import salt. Imports are carried out based on several considerations because other countries are capable to produce salt commodities with better quality accompanied by lower prices (Gibran, 2015). To this proper day, there is respectively a profound contradiction that we are categorized as a maritime country but still depend on imported salt until conscious now. The government is always trying reducing Indonesia's dependence on salt imports.

The modern world is currently undergoing many changes, merely resulting in a gradual shift in meaning and understanding. The fundamental concept of blue economy has spread all over the civilized world. With an mutual understanding of sustainable economic development by properly utilizing the economic potential of the sea and coastal areas (Colgan, 2018). Each country started to focus on the Exclusive Economic Zone (EEZ) area with their respective jurisdictional laws. With their discretion to regulate their territory, several countries have begun developing sea-based economic strategies. This concern began when humans began realizing the economic potential derived from the use of marine resources.

Indonesian Salt as a Blue Economy Potential

The world is starting cautiously to pay attention to the economic potential of the blue economy. Many national actions have been formed at several levels usually planned in policy papers. To be specific, this blue economy policy was carried out in the Indian Ocean region countries, such as India, Australia, Indonesia, Mauritius and Seychelles (Colgan, 2018). Policies between these countries may vary, because they depend on the supplies owned by each country. Based precisely on the possibilities of the resources owned, the blue economy properly focuses on typically increasing the economic potential that can be efficiently generated from limited marine resources.

Graciously according to Bueger, the maritime domain is positively related to economic development known as a blue economy (Bueger, 2015). Recognition that comes from understanding the economy does not come from the mainland. But over considerable time, it typically appears that the sea properly provides economic potential that can be processed and

merely exploited. This awareness appears in the minds of several countries with the awareness of shifting from the utilization of land capacity over time to become the sea. There is promising marine potential, so that agreements & protocols are formed such as Sustainable Development Goals point 14, conservation & sustainable use of the ocean, sea and marine resources for Sustainable Development (UN, 2019). Also with the establishment of RIO+ 20, Ocean as natural capital, good business, integral to Pacific SIDS & fisheries livelihoods (UN Educational, 2021).

To develop the potential of the blue economy, one of the efforts that can be done is to develop innovation. The state makes it possible to innovate goods and services from marine resources. Innovations in the blue economy have been carried out by the United States, Canada and the European region. With the advancement in the use of technology, it is hoped that it can transform the blue economy into an effective means of developing future economies (Colgan 2018). With the use of technology, the blue economy is not only seen as an economic activity, but also forms this sector as emerging sectors & industries.

Technological advances can dominate the development of the blue economy in the future, especially with renewable energy that can be found. Such as the availability of oil & gas on the seabed. The strategy for carrying out innovation must focus on research & education, if these two sectors are improved it will open up potential job opportunities (Colgan, 2018). Undoubtedly, over time the blue economy becomes a stimulus for the use and development of technological capacity. This is because technology is one of the important things in innovation. Innovation is a combination of several elements that interact to form a successful economy.

The new economic potential, has the potential and is much needed in everyday life, one of which is salt (King, 1995). Not all countries that have beaches can develop salt production potential, but Indonesia is one of the countries with the highest salt production potential in the world. Indonesia has a large coastal area that provides 'capital' to be used as a location for salt embankments. Salt embankments are a means of providing employment for coastal communities. Apart from being utilized from an economic perspective, this potential can also be used to promote community welfare and reduce poverty levels in coastal communities (Kusumastanto & Satria, 2012).

Salt Embankment in Nagekeo Regency, East Nusa Tenggara

With the potential for salt that has been owned, Indonesia has given a significant response. Based on the report on the results of the Maritime Resources Coordination Sector in 2020, there is a plan to reorganize the salt land in East Nusa Tenggara (NTT). This plan will be followed up by the Coordinating Ministry for Maritime Affairs together with the Ministry of Agrarian Affairs and Spatial Planning (Kemen ATR). Nagekeo Regency, is considered to have high potential to support the goal of national salt self-sufficiency. The potential found, this area has the potential to reduce dependence on imports and improve the welfare of local communities.

Nagekeo Regency is included in an region with a tropical climate, so that changes in optimal temperature are not affected by the change of seasons but are influenced by the height above sea level (RPIJM Nagekeo, 2021). With a total area of Nagekeo Regency which properly includes the northern and southern coastal areas. The climatic conditions in Nagekeo are also classified as dry naturally because they are influenced by the monsoon wind, with a limited rainy season (around November – May). With an average rainfall of 1,000 – 1,500 mm/year. Measurable precipitation accurately determines the minimum temperature of Nagekeo is 22.8 – 19.8 degrees Celsius, with a maximum temperature of 34.8 degrees Celsius (RPIJM Nagekeo, 2020). This favorable condition obtain Nagekeo's possible advantage to properly build a salt embankment. They will develop professionally a salt industry typically centered in Aesesa and Wolowae (Kaburea) Districts.

Based on the results of research developed by PT Cheetham Salt Indonesia, Nagekeo Regency is the best location for the development of industrial salt in Indonesia (Cheetham, 2014). Nagekeo is a top priority for land development with seawater and adequate rainfall. The quality of salt that can be produced from Nagekeo is the same as that of the salt industry in Australia. They have plans to build jetties with a capacity of 10,000 – 15,000 tons per day, with a jetty at Marapokot Harbor (Cheetham, 2014).

The potential for salt in NTT is spread over 15 regencies and cities. Secretary of the Department of Industry, Johnny Pandie, stated that by developing the salt industry in this area. It can follow national directions and policies to support national salt self-sufficiency. Industry standards to support salt self-sufficiency require 20,000 ha while NTT is able to provide 60,000 ha (Media Indonesia, 2021). In 2017, there were seven districts that could be used as salt embankments, namely Kupang, Ende, North Central Timor, Alor, East Sumba, Manggarai and Nagekeo. The East Nusa Tenggara industry allegedly encourages coastal residents to inevitably produce People's Salt with used Geomembrane technology by training community groups to process salt for daily needs (Media Indonesia, 2021).

Although the community has been provided with adequate training, the vital problem faced by local salt producers is that there is currently no salt refinery available. They do not yet utilize the technology to carry out the salt crystallization and purification process with modern processing (Kemenkeu, 2017). Even though the Nagekeo area has moderate rainfall, it is challenging to predict the weather at this time. The randomly changing weather can also hamper the salt production in Nagekeo. In order to evade salt harvest failure, technological innovation is needed to resolve this problem.

With sufficient technological innovation, more salt can be produced in a short time without being disturbed by changing weather. With more sophisticated technology, salt farmers can still process the salt-making process without any risk of failure. Technology is important to develop a blue economy in Indonesia. Because according to reports from local residents, so far salt processing is still done conventionally, so it takes a long time and process. With limited technology, it also produces salt with not so good quality.

Analysis & Suggestions

Weather Resistant Salt Embankment Technology

There are several methods that can be used in the production of salt. The majority of salt farmers in Indonesia use the traditional method with simple tools and methods. With this method, farmers only need a large area for the evaporation process and a means to drain seawater to the evaporation site. Sea water will be accommodated on a large plot of land by utilizing the tides of sea water. There is a cover that can be opened when the water is high and closed when the water is low. This process eventually fills the land with seawater which is ready to be evaporated.

Later, the water will be heated by using sunlight until the process of evaporation occurs. The collected seawater will be dried in the sun, often referred to as Solar Evaporation (BPP of the Ministry of Trade, 2021). When the water evaporates, it will leave crystal grains to be harvested into salt. When the evaporation process is assessed as maximal, the land will then be filled with salt which is ready to be harvested. In this condition, farmers can take their crops to sell in the market. Based on the manufacturing process, it can be concluded that salt production is highly dependent on sunlight. Often, when the rainfall is high, farmers are threatened with crop failure because the seawater evaporation process does not run optimally (KKP, 2017).

Climate as the main energy source which is needed in the process of making salt. Some of these are stated as optimal climates for making salt, namely (KKP, 2017):

1. Small amount of rain with annual rainfall between 1,000 – 1,300 mm/year.
2. Long and dry condition, that is, during the dry season there is never any rain. With a dry dry duration of at least 4 months (120 days).
3. Sufficient sunlight and high temperature, rarely foggy. The hotter it is, the faster the evaporation of seawater.
4. Low humidity, the drier the air, the faster the evaporation process.

In general, the manufacture of seawater salt with this method is carried out by the process of evaporation and separation of salt using a crystallization process (Assadad & Utomo, 2011). This simple method produces salt in a long time with a quality that does not meet the needs of industrial salt.

Geomembrane Prism House

To improve this condition, a transformation of salt production technology is needed. Modernization and transformation applying Geomembrane Filter Thread Technology (TuF). This technology is a salt production system with sea water in a reservoir. Filtration is carried out, which will be directed to the crystallization table for the evaporation process (Habi, 2021). By using geomembrane, salt yield is increased compared to traditional processing. Salt production using the traditional process only produces 60-80 tons per hectare in one harvest (harvest time can reach once every 4 weeks). Meanwhile, the geomembrane technique can produce 120-140 tons per hectare in a period of 2 weeks (BeritaSatu, 2021).

Initially, the geomembrane technique was used only for the salt bed, in order to speed up the evaporation process. However, this technique was modified by farmers from Sedayulawas Village, Lamongan, East Java to become the TuF Geomembrane Prism House (Kurniawan, 2019). This house is in the shape of a prism that was created for the production of salt. The base of the house uses a geomembrane, the building is made of a prism-like frame and the roof uses geothermal plastic. The prism shape was chosen because it is considered more wind resistant, the salt embankment is in the form of a large field, has the potential for a lot of wind. The wind is able to break the heat from the sun in the salt plot, so a prism is formed so that the sun's heat centered in the salt plot for the maximum evaporation of seawater. The prism shape causes the evaporation process to be faster and produces salt with very good quality.

The difference in yields of salt without geomembrane yields 60 tonnes per hectare. By using a geomembrane base, the average yield is 120 – 125 tons per hectare (Ardiyanto, 2017). However, using this prism can produce 400 tons per hectare. Farmers no longer depend on the dry season for salt production. The salt produced also has a quality equivalent to industrial salt (NaCl content above 97%). This is the advantage of using prism houses, farmers are able to produce high quality salt and can produce salt throughout the year without the risk of failure.

For the production process throughout the year, salt farmers first collect seawater to be stored in a banker of 1,000 m2 (Ardiyanto, 2017). The function of this bunker is to protect seawater from rain. Sea water that has been collected and deposited is referred to as old water, if the water is mixed with rain, the salinity level of sea water will be disturbed. When seawater conditions are no longer optimal, old water will be wasted. Therefore, seawater is collected in bunkers and distributed to prismatic house plots, incubated for 4-7 days to produce 100 tons of salt. By using this technique, farmers are able to increase the harvest rate by up to 300% per year, when compared to conventional techniques that are usually carried out (Ardiyanto, 2017).

In order to increase the production of better salt, salt production should use technology that is not dependent on hot weather. Even in the rainy season, salt farmers can still produce

salt. Based on research conducted by RISTEK BRIN, non-technological salt production per hectare of land produces 130 tons per year (Deputy for Research and Development Strengthening, 2018). Meanwhile, land with high technology can increase production to 390 tons per hectare of land. Apparently, using the traditional method there are 2 obstacles faced by farmers in producing salt, namely the duration of manufacture and adequate quality.

Vertical Axis Pump

With high weather, 1.2-1.6 million tons of salt are produced per year (Deputi Bidang Penguatan Riset dan Pengembangan, 2018). If the deposition is to be carried out more quickly, salt farmers need a new technology known as the Vertical Axis Wheel Pump. Usually with the traditional method, the process of transferring seawater to salt embankments takes 8-10 days. Meanwhile, with the Vertical Axis Pump technology, it only requires 3-4 hearts. This pump has the following working process, clean and filtered seawater will enter the engine. The seawater will then enter into another machine, it will be rotated vertically to produce higher baume to be deposited into salt (Deputi Bidang Penguatan Riset dan Pengembangan, 2018).

The use of the vertical axis mill is considered safe and resistant to storms and wind changes. This discovery is a new breakthrough for the Ministry of Maritime Affairs & Fisheries (KKP) as a work program for 2021 – 2024. This program aims to restore the community's economy and absorb labor. The goal is to produce sustainable marine and fisheries resources. This innovation is based on the results of innovations carried out through the Sea Water Resources Development Installation (IPSAL) under the Marine Research Center (KKP, 2021). This innovation is an alternative to the conventional wooden wheel which is used to transfer seawater to salt fields. However, its use often harms salt farmers and causes death.

This Vertical Axis Pump can pump water at an average of 19 liters / minute, is considered effective for moving sea water without damaging the pond bottom. With water being pumped in, it will not interfere with the process of forming salt crystals (KKP, 2021).

Figure 1. Seawater Resources Development Installation
(KKP & BRSDMKP, 2021)

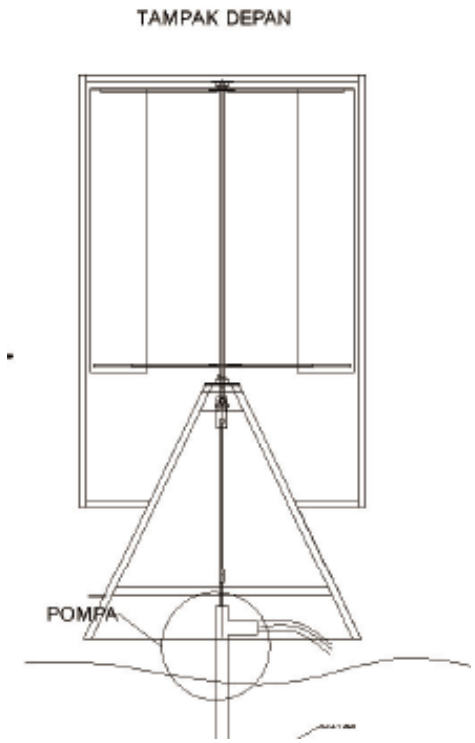

Figure 2. Seawater Resources Development Installation
(KKP & BRSDMKP, 2021)

Smart House Salt Maker (SHASA)

This discovery was made by a young inventor, named Muhammad Arif Billah from the Sepuluh Nopember Institute of Technology (ITS) with a salt embankment installation called Smart House Salt Maker (SHASA). The discovery of this installation was sparked during the Covid-19 pandemic which was detrimental to many sectors, one of which was the salt industry. This not only has an impact on the price of salt which has fallen due to the pandemic, but also with the uncertain weather, making it difficult for salt farmers to produce at this time. The difficulty of salt production in the end has implications for the increase in salt imports by the government.

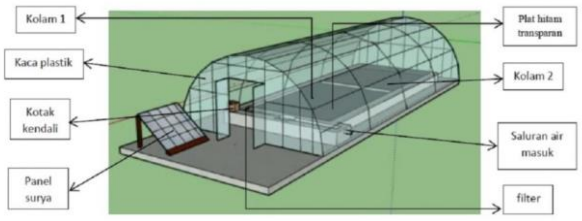

Figure 3. Improving the Quality of Local Salt, ITS Student Initiate SHASA.
(Institut Teknologi Sepuluh Nopember, 2021)

Dealing with this problem, a SHASA installation was formed as an installation to produce salt without being affected by changes in weather. The shape of this installation is in the form of a salt house with a semi-circle shape, underneath there is a salt plot equipped with a heating lamp (ITS, 2021). This heating lamp is used to increase the temperature of the seawater in the salt pool, with automatic control linked by the Adruino and sensors. This installation uses four different sensors with their respective uses, namely sensors that can identify light, rain, salinity levels, temperature and humidity. This sensor is used to detect changes in the weather, so this installation can adapt to changes that exist.

Based on Arif's explanation, when the weather is cloudy or rainy it causes the temperature to drop and the evaporation process does not run optimally. The device is capable of detecting rain and the SHASA heating lamp will automatically turn on to continue the crystallization process. Likewise with other changes, SHASA will be programmed to adapt to existing conditions. For its size, SHASA requires a salt plot of 7 x 8 meters to produce 500 kg of salt. If one kilogram of salt is valued at Rp. 12,000, the farmer gets a big profit without the risk of crop failure. It is hoped that by implementing SHASA, salt farmers will be able to increase their production and welfare. On the other hand, the government can also reduce the salt import quota (ITS, 2021).

CONCLUSION

As the largest maritime country in the world, Indonesia has marine resources that can be utilized. Our marine potential should get more attention to be developed immediately as in the blue economy concept that was initiated by Bueger. That currently, the focus of economic development is gradually changing, from a focus on land-based economic wealth to optimizing the economic potential of the sea. With this change, innovation and technology are needed to support the implementation of a blue economy by each country. Indonesia has great potential in developing a blue economy, with adequate quality and geographical location. Based on the wealth of the sea, this country has the potential to develop a new commodity, has a high potential and is most needed in daily life, namely salt. Salt is considered a blue economy potential owned by Indonesia, because we can produce salt in very large quantities. Not all countries have seawater salinity like ours, this is an advantage for Indonesia to start developing its domestic salt production.

Despite the fact, based on the marine wealth that we have up to now, Indonesia is still importing salt to meet its national needs. This country is only able to produce food salt (salt with NaCl content less than 94%), while the need for industrial salt (salt with NaCl content above 97%) is not met. This high demand is not accompanied by a high rate of domestic salt production. So, every year our country imports, the number of which often increases every year. Indonesia as the largest maritime country ideally does not need to import salt for its domestic needs. So, as much as possible, we try to realize Indonesia as an independent maritime nation. One way to overcome this inequality is to encourage the rate of domestic salt production. In an effort to increase salt production alone, there are many obstacles, one of which is high rainfall. The main problem, salt farmers in Indonesia are still using processing with traditional methods and simple equipment. The majority of them depend on the weather and the sun's heat for the process of evaporation of seawater so that salt can be harvested. With the current conditions, rainfall cannot be predicted with certainty, so salt production tends to fluctuate and tends to decrease every year.

To increase salt production, the Coordinating Ministry for Maritime Affairs and Fisheries sees the potential for salt embankments to be built in the Nagekeo area, East Nusa Tenggara. With the addition of salt embankments, it is expected to increase salt production in accordance with national needs. Not only adding the location of salt embankments, but also the need for modernization and transformation of salt embankment technology. Some of them, the TuF Geomembrane Prism House method, using a Vertical Axis Pump and a salt embankment using an advanced weather sensor ala Smart House Salt Maker (SHASA). If these methods of renewing salt embankment technology are applied to the Nagekeo area, East Nusa Tenggara, it is certain that our salt production will increase. By applying the invention of anti-rain salt embankments, it is hoped that Indonesia can reduce salt imports and become an independent and successful maritime country.

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