Ethno-SDGs and Science in Madurese Salt Production: Toward Blue Economy and Sustainability in ASEAN

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Abstract. One of the largest salt production sites in Indonesia is on Madura Island. Salt production in Madura has a long history and is one of the important commodities for the regional economy. This research aims to transform the local knowledge of the Madurese people in traditional salt production into scientific knowledge. It will integrate this knowledge with the perspective of the Sustainable Development Goals (SDGs) and develop sustainable environmental strategies within the framework of the blue economy in the ASEAN region. This study employs a qualitative research approach with a descriptive exploratory method. Data were collected through triangulation techniques, including observation, in-depth interviews, and documentation, and were supported by literature studies. The findings show that salt production integrates several sustainability principles and science concepts. The process begins with directing seawater into ponds based on clean water and sanitation principles, combined with an understanding of water compounds and currents in crystallization. Windmills are used to pump seawater, reflecting affordable and clean energy principles while applying energy transformation to support evaporation. Production also relies on weather cycles and the use of HDPE plastic, connected to climate action and the sciences of evaporation and polymers. No chemical additives are used, supporting life below water and natural evaporation. Finally, land management practices support the principle of life on land, guided by ecosystem science. In conclusion, Madura's traditional salt production has significant potential to be transformed and sustained through a blue economy approach that emphasizes the sustainable use of marine resources.

Keywords: Ethno-SDGs, Science, Sustainable, Environmental

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1 Introduction

Salt production has been an important activity throughout history, with different methods used in different regions. More than just a seasoning, it has influenced diets, preserved food, maintained health, and even impacted trade routes and government. Ethnoarchaeological studies on the coast of Michoacan reveal the importance of salt production and trade in pre-Hispanic times (Williams, 2002). Solar evaporation salinas are complex ecosystems that support biodiversity while producing high-quality salt (The House of Kortekaas, 2020). Around the world, communities have created unique ways to produce this essential mineral, reflecting both their environment and cultural identity. From the solar evaporation pools of ancient Mexico (Salado et al., 2004) to the centuries-old salt farms of Goa, India (Mani et al., 2012), and from early archaeological finds in China . (Flad et al., 2005) to artisanal salinas in Portugal (Rodrigues et al., 2011, Zainal Arifen et al., 2024), salt has always been more than just a commodity. It tells a story of human ingenuity, adaptation, and survival.

Amidst global efforts to mitigate the impacts of climate change and increase environmental resilience, an EthnoSDGs-based strategy that integrates tradition with science can be a relevant solution to achieve sustainability. By optimizing more environmentally friendly and efficient production methods and utilizing local economic potential, this study hopes to provide a positive contribution to the development of sustainable salt production in Madura, as well as providing a new perspective on how traditional knowledge can play a role in achieving sustainable development goals at the local level. The urgency of this research is very important considering the increasingly stressed environmental conditions due to climate change, land degradation, and declining quality of natural resources. Traditional salt production in Madura has several aspects that have used the principles of sustainability, but there are still several other aspects that need to be considered for sustainability. Both in terms of production and its impact on the surrounding environment. This is important for Indonesia in achieving the SDGs, especially in the fields of an inclusive economy, environmental conservation, poverty reduction, and improving community welfare. This research can also contribute to government policies in developing an environmentally friendly and sustainable salt sector in Indonesia, which can ultimately provide a model example that can be applied in other regions throughout Indonesia.

Madura has long been known as the center of traditional Indonesian salt production, with a unique local knowledge system developed through long interactions between coastal communities and their marine environment. Madura Island itself is known as the salt island in Indonesia. Salt production in Indonesia faces significant challenges in meeting market demand, which exceeded 4 million tons in 2022 (Akbar et al., 2023). This is a great opportunity to continue producing salt according to Indonesia's needs and compete to be able to export salt to various countries. Analysis of the sustainability of salt cultivation in three areas of Madura shows sufficient sustainability, with Sumenep performing well in economic, social, technological, and institutional dimensions (Astutik et al., 2019). In this review, the main questions are: How can the indigenous knowledge of the Madurese people in traditional salt production be constructed into natural science knowledge and integrated with the Sustainable Development Goals (SDGs) perspective to formulate sustainable environmental strategies? Additionally, how can the traditional production of Madurese salt be transformed and sustained within the blue economy framework to address climate change, regional market dynamics, and environmental sustainability amid competition in the ASEAN salt industry?

2. Literature Review

In Southeast Asia, salt production has long been intertwined with local economies and social systems. Salt plays a crucial role in both health and cultural contexts across many countries. In Malaysia, for instance, the average daily salt intake is 7.9 grams, which exceeds the WHO recommendation of 5 grams. Approximately 70% of the population eats outside the home (Zainal Arifen et al., 2024). In contrast, traditional salt production practices continue in countries like Vietnam. In Bac Lieu Province, 118 hectares of salt fields are managed by 25 households, with 45.3 hectares still employing traditional methods. These areas are now being developed through projects that integrate sustainability, tourism, and the improvement of local communities' well-being (Viet Nams News, 2023). Furthermore, archaeological research indicates that salt production in Southeast Asia has a long history, documented through both ethnographic and archaeological studies. Salt was not only a staple but also an important trade commodity that connected coastal producers with inland consumers. One traditional technique involved boiling salt water in ceramic vessels (Khram et al., 2013).To meet rising demand and reduce imports, Indonesia is exploring intensification methods such as the Salt Production House concept that combines Japanese techniques with a closed system (Prabawa & Bramawanto, 2021).

Salt has not only been a staple but also a central factor in state revenue and regional trade (Wang et al., 2015). Salt production is one of the oldest coastal economic activities and plays a key role in the blue economy and the sustainability of coastal areas (ASEAN, 2023). However, in Indonesia, domestic salt production is unable to meet national demand due to the limitations of traditional methods that rely on weather conditions, leading to low productivity and quality that often falls short compared to imported salt (Wiendiyati et al., 2021) Efforts to modernize the industry through technological advancements, improved infrastructure, and stronger support for salt farmer organizations are ongoing. However, political dynamics and state control over this commodity pose significant challenges to its sustainability (Foo, 2018). This situation highlights the urgent need to integrate traditional methods with modern practices in salt production to support the achievement of the Sustainable Development Goals (SDGs) and establish a sustainable environmental strategy based on the blue economy.

The UN 2030 Agenda, with its 17 SDGs, calls for the active participation of the private sector to address global sustainability challenges (Jamali et al., 2022). Soil scientists can make significant contributions to achieving the SDGs through interdisciplinary collaboration and knowledge transfer (Keesstra et al., 2016). The SDGs adopted by the UN in 2015 emphasize the importance of achieving development that not only prioritizes economic growth but also pays attention to social and environmental balance. No exception for salt production agriculture, which must pay attention to sustainability according to the principles of the SDGs. Research on the integration of traditional knowledge, such as that found in Madura salt production, with a science-based approach opens up opportunities to create more relevant and applicable sustainable solutions.

The sustainable management of saline farming offers solutions to achieve various SDGs, particularly food security (SDG 2), economic sustainability (SDG 8), water quality (SDG 6), and biodiversity (SDG 15) (Negacz et al., 2021). Soil salinity, which affects more than one billion hectares worldwide, poses a significant threat to agricultural production and environmental health (Singh, 2021). Proper management of soil salinity is critical to achieving most of the SDGs, including Zero Hunger (SDG 2) and Life on Land (SDG 15) (Singh, 2022). Reducing salt intake is beneficial for health and can prevent millions of deaths each year(He et al., 2010).

Ethno-SDGs is an approach that integrates the culture, beliefs, and practices of indigenous communities into the framework of the Sustainable Development Goals (SDGs). This concept combines ethnographic studies of community culture with the 17 global SDGs, which focus on critical issues such as poverty, inequality, and climate change (Wadhwani & Malpani, 2023) In this framework, local knowledge—often referred to as Indigenous Knowledge (IK)—plays a crucial role. IK represents a community construct that has evolved over generations to understand and manage the environment. It includes traditional practices, beliefs, and innovations in areas like agriculture, health, and natural resource management. This knowledge is adaptive, passed down orally, and collectively owned (Godfrey & Siraje, 2019; He et al., 2010; Mistry et al., 2019). Therefore, Ethno-SDGs provide a more contextual, inclusive, and locally relevant framework for sustainable development.

Salt production in Indonesia faces significant challenges in meeting domestic demand, which surpassed 4 million tonnes in 2022 (Akbar et al., 2023). Madura salt, or Madura salt, has become a vital commodity and the main livelihood for many residents along the southern coast of Madura (Parwoto & Hartono, 2018). Madura, with its salt production tradition that has existed for hundreds of years, is one of the regions that has great potential in developing salt as a strategic commodity. The traditional salt production process carried out by the Madurese people not only utilizes hereditary knowledge regarding environmentally friendly salt harvesting techniques, but is also closely related to the pattern of interaction between humans and nature. This makes salt production in Madura an appropriate example for analyzing the relationship between ethnic knowledge (ethno-science) and the implementation of more holistic SDGs, especially in terms of environmental sustainability and community economic empowerment. Salt production in Madura is divided into 2, namely PT.Garam salt production and traditional salt production by local residents. In this study, the focus is on traditional salt production carried out by the community independently or not affiliated with PT.Garam.

Salt production has historically been integrated into local economies and has influenced settlement patterns and community organization. Traditional methods, such as brine evaporation and mining, are still practiced in rural areas, despite facing competition from industrial production (Ekrami et al., 2021). Traditional salt production in Nepal is not only a source of income but also an integral part of the cultural identity of mountain communities. The history of the trans-Himalayan salt trade confirms its position as a strategic commodity, although its sustainability now faces challenges due to climate variability, market competition, and limited infrastructure (Devkota et al., 2022). Traditional methods are still prevalent, making production vulnerable to weather fluctuations and producing low-quality salt that often fails to meet national standards (Akbar et al., 2023; Izzaty & Permana, 2011). To overcome this problem, innovative technologies such as Spiral Filter Technology (TUF) with Geomembrane media have been applied, increasing production efficiency and quality (Yasin et al., 2019). Traditional salt production in Indonesia faces challenges in terms of quality and efficiency. Studies show that geomembrane technology can significantly increase salt production by up to 122.22% and increase NaCl content by up to 6.12% compared to traditional methods (Maurina et al., 2021). Several traditional Madurese salt-producing farming communities have begun to use this plastic media.

Traditional Madurese salt production has tended to rely on natural and low-tech methods. However, with the challenges of climate change, limited natural resources, and the need for production efficiency, it is important to integrate aspects of science and technology into the practice of salt production. Modern scientific knowledge, such as more efficient seawater processing technology, can strengthen traditional techniques without eliminating existing cultural and sustainability values.

Various studies have explored various aspects of salt production in Madura, including purification methods to achieve SNI standards (Umam, 2019), the use of geomembrane technology to improve quality and price(Abdullah & Susandini, 2018), and the technological readiness of salt farmers (Utomo, 2022). Madura, as one of the main salt-producing areas in Indonesia, has great potential in providing a model for the development of a sustainable salt sector. Integration of traditional knowledge in salt production with a more efficient modern scientific approach can be a solution to address sustainability issues in this sector. This research is very relevant because it can introduce the concept of EthnoSDGs, which combines local wisdom with science to create production practices that are not only economically profitable but also environmentally responsible. With the application of more environmentally friendly technology, efficient use of seawater, and better waste management, Madura salt production can be improved in quality and quantity, without sacrificing the sustainability of natural resources.

Salt has been an important substance throughout human history, playing a vital role in many aspects of life and science (Lozada et al., 2007; Roos, 2007). Salt is essential for food preservation, flavoring, and human health, with its consumption associated with benefits and risks such as hypertension (Mokhtari & Vahid, 2016). In earth science, salts are important in groundwater dynamics and geological processes (Çinku et al., 2020). The salt industry has evolved from empirical practices to scientifically informed production methods (Multhauf, 1976). Recently, salt has gained attention as a potential building material, offering opportunities for sustainable construction and addressing waste management challenges from desalination and mining processes (Pungercar & Musso, 2021). Understanding the diverse properties of salt and its impact on health and the environment remains an important area of research (Nagendra et al., 2020). Viewing salt production from a scientific perspective is essential as it provides a comprehensive understanding of the process, its efficiency, its impact on the environment, and its relationship to sustainability.

3. Research Method

The study employed a descriptive–exploratory approach in Sumenep District, Madura, which is the largest salt-producing region on the island and represents a stronghold of traditional salt-making practices. This site was selected purposively because of its historical continuity, reliance on indigenous knowledge, and current challenges in integrating sustainability and modernization. This approach was chosen to explore the indigenous knowledge of the Sumenep community regarding traditional salt production, reconstruct it scientifically, and explore how the principles of SDGs relate to it.

This research incorporated secondary data from academic literature (e.g., Imaduddin et al., 2020) with a detailed study of the characteristics and spatial context of salt production (e.g., Dzięgielewski & Mazur, 2025). The analysis is further enhanced by incorporating ethnographic data, which helps to reconstruct traditional practices and conduct cross-cultural comparisons to explore the technological and socio-cultural aspects of salt production (Eubanks, 2015). Additionally, data collection involved surveys, interviews, and active engagement with local stakeholders, including salt farmers, community leaders, and young people, to design sustainability initiatives (Goca et al., 2024). In-depth interviews were conducted with salt farmers and traders regarding the indigenous knowledge of the community about the salt they produce. Observations were conducted to directly observe how the Sumenep community farms salt, stage by stage, from the flow of seawater to the ponds to the process of harvesting salt. Meanwhile, documentation and literature studies were used to obtain more holistic information and support interview and observation data. Literature studies support the results of field survey observations. Then, the analysis of various data is described using exploratory descriptive analysis.

4. Result and Discussion

4.1 Madurese Traditional Salt Production Process as a Local Knowledge Base

One of the areas with the largest salt production in Indonesia is Madura, even Madura itself is known as the Indonesian Salt Island. Madura is one of the islands in the Province of East Java, Indonesia. All districts on this island, consisting of Bangkalan, Sampang, Pamekasan, and Sumenep, have extensive and productive salt ponds because they produce salt in large quantities. A quarter of the area of Indonesian salt pond production is on Madura Island, namely 6,240 out of 25,800 hectares, and a quarter of Indonesia's salt production is produced from Madura Island, namely 758,000 out of 2.91 million tons (Finaka & Putra, 2018). Sumenep Regency is a regency with the largest salt production on Madura Island. Salt itself is a major commodity in Sumenep Regency. From the largest salt commodity on Madura Island, it is a source of income for some people in Sumenep and has a very important role in the economic growth of Sumenep Regency (Ashley, 2019). In terms of seasons, Indonesia should have two seasons: rainy and dry. Uniquely, the dry season is longer than the rainy season, ranging from April to October. The dry season is the most-awaited season by the Salt farming community.

In Sumenep, Madura, Indonesia, traditional salt farmers produce once a year during the dry season for about 3 months. This process includes: land preparation, about one hectare of land can be used as land for salt production by being divided into 12 plots of land, plots 1 to 9 are plots of land for seawater flow, while plots 10 to 12 are plots of land for taking salt, which are coated with HDPE geomembrane plastic. Based on (Abdullah & Susandini, 2018) Recent efforts to increase salt production in Madura have focused on the use of geomembrane technology, which has been shown to improve salt quality and increase selling prices compared to traditional land-based production methods.

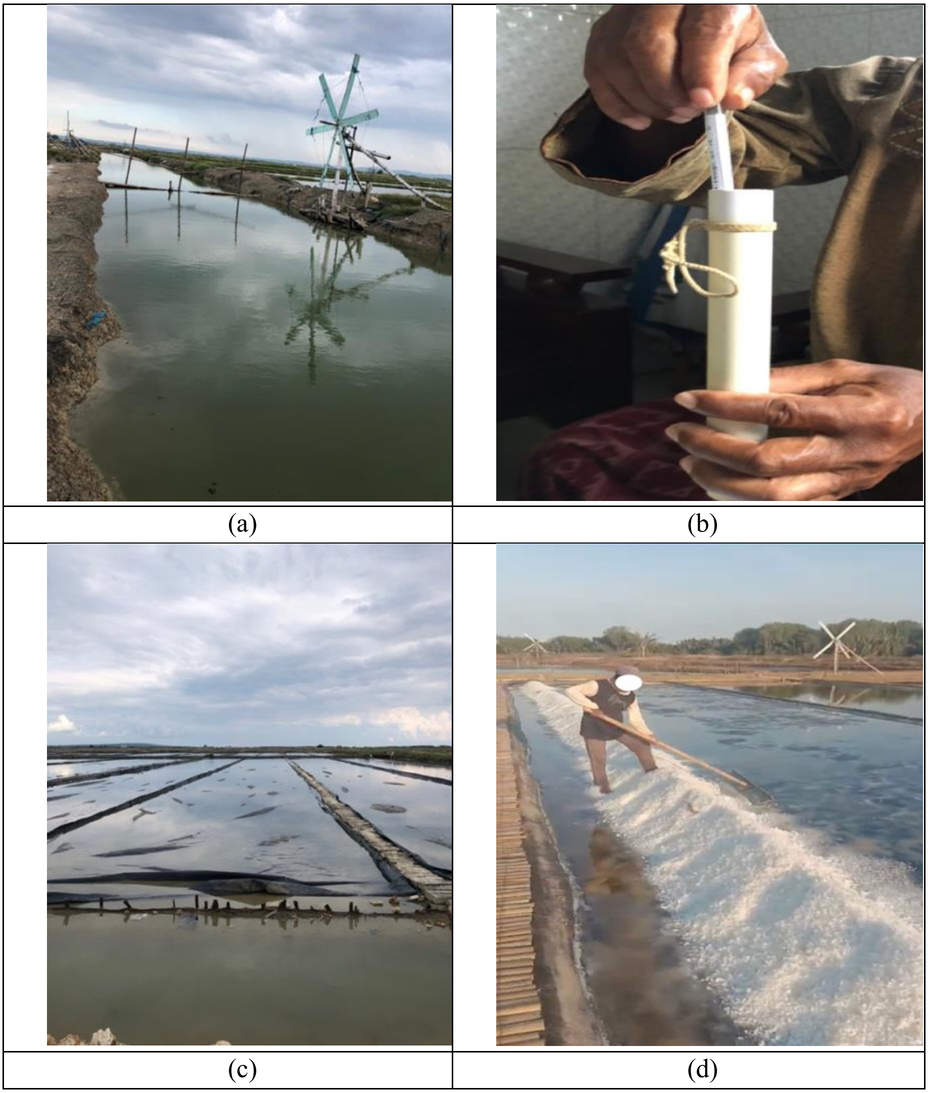

Figure 1. The traditional salt production process by the Sumenep community. (a) River that flows seawater to residents' salt ponds; (b) Baume Hydrometer; (c) Salt ponds; (d) Madura salt harvest

In the initial preparation, farmers also fill/compact the soil to make it higher as a boundary between one plot and another. Filling with seawater, each salt production land owned by farmers has a water flow from the sea. To channel seawater to each plot, salt farmers rely on windmills. Water will flow from plot 1 to 9 in series. Then in plot 9, it will be channeled to plots 10, 11 & 12 in parallel. The water in these three plots of land is supplemented with seawater from plot number 9, with a salinity level that is at least the same as the plot to which seawater will be added, so as not to reduce the salt content. Thus, the seawater in plots 1 to 9 sequentially starts from the lowest to the highest salt content. The people of Sumenep call it young water and old water. To measure the salt content, farmers use a simple Baume Hydrometer tool. Evaporation by the sun: Old seawater in the last three plots of land undergoes an evaporation process with the help of direct sunlight until it crystallizes and is ready to harvest. This process is greatly influenced by the weather. During the harvest process, the salt crystals will be collected with a shovel or other traditional tools. Collected until completely dry, then put into sacks to be sold to collectors. Generally, this traditional salt production process lasts for 5 to 10 days for one harvest. Visualization of the traditional salt production process by the Sumenep community can be seen in Figure 1.

4.2 Constructing Local Knowledge of Madura Salt Production into Science and the SDGs

The following is a science-integrated ethno-SDGs reconstruction that can be dissected from the traditional salt production process in Sumenep, Madura:

1. SDG 6: Clean water and sanitation

   Indigenous knowledge of the community:

   a. Madurese people choose salt pond locations that are close to the coast but protected from pollution and large waves.
   b. The water used is very safe, so that when it is not during the pond salt production period, farmers use it for fish farming.
   c. Seawater management free from additional chemicals supports the absence of pollution of freshwater used directly by local communities.

   Science:

   Unpolluted seawater can produce high-quality salt that is safe for consumption. Water with high salt content accelerates the formation of salt crystals. Modern science studies the content of ions in seawater (Na^+, Cl^-, Mg^{2+}, Ca^{2+}) to determine the efficiency of salt production.

   SDGs: SDG 6

   The use of clean water access for salt production involves seawater that is free from industrial pollution and household waste. In addition, the gradual flow system (from young water to old water) shows the efficiency of water resource use. In salt production, there is a need to maintain the balance of marine and coastal ecosystems to support the sustainability of salt production. For hundreds of years, Madura salt has been able to maintain the sustainability of wise seawater management with natural channels. In Madura, water use for salt production often depends on rainfall, which varies from year to year. This can cause instability in the availability of water for production, thus increasing the importance of implementing efficient technology in water use, such as rainwater harvesting systems or more water-efficient evaporation technology.

2. SDG 7: Affordable and Clean Energy

   Indigenous knowledge of the community: the flow of sea water into the salt ponds uses windmill power, and salt farmers rarely use engines that run on gasoline or petroleum. Windmills are used both to flow water from the sea to the ponds and between ponds in one salt production cycle.

   Science:

   a. Windmills work by converting the kinetic energy of the wind into mechanical energy, which is used to turn the water pumping wheel.
   b. This principle itself already carries the conservation of energy in the laws of thermodynamics, that energy cannot be created or destroyed, it can only change form from one form to another.
   c. This reduces dependence on fossil fuels or electricity in the process of flowing seawater.
   d. The use of this windmill is to increase air circulation in the pond to increase the rate of evaporation.

   SDGs: SDGs 7

   A windmill used to channel seawater, showing the utilization of renewable energy. The use of windmills reduces the need for electricity or fossil fuels, making it more environmentally friendly and sustainable because it can reduce carbon emissions.

3. SDG 13: Climate Action

   Indigenous knowledge of the community:

   a. The Madurese people are very dependent on weather cycles, such as the dry season, to produce salt.
   b. Salt production uses adaptive original evaporation by coating the land with a geomembrane using HDPE (High-Density Polyethylene) plastic at the same time to improve the quality of salt and lighten the workload of farmers. The use of this plastic is making salt production begin to face semi-modern innovation.

   Science:

   a. The evaporation process in the production of salt in Madura depends on the weather (high temperature and sunlight). Evaporation of seawater to produce salt crystals involves the principles of thermodynamics and fluid physics. Seawater heated by the sun evaporates, leaving salt crystals.
   b. HDPE is a material that is very resistant to water penetration, including seawater containing salt. This property allows HDPE to maintain high salinity in the pond without the risk of leakage that will affect the evaporation process and salt quality. HDPE plastic does not react with salt or chemicals in seawater, making it a better choice than other geomembrane materials that may degrade in a short time. HDPE is resistant to corrosion, UV rays, and

chemicals, making it ideal for salt pond environments filled with seawater that has a high salt content.

SDGs: SDG 13

a. The use of sunlight as a renewable energy source in the production of traditional Madurese salt can help reduce carbon emissions.
b. The use of geomembranes such as HDPE plastic can accelerate evaporation so that salt can be harvested faster before the rainy season arrives. Although HDPE is very effective in increasing evaporation efficiency, this plastic material does not biodegrade easily in the environment. Therefore, despite reducing leakage and increasing salt production, the use of HDPE still poses challenges in terms of managing plastic waste after the geomembrane is damaged or worn out. It is important to consider alternatives that can reduce the long-term impact on the environment.

4. SDG 14: Life below water

Indigenous knowledge of the community:

a. Do not use additional materials to settle dirt in the seawater used.
b. They understand the tidal cycle and use it to channel seawater into the ponds through natural water channels, which are then gradually channeled from one plot of land to the next, little by little. Meanwhile, the salt waste is always used up, and much of the water used crystallizes into salt.

Science:

The production of traditional Madura salt is entirely based on natural evaporation, where seawater consisting of ions such as Na^+, Cl^-, Mg^{2+}, Ca^{2+}, and K^+ becomes steam and then salt (NaCl) precipitates. This opinion occurs without additional chemical reactions.

SDGs: SDG 14

Does not use hazardous chemicals, thus minimizing marine pollution and maintaining a stable marine ecosystem.

5. SDG 15: Life on Land

Indigenous knowledge of the community:

Using the land periodically (seasonally), salt ponds are only active during the dry season, and then can be used for fish/milkfish ponds during the rainy season.

Science:

No risk of soil contamination or chemical erosion because no additional chemical fertilizers are used. The traditional natural Madura salt process keeps the soil safe because there is little heavy equipment intervention.

SDGs: SDG 15

Using marginal coastal land without damaging the terrestrial ecosystem, Natural production without chemicals maintains soil quality.

4.3 Transforming Madura Salt Production within the ASEAN Blue Economy Framework

Since prehistoric times, salt has been a vital commodity for human civilization. Historically, salt has often been referred to as "white gold" due to its fundamental role, not only as an essential element for biological survival, but also as a strategic and symbolic commodity in ancient societies (Alessandri et al., 2025). To this day, its production remains a sustainable industry utilizing renewable natural resources.

The Indonesian government has faced several challenges in achieving salt self-sufficiency, which requires the formulation and implementation of strategic steps to increase salt production (Malawani et al., 2021). Traditional Madurese salt production is a coastal economic practice rich in local wisdom that utilizes natural energies, such as sunlight and wind, for the crystallization process. This activity not only supports local livelihoods but also has significant potential to contribute to the global sustainability agenda. From a micro perspective, this practice showcases energy efficiency, minimal chemical use, and the effective use of marginal coastal land. When examined from a macro perspective, the characteristics of this salt production align with various Sustainable Development Goals (SDGs). For instance, the use of renewable energy and efforts to reduce carbon emissions are directly linked to SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action). Additionally, the environmentally friendly practices associated with the use of marginal coastal land support SDGs 14 (Life Below Water) and 15 (Life on Land) by helping to maintain the balance of marine and terrestrial ecosystems.

Traditional salt production in the Mediterranean region demonstrates the continuity of practices that adapt to economic and environmental changes. Salt ponds serve not only as production centers but also as cultural landscapes connecting heritage, biodiversity, and local identity. Today, these practices are increasingly recognized as cultural heritage through conservation initiatives, ecotourism, and sustainable development (López et al., 2025). Salt farming is more than just an economic activity; it is also a cultural practice that contributes to community identity and social relationships. The traditional knowledge of salt production is handed down through generations, reflecting local cultural resilience and adapting to environmental conditions (Resmi et al., 2025).

The connection becomes particularly significant when viewed through the lens of the Blue Economy, which focuses on the sustainable management of marine and coastal resources for both economic prosperity and ecosystem health. Madurese salt production serves as a prime example of eco-innovation within a traditional industry. By utilizing simple technologies such as geomembranes, production efficiency is increased, and losses during the rainy season are minimized. However, challenges arise from plastic waste generated by these geomembranes, highlighting a major concern of the Blue Economy: marine pollution. This situation underscores the need for more environmentally friendly alternatives. On a broader scale, Madurese salt production practices contribute to carbon emission reductions, the balance of coastal ecosystems, sustainable resource management, and green innovation—all essential components of the Blue Economy. From a local perspective, grounded in traditional practices, Madurese salt production exemplifies a meaningful contribution to the Sustainable Development Goals (SDGs) and serves as a model for enhancing the Blue Economy in coastal regions. This approach also has strategic implications for regional sustainability agendas, such as those outlined by ASEAN, as shown in Figure 2.

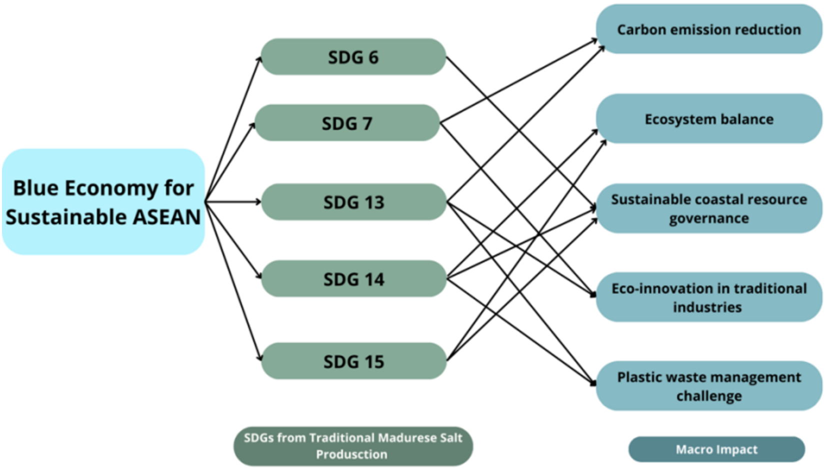

Figure 2. Madurese Salt Production in the Blue Economy Framework: Strengthening SDG Impact in ASEAN

The Indonesia Blue Economy Roadmap outlines a pathway to a diversified and sustainable maritime economy, based on ensuring the health and resilience of marine ecosystems and securing benefits for current and future generations. The roadmap provides guidance on how the blue economy can increase productivity and contribute to economic transformation toward Indonesia's Vision 2045 (Bappenas, 2024).

Conclusions

Traditional Madurese salt production that combines local wisdom of indigenous knowledge with the principles of SDGs, which can also be seen from a scientific perspective, offers a sustainable strategy for coastal environmental management. The principles of SDGs include clean water and sanitation, affordable and clean energy, climate action, life below water, and life on land. Each of the SDGs principles contains scientific studies in strengthening sustainable environmental strategies. Madura’s traditional salt production has significant potential to be transformed and sustained through a blue economy approach that emphasizes the sustainable use of marine resources. This research is confined to the local context of Madura and employs a descriptive, qualitative approach, making it unsuitable for generalization. Moreover, quantitative data have not been thoroughly examined, and the incorporation of Ethno-SDGs remains a conceptual framework. Future studies should broaden the scope, develop quantitative instruments, and evaluate the application of Ethno-SDGs in Blue Economy policies and environmentally friendly technological innovations. This will enhance the sustainability of the traditional salt industry.

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