ASSESSING THE POTENTIAL OF WEATHER FISHERMEN'S FIELD SCHOOL TO SUPPORT BLUE ECONOMY IN INDONESIA

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ABSTRACT

The blue economy represents an innovative approach to harnessing the marine economy's potential while safeguarding the sea and its ecosystems. This paper explores the potential contribution of Indonesia's Meteorological, Climatological, and Geophysical Agency (BMKG) through Fishermen's Weather Field Schools (SLCN) in supporting the country's blue economy. By analyzing the role of SLCN as a collaborative platform for stakeholders in the fisheries industry, the paper seeks to integrate stakeholder capabilities into a comprehensive framework for a successful and sustainable blue economy. It recommends leveraging SLCN as a ready-to-use platform for stakeholder interaction and encourages collaboration among researchers, government agencies, and non-governmental organizations to ensure the safety and success of local fishermen through effective research and communication.

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1. INTRODUCTION

Meteorological, Climatological, and Geophysical Agency of Indonesia (BMKG) is a government institution that provides services in the fields of meteorology, climatology, geophysics, and air quality. In carrying out its duties and responsibilities, BMKG is committed to supporting and assisting the government's efforts to realize Indonesia's vision towards Indonesia Emas 2045, particularly in the maritime sector. The support provided includes various innovations in providing maritime weather and climate information services to support the development of the maritime sector, including fisheries, maritime transportation, oil and gas, marine infrastructure development, and others. One of the first innovations implemented is the deployment of the Fishermen's Weather Field School (SLCN), which aims to provide an understanding of the effective use of weather and climate information in supporting fishing activities.

Indonesia is famous as a maritime continent with more than 70% of its territory being ocean. According to the data from the Coordinating Ministry for Maritime Affairs, water covers around 6.4 million km2 out of the 8.3 million km2 total area of Indonesia. Indonesian waters have 27.2% of all flora and fauna species in the world. These flora and animal species comprise 44.7% of fish, 40% of molluscs, 12% of mammals, 31.8% of reptiles, 23.8% of amphibians, and 8.6% of seaweed out of the total global species [1]. The aquatic resources make Indonesia rank as the world second second-highest capture fisheries production in marine fisheries [2]. The country's marine economic potential

is estimated at US $ 1338 billion per year [3], which arguably has not been optimally utilized for the welfare of Indonesian society.

Currently, with the astronomical economic potential, Indonesia's ocean is also faced with a multitude of challenges coming from both humans and nature. To begin with, anthropogenic activities such as illegal fishing, overfishing, and unsustainable traditional fisheries such as fish blasting, fish poisoning, and gleaning activities seriously threaten the ocean's ecosystem [4]. In 2021, the Task Force to Combat Illegal Fishing (Task Force 115) reported that it had captured at least 167 illegal fishing vessels [5], but this number could be more. In addition, signs of overfishing emerge in many areas in the central and western parts of Indonesia, such as the Java Sea, the Malacca Strait, the Bali Strait, and the eastern waters of Sumatra. On the other hand, in eastern Indonesia areas, the marine resource utilization level is not optimal or is still underfishing [6]. Approximately 90% of the global fish stocks have been overexploited or fully exploited. Indonesian fishing households decreased by half in just one decade, from 1.6 million in 2003 to only 800 thousand in 2013 because of overfishing and illegal fishing. Illegal fishing and unsustainable fisheries methods also threaten more than 50% of Indonesia's coral reefs, the habitat for marine species and adjoining ecosystems [7].

Secondly, the detrimental effects of human pollution on the ocean. Civilization development contributes to water resource exploitation, and sedimentation, and produces waste and pollution, affecting ocean biodiversity [8]. The inputs of agricultural residue, urban untreated sewage, and industrial wastes on the coastal plains pollute the marine environment and damage its flora and fauna [9]. For example, the marine area in Bunaken was reported to have garbage and waste dumped through Manado Bay continuously [10]. In addition, plastic waste leaks out from the land and makes its way into the ocean. The United Nations estimated up to 10 million tonnes end up in the ocean each year [11]. In a business-as-usual scenario, by 2025, the ocean is expected to have a ratio of 1 tonne of plastic for every 3 tonnes of fish. Looking ahead to 2050, it is estimated that the combined weight of all the fish worldwide will be surpassed by the weight of total plastic waste [12].

Lastly, the ocean has been experiencing changes caused by global warming. The increase in sea temperature leads to other problems—including deoxygenation, acidification, and increased extreme weather[13]. Most of the changes put pressure on the existence of living creatures inside the ocean. For example, coral bleaching and mortality occur because of the combined effects of ocean acidification, rising seawater temperature, and chronic low oxygen [14].

The economic potential, the welfare of Indonesian people (especially those who live in the coastal area), and threats to marine sustainability create a difficult question about how to balance the economy, society, and environment of the marine area. The blue economy emerges as one of the innovations to optimize the effort to maximize the profit from the marine economy while simultaneously conserving the sea and its ecosystem. In order to do that, collaboration from all stakeholders becomes increasingly urgent to ensure the sustainability of marine ecosystems and the livelihoods of coastal communities.

In this context, the goal of this research is to identify the potential contribution of BMKG through the utilization of SLCN to support the blue economy in Indonesia. This paper will analyze and elucidate the potential of the Fishermen's Weather Field School by BMKG as a platform for identifying and facilitating collaboration among stakeholders in the fisheries industry. Stakeholder mapping can serve as the initial stage for determining possible collaborations. The results can be used as supporting evidence for integrating all crucial aspects of stakeholder capabilities into a comprehensive framework that connects various elements involved in the blue economy.

2. METHODS

This paper is a hybrid between desktop research and field observation from SLCN in Nusa Tenggara Barat (NTB). It uses a mixture of primary and grey literature. In evidence-based practice research, primary literature (proceeding and peer-reviewed articles) is required to build the quality and rigor of the review. However, grey literature which comes from unpublished and non-peer-reviewed papers, organizations, and/or government reports will also be included to complete and provide relevant information that might not be obtainable from the primary literature.

2.1 Integrated Analysis Framework

After the analysis of single components, this research will integrate the findings into a unified integrated analysis framework. This framework will aid in comprehending how the Fishermen's Weather Field School can support the blue economy.

2.2 Study scope

The paper will explain how SLCN NTB functions as a platform for stakeholders' interaction and suggest the ideal contributions from each stakeholder to support the blue economy through sustainable fisheries. Although the study only observes SLCN NTB, for practical consideration, we conclude that the results could be applied (to a limited extent) to all SLCN sites in Indonesia. The findings of this research may provide valuable insights, but the results might not be directly applicable to various fishing contexts worldwide.

3. RESULT AND DISCUSSION

3.1 The concept of Weather Fishermen's Field School

The Fishermen's Weather Field School (SLCN) is an initiative developed by the Meteorology, Climatology, and Geophysics Agency (BMKG) with the aim of providing training and education on the interpretation and dissemination of maritime weather information, such as wave height and wind speed direction, to fishermen. This program aims to enhance the safety of fishermen at sea and support activities in the fisheries and maritime sector. The tagline of this program is 'With SLCN, Fishermen are Great, Safe, and Prosperous'.

The SLCN introduced an innovation from BMKG named Indonesia Weather Information for Shipping (INAWIS), an interactive map that provides maritime weather and fishing ground information. InaWIS BMKG was developed to support the safety of fishermen during their voyages. This website utilizes weather and ocean models to generate weather and wave predictions up to the next 10 days. It streamlines the procedure of accessing maritime weather data, including insights into weather effects, wave height, sea currents, wind speed, and direction. Additionally, it provides supplementary information regarding fixed fishing ground locations plotted on the map. With this information, fishers should be able to make plans before embarking on their sea journeys. Users can access the information at https://maritim.bmkg.go.id/inawis.
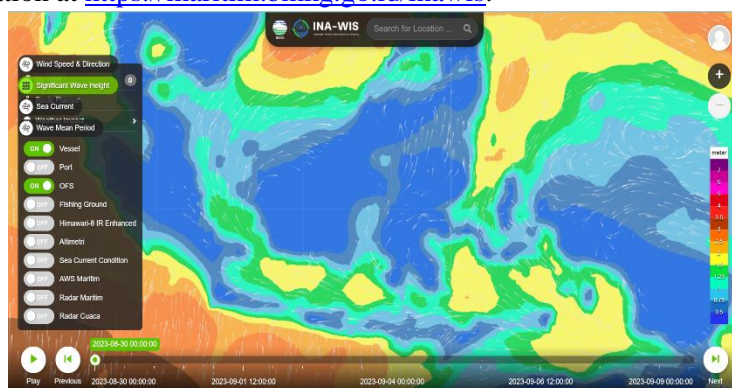

Fig. 3.1 INAWIS display of Indonesian significant wave height
(https://maritim.bmkg.go.id/inawis)

Since its first SLCN in 2016 until 2022, BMKG has organized SLCN in 128 sites across Indonesia. The event invites various key stakeholders ranging from government agencies to local

communities. Based on the framework developed by BMKG, each workshop should invite 100 local fishermen and key stakeholder representatives. Through the workshop, fishermen and stakeholders can give feedback to BMKG by sharing their experiences about weather patterns, fish behavior, and effective fishing practices. The stakeholder representatives also get opportunities to share their knowledge through the interactive dialogue in the workshop. Such collaboration can help increase collective understanding of ocean dynamics and support wiser decision-making regarding when and where to go to sea.

Identify stakeholders in sustainable fisheries on SLCN NTB

Stakeholder engagement is needed to support a successful and sustainable blue economy. Their active involvement must be seen in the operation, management, and assessment of the issues more generally. The 'stakeholder' definition has become considerably varied over time. However, this paper uses the definition from NOAA that defines a stakeholder as "those who have an interest in or are affected by a decision or have influence or power in a situation. Stakeholders' interests in an issue can be monetary, professional, personal, or cultural, or can arise from a host of other motivations." [18]. To simplify the categorization, by using the ex-ante approach, stakeholders are pre-identified based on anticipated stakeholder groups [16]

In 2023, BMKG Nusa Tenggara Barat organized its third SLCN in Tanjung Luar Fishing Port, Lombok Timur (the largest fishing center in NTB). The previous two activities were carried out respectively in Teluk Awang (2021) and Labuhan Lombok (2022). Every year, BMKG NTB invites 100 local fishermen and related stakeholders such as the chief of the fishing port, the district regent, the head of the village, a representative of the local Regional Agency for Disaster Management, a representative of the local Water and Air Police, a representative of the local chief fish market, a representative of the Indonesian Navy, a representative of the local Maritime Education and Training Academy, and local community such as Kelompok Sadar Wisata (Tourism Awareness Community).
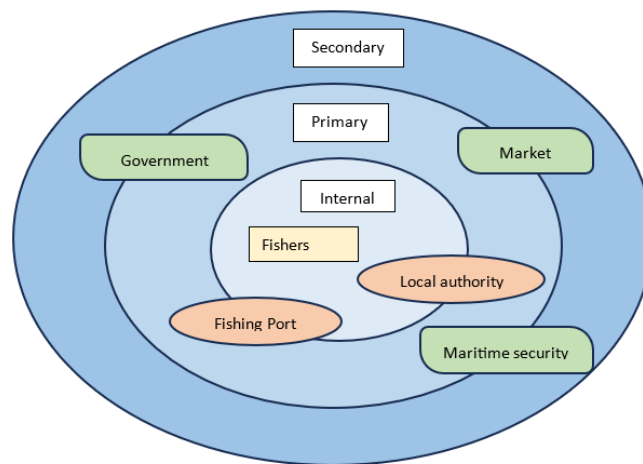

Fig. 3.2 Schematic of stakeholder invited to SLCN NTB

All of the stakeholders that were invited to SLCN NTB play important roles that can be optimized to support sustainable fisheries. However, there was a lack of discussion among them and no interaction between the stakeholders and local fishermen. As a ready-to-use platform, SLCN could be upgraded to act as a platform to connect stakeholders in Indonesia, especially between policymakers and fishermen.

Future Prospective Stakeholders

This paper sees some other prospective stakeholders that could be invited in purpose to support sustainable fisheries in Indonesia such as

Scientist

Scientists are able to develop innovations to boost fisheries corresponding with the blue economy principles. This paper suggests the involvement of scientists (individual/academia) and/or

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government agencies (National Research and Innovation Agency or the Research and Development Agency of the Marine and Fisheries Ministry) in conducting research to recommend dynamic fishing ground locations. The location can be determined based on sea surface temperature (upwelling and downwelling) or chlorophyll concentrations using a satellite-based approach [15]. The information could be integrated into INAWIS map to perfect the previous fishing ground information. They also should give recommendations based on fish breeding season and/or habitat of certain species to minimize the catch of unwanted sea life while fishing for a different species and allow fish to naturally replenish. By determining fishing areas in advance, fishermen can create operational plans that can help them save costs and time while also having a high success rate

Non-Governmental Organization

FAO's Strategic Framework underscored the partnerships between fisheries and aquaculture with non-governmental and civil society organizations (FAO, 2023). Non-Governmental Organizations could help to connect different stakeholders involved in the creation and management of marine protected areas. On the local scale, NGOs could facilitate the bottom-up approach between local communities and local authorities. An interesting example has been shown by Juang Laut Lestari (JARI), a local NGO based in Lombok, NTB. The NGO assists people in the coastal area of Pototano, East Lombok in conserving octopus. The concept is forbid octopus catching during the breeding season and allow the hunt after certain period. This method has been successfully increasing the caught octopus which ultimately affect local people wellbeing. Another example come from NGO that plays role in the ecological and social effectiveness of marine protected areas in Raja Ampat [20]. There is various contribution that NGOs could take to support sustainable fisheries. Research concludes that NGOs employed included: building capacity, facilitating community engagement, providing access to resources, linking stakeholders, and co-producing knowledge.

4. CONCLUSION

In conclusion, harnessing the economic potential of Indonesia's marine areas while safeguarding the environment hinges on the adoption of the blue economy approach. This strategy not only ensures sustainable growth but also underscores the crucial role of government agencies such as BMKG. A tangible step forward is through the utilization of the SLCN program, offering distinct advantages—facilitating collaboration among stakeholders, spanning all of Indonesia's provinces, boasting a consistent framework, and bolstered by a dedicated website (INAWIS) to promote sustainable fisheries. As we forge ahead, the implementation of the SLCN program not only aligns with our vision of a thriving blue economy but also promises a brighter future for Indonesia's marine ecosystem and its communities.

SLCN NTB identified 6 key stakeholders coming from the government, fish market, marine guard, fishing port, local authority, and fishers. Building upon this foundation, it is recommended that additional key stakeholders, notably scientists and non-governmental organizations. This collaborative expansion is poised to contribute significantly to its effectiveness and the realization of a sustainable and thriving marine ecosystem.

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