

A REVIEW OF COASTAL DEFENSE MANAGEMENT TO SUPPORT NATIONAL RESILIENCE

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ABSTRACT

The Surabaya Western Access Channel (SWAC) is a very congested, narrow channel but has several potentials for abundant natural resources. The problems in this Channel's are The busy traffic of both military and civilian ships passing through this channel has resulted in damage to several ecosystems and threatens fishery cultivation. Under the channel there are also dangerous objects for navigation such as shipwrecks that have not been lifted, many pipe installations and underwater cables. The level of shipping safety in SWAC is also relatively low. Therefore it is necessary to have shipping management, shipping safety, ecological maintenance, coastal community life and defense and security governance. The purpose of this paper is to review the existing conditions of coastal defense governance that have been implemented before. The method in this article is the VOSViewer analysis which analyzes the relationship between several keywords related to coastal defense management.

KEYWORDS : Coastal defense, management, SWAC.

1. INTRODUCTION.

The Archipelagic State of The Republic of Indonesia (known as NKRI) comprises 17,504 islands and has the world's second-longest coastline, stretching 99,083 km. Because of this, ocean and coastal management focuses on the distribution of goods and people and the realization of regional connectivity. Transportation services are an important component for achieving inclusive growth, economic progress and the efficiency of the national logistics system (Malisan, et.al. 2023). These conditions make Indonesia rely on the maritime sector as a priority for its activities (Rizal, 2022). The advantage of Indonesia's geographical position invites threats such as piracy, terrorism and attacks from other countries. Therefore it is necessary to have a strong defense in the sea and coastal areas.

Management Indonesia's coastal defense is currently not optimal both in terms of infrastructure in supporting the economy and social life of the people. Maritime defense requires good management of sea and coastal areas (Sim, 2017). Integrated early detection by utilizing modern technology such as UAV and USV can provide advantages in coastal defense (Wu.et.al, 2023).

The Surabaya Western Access Channel is a very dense channel but has a narrow width and length. Erosion and sedimentation in coastal areas is very high so that it is detrimental to the economy and requires policies from stakeholders (Ballinger, 2017), (Dong, 2023). Sedimentation is affected by the very high activity of commercial ships and military vessels (Zuhri, et.al, 2019). Dense shipping traffic and ships anchored waiting for loading and unloading also result in ecological damage in coastal areas (Liu et al, 2021), (Philippe, 2023). The problems of rising sea levels and coastal erosion have a negative impact on the economy in coastal areas so that coastal defense is urgently needed (Xuan et.al. (2022), (Dong, 2023).

The current condition of SWAC governance is not optimal and can pose a threat to the sustainability of national resilience. Shipping governance policies, shipping safety, ecological systems and the welfare of coastal communities as well as defense and security systems require management planning policies that are proactive and oriented towards national development (Evans et al, 2017). This paper aims to analyze the factors that influence the management of coastal defense which creates national resilience through literature review of existing references.

2. MATERIALS/METHODOLOGY ;EXPERIMENTAL PROCEDURE.

2.1. Size of datasets

This research was carried out in SWAC Waters (figure 1) because it is one of the shipping lanes in Indonesia which is narrow, shallow, has lots of underwater cables and pipes. SWAC was chosen because it has a relatively narrow channel compared to other large ports facing the open sea. SWAC has a length of 25 Nm, a maximum width of 2200 m at the ninegan, a minimum width of 100 m at bouy 2 and 7, there are many unresolved problems that require a review of the research that has been carried out as material for making a decision.

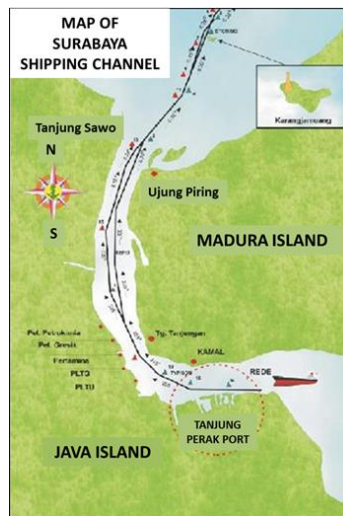


Figure 1. SWAC Flow

2.2. Methods

This study uses a review from several trending articles and research focus on coastal management. The method used is Biometric and literature review using Vosviewer software. The link used to search for data is the ScienceDirect website. Articles were analyzed based on abstract, keywords, year and publisher. Bibliometric studies use mathematical and statistical methods for books, articles and other information media (Jena, 2012). The purpose of this study is to analyze and study the map of the development of literature in a science. VOSViewer is software for creating, exploring and visualizing metadata network maps and then visualizing them (Van Eck NJ., Waltman L., 2002).

Article collection was searched from 2010 to 2023. Article data search techniques used the keyword coastal defense and management based on the title word category. Then the article data that meets these criteria is downloaded, then exported using the RIS format (Research Information System). After importing into the VOSViewer algorithm software (Visualization of Similarities). This is done to find out bibliometric maps and trends in scientific publications regarding coastal management in the world over the past 10 years. Furthermore, by using a literature review, the results of the VOSViewer software analysis will describe the distribution of research topics, the number of studies and identify research gaps that need to be filled/completed around coastal management

3. RESULT AND DISCUSSION.

Research article results on the ScienceDirect Website are divided into 6 clusters as follows:

- a. Cluster 1 consists of 22 topics, adaptive governance, adaptive management, agriculture, aquaculture, biodiversity, conservation, coral reefs, ecosystem services, ecosystem-based management, environmental management, eutrophication, fisheries, fisheries management, governance, management, mangroves, marine protected areas, marine spatial planning, policy, salt marshes, seagrass, stakeholders, sustainability
- b. Cluster 2 consists of 16 topics, namely Beach, beach management, coastal defense, coastal dunes, coastal ecosystems, coastal erosion, coastal management, coastal protection, managed realignment, nature-based solutions, protected areas, restoration, salt marsh, sediment transport, tourism, vegetation, wetlands

- c. Cluster 3 consists of 16 topics, Bioaccumulation, biomarkers, coast, coastal, coastal wetlands, estuaries, estuary, fish, heavy metals, mangroves, marine, oxidative stress, pollution, remote sensing, salinity, sediment
- d. Cluster 4 consists of 16 topics, Adaptation, climate adaptation, climate change, coastal engineering, coastal hazards, coastal zone, coastal zone management, ecological engineering, flood risk management, flooding, integrated coastal zone management.
- e. Cluster 5 consists of 14 topics, climate change adaptation, cost-benefit analysis, disaster risk reduction, exposure, flood, flood risk, hazard, natural hazards, resilience, risk, risk assessment, risk management, tsunami, vulnerability.
- f. Cluster 6 consists of 10 topics, coastal adaptation, coastal flooding, erosion, gis, lidar, mitigation, monitoring, sea level rise, shoreline change, storm surge.

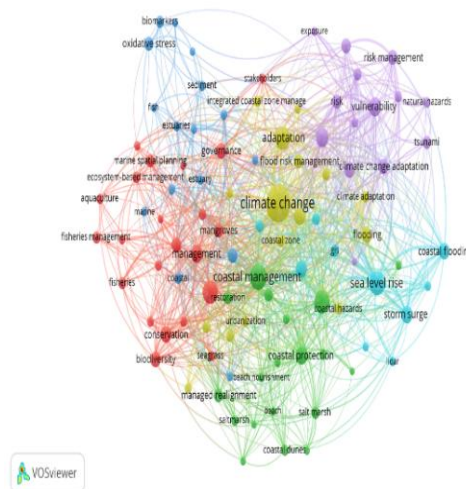


Figure 2. Network visualization of coastal defense management.

In Cluster 1 the word that stands out is ecosystem service where the article discussed is about how the government's policy on coastal defense management has damaged ecosystems. According to Cooper, et.al. 2022 entitled Coastal defenses versus coastal ecosystems: A regional appraisal Government policies in defending the coast for the benefit of humanity have resulted in the destruction of ecosystems on the Irish coast. The method used is using a GIS application with a scale of 1: 10,000 to map ecosystem damage due to coastal defense development. Build sea walls to prevent beach erosion, Groyne to trap beach sand, Sloping stone walls to hold waves against the beach.

According to Jacob et.al. 2021 with the title "Not just an engineering problem: The role of knowledge and understanding of ecosystem services for adaptive management of coastal erosion". In the article it is explained that ecosystems in coastal areas provide important services for humans such as increasing fish productivity, carbon storage and reducing sea wave energy and protecting land from climate change, coastal erosion and sea level rise. The method of analysis is using the Ecosystem Service application which evaluates stakeholder policies from a management perspective that can adapt to the socio-cultural and ecological dimensions of Quebec waters. The research samples were ecosystem areas around Quebec waters, namely beaches, eelgrass, tidal marshes (tidal swamps). The pattern of adaptive management government has a positive impact on the socio-ecological system in Quebec waters

In cluster 2 the dominant keywords are coastal erosion and coastal protection where many articles discuss how the management of coastal defense is focused on preventing erosion due to seawater and protecting coastal areas. According to Peter Bacopoulos, Ralph R. Clark (2021) with an article entitled Coastal erosion and structural damage due to four consecutive-year major hurricanes: Beach projects afford resilience and coastal protection. This research examines the analysis of coastal erosion and the impact of structural damage for 4 consecutive years on the Florida Coast. The research method is to use quantitative analysis of wind stress temporal assessment to identify the level of resilience and protection of the coast from various methods of coastal construction and coastal management programs in the face of

the impact of large storms. The results demonstrated a coherent relationship between observed peak storm tides and surveyed measures of coastal erosion and structural damage. From a socio-economic standpoint, Beach management projects by placing sand dunes are able to provide protection and become an embankment from mitigating damage to beach property and infrastructure. Other benefits are that it can be used as a tourism destination, protection of coastal populations and weak infrastructure, and being able to protect coastal erosion and damage caused by tropical cyclone storms.

The next article was written by Tussadiah, et.al (2021) with the title: Assessment of coastal ecosystem services and its conditions for policy management plans in East Nusa Tenggara, Indonesia. This research discusses the ecosystem service management framework and natural potential in the coastal areas of NTT. The research objective is to analyze the application of the InVEST (Integrated Valuation of Ecosystem Services and Trade-offs) model in assessing the spatial distribution of ecosystem services for coastal protection and tourism in all coastal districts in the province of NTT. The results of research on the coastal areas of West Manggarai and West Sumba have high ecosystem services but low coastal protection and tourism services. NTT coastal management requires stakeholder policies that consider ecological aspects,

In cluster 3 the dominant keyword is remote sensing which relates to coastal and ecosystem management issues in coastal areas. Article written by Wu, et.al. (2022) entitled Increasing fragmentation and squeezing of coastal wetlands: Status, drivers, and sustainable protection from the perspective of remote sensing is relevant research. This study examines the wetlands in the coastal region of Fujian which have great ecological and economic value but are currently experiencing degradation and major losses due to human activities. The research method is to use an algorithm based on periodic tides and time series indices to map the status and trends of events on the Fujian coast from 1994 to 2018. The results of the research show that the wetlands consisting of tidal land and swamps have suffered a lot of damage due to reclamation, dredged and converted into inland areas for cultivation, ports and settlements. This damage causes the defense of sustainable coastal areas to be weak but has a positive impact on economic development.

Next is an article written by Ahmed, et.al. (2018) entitled Where is the coast? Monitoring coastal land dynamics in Bangladesh: An integrated management approach using GIS and remote sensing techniques. The focus of this research is to examine the level of erosion in the coastal areas of Bangladesh. The research method uses the use of GIS and remote sensing techniques to map erosion that occurred from 1985 to 2015. The results show that the erosion rate in the western and eastern zones is very severe. The recommendation put forward is that stakeholders must carry out policies related to rehabilitation and resettlement in the management of the western and eastern coastal zones of Bangladesh.

In Cluster 4 the dominant keywords are Climate change where articles discuss how climate change can impact sea level rise, flooding, management of coastal areas and so on. An article written by Techera (2023) entitled The intersection of marine and coastal conservation and nature-based solutions to climate change: Governance insights from Indian Ocean small island States also discusses coastal environmental problems caused by climate change, global warming and damage to natural resources. living nature. The research method used is the analysis of exploration assessment of natural-based solutions (NbS) and measurements from Nationally Determined Contribution Documents (NDCs) on the basis of the Paris Agreement.

The next article is Robert, et.al (2023), entitled *Erritorial inertia versus adaptation to climate change. When local authorities discuss coastal management in a French Mediterranean region.* In this study discusses critical issues caused by climate change such as erosion, rising sea levels and tidal flooding from the sea in the French Alpes region. This area is a well-known tourism sector so that it is one of the economic supports in the Alpes Province. The research method is qualitative by interviewing stakeholders who deal with adaptation of the Alpes coast to climate change. Stakeholder research results seek to adapt to the impacts of climate change and highlight the attractiveness of tourism as the foundation of the economy. The problems of erosion, rising sea levels and flooding are the focus of the government to maintain tourism in the area as a support for the economy.

In Cluster 5 the dominant keyword is resilience where the article discussed is how the resilience of coastal areas to climate change, rising sea levels, risks and stakeholders. Article written Bianco and Salvador. (2021) entitled Coastal resilience potential as an indicator of social and morphological

vulnerability to beach management focusing on coastal resilience in San Vincenzo, Italy. This research discusses how coastal resilience strategies from the aspects of morphology, economic trends, sediment and erosion affect human life in coastal areas. The research method used is quantitative research based on ISMV (Social and Morphological Vulnerability Index), ISC (Index of Service's Cost) and CRI (Coastal Regeneration Index). The results of the study show that the ISMV approach is quite successful in determining government policies in increasing coastal ecosystem conservation. From ISC analysis, the strategy implemented by the government is not effective in supporting coastal resilience.

The next relevant article on Cluster 5 is Arkhurst, et.al (2022) entitled "Perception on coastal erosion: An assessment of how national level resilience strategies promote indigenous knowledge and affect local level adaptation in Ghanaian communities". This research discusses coastal resilience strategies in managing the impact of earthquakes and climate change pressures that disrupt coastal areas globally. The research method uses qualitative by conducting interviews and FGDs with fishermen, residents and the government about 51 coastal areas affected by erosion in Ghana. The results of the research require innovation in an integrated coastal resilience strategy between people who depend on the sea and the government in developing coastal management strategies that can adapt to climate change and social life.

Whereas in Cluster 6 the dominant keyword is sea level rise where the article discussed is sea level rise on the resilience of coastal areas. The relevant article is research conducted by Rocha, et.al (2023) entitled *Coastal indices to assess sea-level rise impacts - A brief review of the last decade*. In this study discusses the vulnerability of coastal areas caused by rising sea levels. The method used is qualitative by studying 37 relevant studies of the concepts, methods, parameters and indices used by considering the time and space scale for coastal operations. The results of the study found that most of the research used the help of the CVI index but only discussed the economy and did not discuss the impact of economic activity on the coast. Rocha further said that there is no proper method for assessing risk factors in the management of coastal areas and their threats to the social life of the people living in the area.

4. CONCLUSION.

Based on the bibliometric analysis, the dominant themes discussed in each cluster are ecosystem services, sea level rise, climate change and coastal management. These four keywords have a close relationship with the management of coastal defense. To get optimal management of coastal defense requires synergy between stakeholders who have authority over these four aspects and contribute to integrated and sustainable maritime national development. From the ecosystem service aspect, active participation from the government, ecosystem users and the socio-cultural environment around the area is needed. Because the maintenance of ecosystems in coastal areas will be able to provide great benefits from an economic point of view, so that it requires professional management and involves all stakeholders. From the aspect of sea level rise and climate change is to provide awareness of the possibility of a disaster that can harm national security. With good marine spatial planning, Indonesia will become a World Maritime Axis. From the aspect of coastal management, it requires a management system consisting of planning, utilization, supervision and control of coastal resources in a sustainable manner which integrates the government, maritime business, fishing communities and stakeholders related to the maritime sector. However, from all the research and aspects discussed, only a few discuss the role of defense and security in the management of coastal defense. The defense and security aspects must also be integrated with other indicators such as ecological, economic, socio-cultural,

The coastal defense management policy model based on the literature review is that it must involve government intervention in shipping management, shipping safety management, ecological system governance and community social life as well as defense and security system governance in the framework of supporting national resilience.

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