

INVESTIGATING SUSTAINABLE COMMUNICATION STRATEGIES FOR MANAGING COASTAL EROSION AMONG THE TERENGGANU COASTAL COMMUNITIES, MALAYSIA

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Abstract: The goal of sustainable development is to protect the environment and its ecosystem while relying on the economy to create a stronger society. In order to effectively ensure sustainable development in an environmental setting, community engagement in decision-making is essential. Hence, this study investigates the communication channels used by the communities in the Kuala Nerus region in Terengganu, Malaysia, who have been severely affected by coastal erosion. This multidisciplinary research uses geographic approaches, such as the Digital Shoreline Analysis System, as well as Laswell's Communication Model, to explore the coastal erosion issue, including its impact on the local community. Qualitative methods, including interviews and observations, were employed alongside a simple random sampling procedure to gather information. The findings underscore the vital role of effective communication in conveying erosion-related issues to relevant authorities. Understanding the communication channels used by the community is crucial for fostering collaboration between residents, experts, and decision-makers. This study reveals that the community employs various communication avenues, including village committees, newspapers, and social media, to voice their concerns. This study can guide coastal management strategies that involve stakeholders and communities in addressing coastal erosion challenges.

Keywords: Communication channels, community involvement, monsoon, stakeholders, South China Sea.

Introduction

Communication is a critical tool for disseminating information, and effective communication occurs when the receiver acts accordingly and responds to the information given. Environmental communication, on the other hand, encompasses the exchange of information, knowledge, definitions, shared perspectives, and actions related to environmental problems and wisdom pertaining to environmental issues. (Basto & Centemeri, 2014; Dreher & Voyer, 2015; Harris, 2017; Carvalho *et al.*, 2017). In this context, communication plays a critical role in the community's ability to manage how they distribute, receive, understand, and use messages related to human interactions with the

environment. Effective communication can only be successful if the recipients act accordingly. Therefore, ensuring that the community effectively communicates and receives accurate information concerning environmental issues, such as erosion, is crucial.

Erosion is a global issue that can be attributed to both natural and anthropogenic factors, posing risks to coastal populations (Gomez *et al.*, 2020). Coastal areas serve as a buffer zone between land and ocean, providing space for economic activities. However, environmental changes (Ratnayake *et al.*, 2017; 2018; Yaacob *et al.*, 2018) have had adverse effects on coastal areas, leading to historical social-environmental

changes (Kabir *et al.*, 2016; Vousdoukas *et al.*, 2020). Malaysia shares a similar challenge, with its coastal areas undergoing coastal development influenced by natural and anthropogenic factors (Asmawi & Ibrahim, 2013; Hassan & Rahmat, 2016).

In this situation, extensive agricultural land adjacent to coastal zones have been severely affected by erosion (Ariffin *et al.*, 2018). Scholars have classified erosion into three categories based on a national coastal erosion study, commissioned by the Economic Planning Unit of 1985, and is shown in Table 1.

The categories can serve as guidelines for policymakers in Malaysia to determine which areas need significant mitigation efforts, especially in proximity to residential and urbanised communities. Coastal erosion can pose a threat to the coastal structure if not properly managed (Rangel-Buitrago *et al.*, 2018; Ratnayake, *et al.*, 2018; 2022). However, there have been numerous unsuccessful projects along the coast involving the implementation of coastal structures (Charlier *et al.*, 2005; Elsayed & Mahmoud, 2007; Rangel-Buitrago *et al.*, 2015; Zulfakar *et al.*, 2020; Sanitwong-Na-Ayutthaya *et al.*, 2022; Dong *et al.*, 2023; Saengsupavanich *et al.*, 2023).

Despite several studies on coastal erosion, including those by Awang *et al.* (2019), Jarmalavičius *et al.* (2016), and Yin *et al.* (2018), this study focuses solely on people’s perceptions of the environmental problem and scientific research. Other studies have addressed how communication can tackle coastal erosion issues

and benefit coastal communities (Montero & Batista, 2020). These studies have explained how the top-down application of policies can hinder effective risk communication. Specifically, the problem of coastal erosion is not effectively communicated across governmental levels, highlighting the need for authorities to involve the public in solving the problem. Consultation with the local community should be a priority before undertaking coastal defence restoration, and authorities should address the lack of public input in policymaking.

Based on this statement, several studies have explored erosion issues from scientific perspectives and their impact on communities (Kasayanond *et al.*, 2019; Elfithri *et al.*, 2021). Meanwhile, other studies have focused on the community’s perception of erosion problems (Martins *et al.*, 2009; Basto & Centemeri, 2014; Bakti *et al.*, 2017; Harris, 2017; Mohamed Rashidi *et al.*, 2021). Unfortunately, there has been limited research on how communication can assist the community in addressing environmental issues. His study aims to fill this gap by investigating the communication channels used by communities to express their concerns about erosion, the assistance they can provide, and the impact of erosion on their economic and social life. In doing so, this study addresses the gap identified by Basto and Centemeri (2014) by focusing on the communication channels communities use to voice their concerns about erosion issues. Additionally, this study explores the collaboration between the community and authorities, shedding light on their concerns and anxiety regarding erosion issues.

Table 1: Three categories of coastal erosion

Category	Description
One	This category is considered critical erosion areas, where shore-based facilities and economic activities are in immediate and imminent danger.
Two	Significant erosion areas, where shore-based facilities and economic activities are expected to be endangered within 5 to 10 years if no remedial action is taken.
Three	Acceptable erosion areas are generally undeveloped, resulting in minor economic losses if coastal erosion continues.

Methodology

Shoreline Rates

To identify the erosion rate, a compilation of images from Google Earth and Landsat was obtained between 2010 and 2018. The study area in Kuala Nerus, Terengganu, encompassed Batu Rakit (BR), Pengkalan Maras (PM), Universiti Malaysia Terengganu (UMT), Tok Jembal (TJ) and Teluk Ketapang (TK) beaches. These areas are located near Sultan Mahmud Airport, Kuala Nerus, on the northern side of Terengganu state (Figure 1). The study area has been affected by severe erosion events since the expansion of the airport in 2010. Subsequently, various strategies to mitigate erosion have been implemented by Terengganu authorities (Ariffin *et al.*, 2018; 2019). However, despite these efforts, the area continued to experience changes in erosion rates and accretion between 2014 and 2018 (Ariffin *et al.*, 2018; Zulfakar *et al.*, 2021). Initially, the images from Google Earth were saved in JPEG format and were georeferenced to determine their spatial reference.

Simultaneously, Landsat images were retrieved from the United State Geological Survey (USGS) Landsat LandLook website, an open-source platform, and were saved in

GeoTIFF format. Both sets of images were then projected in UTM 48N. Subsequently, the images were digitised in ArcGIS 10.3 to capture the beach shorelines. This digitisation process was repeated until the entire shorelines were accurately collected. By using the ArcGIS extension and the Digital Shoreline Analysis System (DSAS), the shoreline change rate within the specified years can be determined, using the vegetation line as a reference for determining the erosion line (see Figure 1).

Figure 1 provides an overview of the study area, allowing for the observation of shoreline shifts over multiple years. Specifically, we examined two phases: the period from 2010 to 2014, which coincided with the airport construction, and the subsequent period from 2014 to 2018, following the completion of the airport construction and the implementation of various coastal defence structures. To calculate the End Point Rate (EPR) statistically, we divided the distance between the earliest and latest shorelines by the time interval, as depicted in Figure 2. Each transect has a 50-metre (m) interval. The results yield both positive (+) and negative (-) values, signifying accretion and erosion events, respectively.

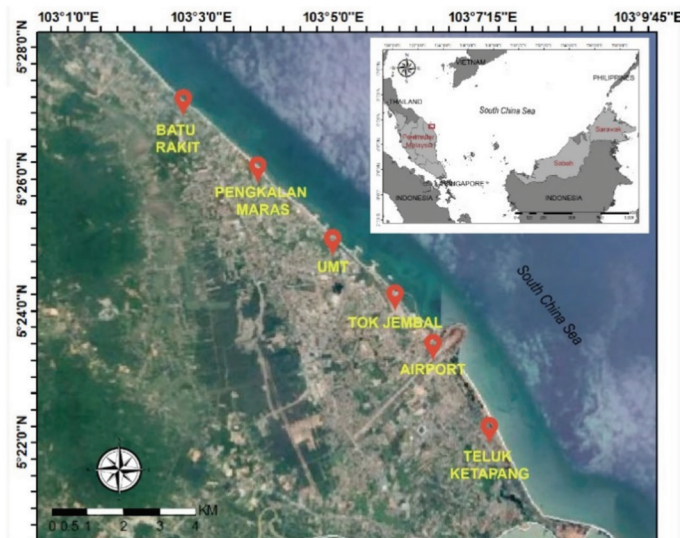


Figure 1: The study area from Batu Rakit until Teluk Ketapang, Terengganu

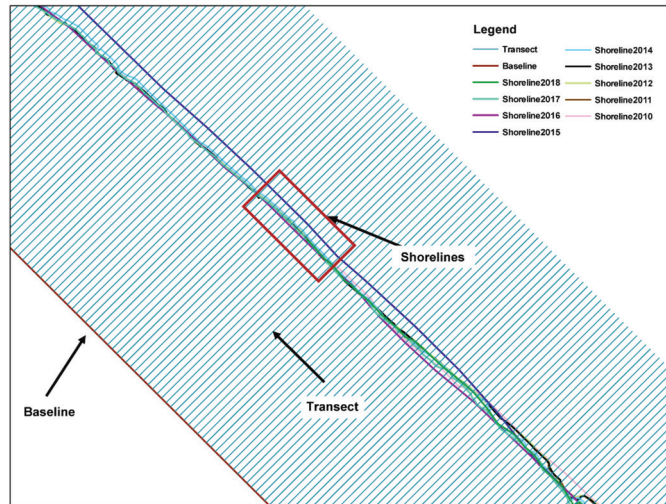


Figure 2: The inputs (shorelines, baseline, and transects) for EPR calculation

Semi-structured Interview

This study employed qualitative methods, including in-depth interviews with protocols containing structural questions, to identify coastal communities impacted by coastal erosion. In-person interviews took place in respondents' villages. The interview process followed several steps, beginning with scheduling appointments at a convenient time and date for the respondents (Akcem *et al.*, 2019; Sileyew, 2019; Deterding & Waters, 2021). In-depth interviews fundamentally provide more comprehensive information than other data collection methods, such as surveys. The personal rapport between the interviewer and respondents can generate more insightful responses, especially on sensitive topics. In this study, face-to-face interviews allowed for extensive probing and follow-up questions, contributing to a deeper understanding of attitudes, perceptions, motivations, and experiences. Additionally, the interviewer had the flexibility to revisit critical questions later in the interview, facilitating a comprehensive exploration of the respondents' insights. Qualitative methods often require a small number of respondents to gain critical and relevant insights because in-depth interviews have the potential to be significantly insightful, and valuable insights can be identified rapidly (Creswell & Creswell, 2017; Leavy, 2017). To safeguard the privacy and identity of

the respondents, pseudonyms were assigned. Pseudonyms are particularly useful in research involving sensitive or confidential topics, as they enable researchers to present findings without revealing participants' actual identities. In this study, respondents were identified using labels like "Respondent x" to maintain their anonymity.

Four respondents in this study were residents living around the coast of Pengkalan Maras and Tok Jembal, Terengganu. These areas are situated in the northern region, as shown in Figure 1, and exhibit a decreasing population density towards Batu Rakit. The selected respondents consisted of residents from Pengkalan Maras and Tok Jembal, areas directly affected by coastal erosion since 2013 (Muhammad *et al.*, 2016; Ariffin *et al.*, 2018). To ensure the legitimacy and reliability of the study, the transcripts of the interviews were shared with the respondents for their review and validation. Lastly, the interviews were transcribed, and the researchers thoroughly examined the transcripts to identify key categories. Informed consent forms were also provided to the respondents before conducting the interviews. The interviews were audio-recorded and transcribed verbatim, capturing all verbal information, including the Terengganu dialect. Later, these transcripts were translated into English. The interview agenda

revolved around key themes such as community livelihoods, communication regarding erosion issues, and community life.

The methodology employed in this study was established through literature review, following Lasswell's Communication Model. The five fundamental questions (5W) of "Who", "Says What", "In What Channel", "To Whom", and "With What Effect" are used by Lasswell's approach to assess communication. The key elements of the communication process are discussed in these queries. This model focuses on the communication process and how it affects society. There are three purposes for communication according to Lasswell, including environmental monitoring, societal component correlation, and generational cultural transmission. The message flow in a multiracial society with various audiences is suggested by the Lasswell model. The communication is transmitted through a number of channels (Singh, 2016).

From this model, we tailored the interview questions to ensure effective communication, keeping in mind the five fundamental information elements of 5W. Additionally, our approach was substantiated by relevant literature findings. Unlike several studies (Wenxiu, 2015; Abazari & Brojeni, 2017) that directly conduct interviews without incorporating these critical elements, this study's research method incorporated the 5W questions:

- Who are the communicators for the questions?
- What is said in the message for the questions?
- In Which channel is the medium in the questions?
- To Whom will the receiver be for the questions?
- What effect can be on the questions?

The literature review was conducted using three databases: Web of Science, ScienceDirect, and Google Scholar. Four terms were used for

the publication search, which are "environmental communication, qualitative study, AND erosion", "erosion AND communication", "channel of communication AND erosion problem", and "environment, communication, qualitative, AND erosion". Following the search, five articles were identified (Table 1) and used as references to formulate the interview questions for the study.

The data analysis in this study followed Braun and Clarke's (2006) theme analysis methodology. Two main frameworks guided the coding process: Community livelihoods and communication strategies related to erosion issues. This approach was chosen to provide a clear direction for the analysis and to offer a comprehensive exploration of themes pertaining to community livelihood and communication techniques regarding erosion issues. The analysis process consisted of two parts, the demographic information and the interview questions. A substantial amount of respondent data was collected and manually analysed using an inductive/data-driven approach (Braun & Clarke, 2006). Thematic analysis, a qualitative method for identifying, analysing, and reporting patterns in a data corpus, has proved successful in analysing qualitative data (Treiber & Jones, 2010; Barnieh *et al.*, 2014). Braun and Clarke (2006) argued that a theme will capture a significant portion of the data in a systematic way, regardless of whether it captures the experience of the majority. The data must first be gathered after being systematically annotated with intriguing qualities to develop themes. Before identifying specific themes, the researcher must divide the original codes into various subjects and gather all relevant data for each topic. Reviewing themes entails assessing their compatibility with the coded extracts and the entire data collection. The data was reviewed multiple times to increase familiarity and allow for the identification of some basic themes. Finally, when selecting exemplars, compelling examples that advance the subject and are related to the research issue must be selected (Peel, 2020). Lastly, a selection of strong and

persuading examples with context was made to support each subject.

The themes were further divided into three, as outlined below, each of which provided insights into the research question. They were

developed by drawing from previous studies and theoretical concepts. These concepts were categorised into two overarching themes: Environmental impacts and community pressures.

Table 2: The classification of the search results using the 5W elements is derived from the literature review

No.	Hits (Paper Topic)	Author (Year)	Environmental Impacts	Community Pressure
1	The impact of erosion on the coastal community	(Ariffin <i>et al.</i> , 2018)	Monsoon wave induces coastal erosion	Loss of residence
2	Community perception of coastal erosion	(Asmawi & Ibrahim, 2013)	The existence of coastal erosion issues occurring along the coastline, perception of the existence of coastal erosion in the area, their observation of living near the affected area, factors contributing to coastal erosion in the areas	The erosion process involves soil erosion and the redirection of runoff from various sources such as streets, parking lots, and roofs, which can deepen the nearshore area, disrupt littoral processes, and reflect wave energy onto adjacent shoreline area
3	The communication of the risk of coastal erosion from global and domestic perspectives	(Basto & Centemeri, 2014)	The limitations of communication in coastal erosion, the lack of trust in collective action, the experience of the erosion problem in their everyday lives, and the expectation for action from public authorities when dealing with the problem	The safety of the dwellers, loss of territory, general environmental issues, the profitability of business owners, loss of property/residence, reduced fishing area, and reduced tourism activity
4	Have you ever listened to coastal inhabitants? Know what they think	(Martins <i>et al.</i> , 2009)	The identification of coastal risks, social perception, coastal dynamics, territorial and environmental changes in coastal areas, socio-environmental conflicts, population possibility, capacity to adapt to areas further away from the sea, and the probability of occurrence of certain natural events in their area of residence	Loss of lands, loss of residence, morale damages, the feeling of security
5	The impact of social entrepreneurship on sustainable livelihood	(Halim <i>et al.</i> , 2017)	The experience of the problem in coastal communities	The coastal communities are concerned about the importance of social entrepreneurship that impacts their livelihood

The study also investigated the most effective communication channels used by the communities to express their concerns about erosion problems to the public and the authorities. The relevant parties included the fishermen's association, the village committee (Jawatankuasa Kemajuan dan Keselamatan Kampung, or JKKK), the Department of Irrigation and Drainage (DID), the state government, and Universiti Malaysia Terengganu. Face-to-face interviews were conducted to explore the issues experienced by the community. The findings from this study identified several themes related to coastal erosion and the role of communication in expressing their concern regarding the issue. These findings can be divided into three themes listed below:

- The causes and effects on life.
- The communication channels used.
- The actions of the responsible parties.

This paper discussed the causes and effects of erosion on the communities' lives and communication channels in articulating their anxiety.

Results and Discussion

This study emphasised the gravity of erosion's impact on the economic and social aspects of the respondents' lives. It also delved into the communities' capacity to mitigate erosion in their vicinity. Additionally, the study examined the extent of collaboration between the authorities and the communities in addressing erosion, with a particular focus on the authorities' willingness to incorporate the communities' input into erosion-related initiatives.

Causes and Effects on Life, Livelihood and Culture

The respondents' lives are economically and socially impacted by income loss due to their proximity to the beach. Gradual erosion, particularly during the monsoon season between November and January (Ariffin *et al.*, 2018), poses a threat as waves wash away their livelihoods. This situation significantly affects

villagers who earn their living from coffee shops or stalls selling fried bananas and fish products near the beach, as they can no longer utilise the same spots for leisure gatherings after fishing activities. Moreover, fishing boats face difficulties in landing due to the absence of a beach, replaced by large rocks (e.g., riprap/revetments) used as wave breakers to combat erosion.

A study found a similar economic effect on the community affected by the erosion (Basto & Centemeri, 2014; Hassan & Rahmat, 2016). The surfer community has asserted that changes in the wave patterns are contributing to coastal erosion, reducing the beach area and impacting nearby businesses. Additionally, the reduced availability of sand for beachgoers is diminishing the area's tourism value. This study's respondents, who belong to long-standing coastal communities, perceive that coastal erosion issues stem from uncontrolled coastal development. They also argue that the construction of a sea patch to expand the Sultan Mahmud Airport runway has significantly exacerbated coastal erosion, leading to the inundation of several coastal areas, including their residences. Consequently, residents live in a state of constant anxiety, particularly during the monsoon season. This sentiment is echoed by Respondent 1 (R1), Respondent 2 (R2), Respondent 3 (R3), and Respondent 4 (R4):

R1: *It affects my life. Many houses are endangered due to erosion.*

R2: *I'm worried about my safety.*

R3: *I think my security and that of the surrounding area are alarming.*

R4: *The alarming security factor did worry me.*

Based on the interviews, the primary concern expressed by the respondents relates to safety. Studies have revealed that people's homes were threatened by the lack of sand and flooding, which resulted in damage to their properties (Asmawi & Ibrahim, 2013; Basto & Centemeri, 2014). This predicament is further exacerbated by alterations to coastal areas and man-made structures. These factors have

played a significant role in coastal erosion, leading to changes in wave patterns through wave diffraction, while human interventions have gradually eroded the coastlines (Meilianda et al., 2019). Similar situations were observed in Pengkalan Maras and Tok Jembal. Notably, the significant impact of these factors can be quantified using DSAS to identify the scale of the erosions.

The result depicted the shoreline evolution between 2010 and 2018, with significant transformations primarily attributed to anthropogenic activities. The construction of the airport and coastal defence structures directly influenced natural coastal processes (Muhammad et al., 2016; Ariffin et al., 2018; Ariffin et al., 2019; Narashid et al., 2021; Zulfakar et al., 2021). According to Ariffin et al. (2018), the authorities implemented various mitigation plans, including revetments, breakwaters, and groynes. The EPR results between 2014 and 2018 revealed a shifting shoreline of approximately 10 metres in Batu Rakit and the more populated Pengkalan Maras. In contrast, the densely populated southern area was primarily affected by erosion. Additionally, it is notable that most of the Teluk Ketapang areas continue to experience accretion. These findings are supported by studies, which show that while some sites exhibit erosion from Tok

Jembal to the northern areas, others undergo accretion. Furthermore, coastal structures have been found to obstruct or trap sediment transport at certain locations (Muhammad et al., 2016; Ariffin et al., 2018; Ariffin et al., 2019).

Figure 3 presents two EPR graphs illustrating the erosion and accretion phenomena. For instance, the UMT and Tok Jembal areas were affected significantly based on the EPR between 2010 and 2014. Furthermore, over a five-year period (2010 to 2014), the extension of the airport runway near Tok Jembal beach resulted in a loss of approximately 25 metres of coastline, affecting the local residents. A similar pattern is observed at UMT beach, where more than 20 metres of shoreline eroded. In contrast, the airport area and Teluk Ketapang experienced a surplus of sediment. Through observation and data collection, these beaches gained approximately 120 metres of additional beach width.

The erosions have magnified the negative impacts on the coastal community, especially small-scale fishermen (Hassan & Rahmat, 2016; Freduah et al., 2017). In Terengganu, the primary occupation for fishermen involves using small boats to harvest limited fish resources. Unfortunately, the erosion of beach dunes during storms (Ariffin et al., 2019) can

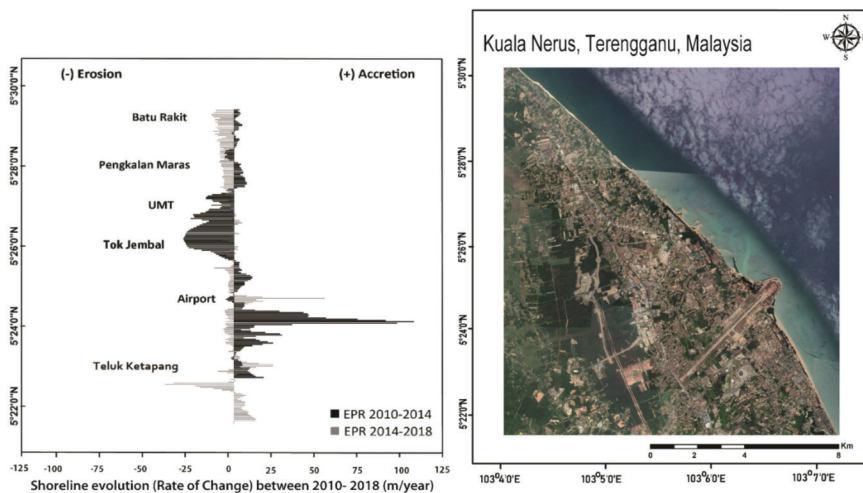


Figure 3: The EPR stretch from Batu Rakit to Teluk Ketapang during the shoreline evolution between 2010 and 2014, and between 2014 and 2018

disrupt coastal activities (Halim *et al.*, 2017). This situation has had far-reaching effects on their lives, compromising household safety, social interactions, and economic activities. For fishermen reliant on catching fish, coastal erosion has significantly reduced their catch. Respondents reported difficulties in landing their boats, compelling them to seek alternative beaches distant from their homes. Remarkably, these critical coastal areas also served as recreational spots after work and playgrounds for children. Based on these observations supported by interview surveys, it is evident that their social lives have been profoundly impacted.

Some interviewees emphasised how strongly the traditional way of life and fishing activities are related to the cultural identity of fishermen. A key aspect of the coastal community was defined as being interested in fishing, owning a boat, and living close to the sea (i.e. a sense of what it means to be a member of this cultural group). One respondent provided the following example:

R4: *We are unable to conduct our activities there due to the erosion. We normally hang out in that area, chilling out. We used to stay around at “kallang” after finishing our job, but this erosion has made that impossible now. Now, the land merged with the ocean!*

The respondents asserted that transitioning to a different livelihood makes it challenging to preserve one's cultural identity. For the beach-loving neighbourhood, a crucial symbol appears to be residents located close to the sea. The terms “kallang” or “pengkalan” refer to these bases where they commonly moor their boats, take breaks, and refuel. Here, people engage in everyday activities such as conversations and playing traditional games that gradually become integral aspects of the coastal community's culture. One respondent highlighted the profound connection between their home and the nearby sea:

R2: *We know that it is dangerous living next to the sea, especially with this erosion issue.*

However, this is where our forefathers lived, and I could never leave this land and live somewhere else.

These passages illustrate the profound integration of living by the sea into the collective identity of the interviewees and its crucial role in preserving their culture (Zal, 2016).

The evidence presented here suggests that there are strong social norms within the respondent communities, encouraging the idea of residing near the sea. Furthermore, it appears that there are established norms in their activities characterised by adaptability and low risk. One respondent encapsulated this by describing his children's perspective, who regarded fishing activities as high-risk:

R1: *One of my children will not follow in my footsteps as a fisherman due to the high risk and low income associated with this profession. I cannot imagine that there will be a future generation that would love to continue what I am doing now.*

This passage underscores the perception that traditional fishing is regarded as a high-risk activity, while the recent transition to tourism is seen as a low-risk endeavour with a high degree of environmental adaptability. This perspective aligns with previous research on ambiguity and risk aversion in coastal communities (Andriati, 2016; Perumal *et al.*, 2016; Zal, 2016; Sa'at *et al.*, 2017), suggesting that risk perceptions may lag behind the pace of environmental change. For instance, there may be an elevated risk of losing cultural values and traditional elements, such as the use of traditional boats, going unrecognised. Therefore, in order to enhance resilience, it may be necessary to adjust risk perceptions associated with both conventional and alternative livelihoods. This recommendation may hold relevance for cultures undergoing environmental or social transformations. There is evidence that such adjustments are taking place for some respondents. For example, some interviewees discussed their recent experiences with erosion and how it has altered their perspectives:

R3: *Due to the erosion, we somewhat needed to relocate our shop to somewhere safe. This could affect our income as well since customers may not be aware of our new location.*

For some respondents, this experience seemed to serve as a more powerful catalyst for change than the erosion itself. In terms of resilience, it shows that respondents might be less prepared or capable of reacting to slow-onset disturbances like erosion, but more willing and able to adapt to sudden shocks such as the loss of income due to erosion. This finding aligns with the notion that societies may demonstrate varying levels of resilience to each of these threats, depending on the adaptive pathways that are activated (Andriati, 2016; Perumal et al., 2016; Zal, 2016; Sa'at et al., 2017).

Overall, the cultural domain can be characterised as moderately resilient from the standpoint of the community, as it encompasses both cultural lock-ins and openness to adaptation and change. From the perspective of cultural dilemmas, the data indicate that prevailing group norms concerning culture, cultural values, and perceptions of risks associated with traditional and new lifestyles may pose challenges in resolving the common dilemma of erosion.

Communication Channel Used

The respondents explained that they employed various communication channels to express their dissatisfaction and concerns about the erosion issue. These channels include the fishermen's association, television (TV), and printed media. Furthermore, they utilised social media, such as Facebook, YouTube, and other forms of channels. The erosion at this specific location was reported by the media and the public through various communication outlets. Furthermore, numerous articles, videos, and stories about the issue were produced and authored by both media professionals and the public. Notably, the respondents mentioned that they raised their concerns to JKKK and voiced their complaints to the Terengganu chief minister.

Nevertheless, they presume that their voice and complaints have not received the appropriate attention, leaving them still waiting for the promised assistance. The erosion rate is progressively worsening, especially during the monsoon season (Ratnayake et al. 2019; Ismail et al., 2020; Shariful et al., 2020; Gunasinghe et al., 2021), which continues to affect their lives. Hence, they maintain a persistent eagerness to secure their future, safety, and economic stability, as expressed by the following respondents:

R1: *So far, no further action.*

R2: *We are still waiting for housing assistance from the state government.*

R3: *I think it is difficult to get help from higher-level authorities.*

This study concludes that the respondents have utilised the appropriate communication channels and have yet to receive adequate support from responsible parties in addressing coastal erosion. Nevertheless, communication involving various stakeholders played a crucial role in facilitating the process of communication in sustainable development. These stakeholders included the fishermen's association, JKKK in collaboration with DID, UMT researchers, and the state government. The findings suggest that Malay culture places significant emphasis on cooperation and consensus-building (Goddard, 2000; Omar, 2007; Suleiman & Maros, 2021). These cultural values can be harnessed to encourage open and facilitated discussions where diverse perspectives are not suppressed but acknowledged. Such discussions may contribute to stronger group identification and the development of collaborative solutions to the coastal erosion issue. These solutions may involve enhancing a sense of collective efficacy and promoting new norms and community self-monitoring systems.

The above steps require extra measures, underpinned by the development of a socio-psychological foundation for changes in cultural identity, community identification, and norms. These steps must be complemented by efforts in three additional directions:

- Support for education on processes and causes of erosion;
- Co-development of viable livelihood alternatives;
- Support for strengthening local governance.

The first step should foster a deeper understanding of the link between specific land-use practices and erosion, thereby generating motivation for change. In the second step, such change must be economically viable, and the third step involves collaboratively designing local institutions to support this transition. Achieving this ideal is an ambitious undertaking, necessitating a large-scale multidisciplinary intervention program. The study acknowledges the imperative for change, as exemplified by communities that provide ample evidence where such efforts could enable genuine and sustained transformation. Rahman (2018) concurred that involving the public in governmental decision-making can enhance public awareness of environmental issues, a crucial step in motivating society to collaborate on various activities, particularly those focusing on environmental issues.

It is challenging to recommend a truly viable and efficient channel of communication during a crisis as each situation demands a unique approach. To ensure the effective implementation of communication tactics during a crisis, whether it is a health crisis like COVID-19 or environmental issues, a study by Kim and Kreps (2020) can be used as a guideline. The communication strategies outlined in their study promote the dissemination of relevant, accurate, and sensitive information to key public groups while minimising communication noise to facilitate coordinated actions. They advocate the use of systems theory to ensure the effective delivery of communication during crises. Furthermore, they suggest that these communication strategies can be applied at the local, national, and even international level.

The Actions of the Responsible Parties

As the primary stakeholder, the government, through DID, oversees erosion issues in Malaysia (Kaur, 2021). In ad-hoc mitigation efforts, DID typically deploys ripraps to temporarily protect beaches near residential areas from erosion. However, the state government lacks the financial resources to address the displacement caused by coastal erosion, as the federal authorities, specifically the DID agency, are responsible for follow-up actions. Consequently, the state government must explore alternative solutions, such as providing temporary housing for individuals who have lost their properties during the ad-hoc process.

In an effort to mitigate coastal erosion, the DID and state government allocated approximately RM100 million secured from state and federal sources for affected beaches. In Tok Jembal, a beach nourishment program originally proposed the construction of four series of breakwaters and one groyne. However, due to tight timelines, only three breakwaters and a groyne were completed by the DID (Ariffin *et al.*, 2019). Additionally, the state government built a lee groyne in Tok Jembal, creating a lagoon that facilitates efficient docking of fishing boats and offers more systematic planning for fishermen's use (Figure 4). This issue of erosion was brought to the government's attention by the fishing community through various communication channels, including formal and informal methods such as social media, mass media, and face-to-face meetings. The government acknowledged their concerns. The mitigation plan has the potential to rejuvenate the beaches, significantly improving the coastal community's livelihood. This is especially critical for fishermen, enabling them to station their boats by the beach dunes after fishing. Communication between communities and stakeholders is imperative to provide solutions for a more sustainable coastline.



Figure 4: The type of coastal defence in a mitigation plan by DID and the state government with the selected coastal segments' aerial views

Source: Retrieved from Google Earth (earth.google.com/web/)

Conclusion

In conclusion, this study revealed that officials made various efforts during face-to-face discussions with the affected communities. However, the process of overhaul and maintenance entails a substantial cost and a relatively lengthy period. This has led to frustration within the local community, who understandably expect prompt resolution of their problems. The efforts undertaken include immediate financial assistance provided by the state government to families whose homes were damaged, including those who lost their livelihoods due to the waves sweeping away their business premises. Additionally, DID constructed breakwaters at identified locations to mitigate erosion in community-driven areas. Simultaneously, the state government developed lagoons for docking fishing boats. Furthermore, UMT collaborated closely with DID and the state government, providing accommodation to victims, especially those who lost their homes and were affected by the erosion.

Coastal community with access to social media display high levels of awareness. Surprisingly, the communication has been a challenge, especially in communities vulnerable

to environmental hazards. Uncertainty, trust, and credibility have revealed conflicting sentiments between the community and experts. This illustrates that, despite the community's awareness of its hazards, there is a perception that experts are not putting forth sufficient effort regarding what matters to them. Community members believe that the decision-making process regarding erosion issues in their areas did not adequately consider expert advice. While experts did their best to provide recommendations to the involved government bodies, they were not directly involved in the final decision-making process on erosion matters. Therefore, active participation and engagement of the community in addressing this issue are crucial and urgently needed to mitigate the erosion problem.

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