

INNOVATION AND GOVERNANCE IN SHIPPING: THE SAFETY NAVIGATION INFORMATION SYSTEM (SIKAPAL) MODEL AND SAFETY MITIGATION SYSTEM IN SUMENEP REGENCY

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Abstract

Sumenep Regency has 126 islands within its territory, divided into 19 sub-districts on the mainland and 8 sub-districts in the marine or island areas. In the past five years, the rate of maritime accidents in Sumenep Regency has been relatively high, with a history of shipwreck incidents. The government needs to offer appropriate solutions to address these naval accidents. An innovation from the government concerning the issues in Sumenep Regency is creating the SiKaPal program (Maritime Safety System) as a tangible form of the government's concern for Sumenep Regency. This study aims to understand the maritime safety mitigation system and explain the SiKaPal model as an innovation in the governance of marine safety. This research uses a descriptive qualitative method with data collection and analysis conducted through primary data obtained from interviews with key ship informants regarding the implementation of security management operations that have been carried out so far, including the obstacles encountered in the implementation of SiKaPal. The Sumenep Regency government, through the Communication and Information Agency (Diskominfo), initiated SiKaPal (Maritime Safety System) to address the occupational safety issues of fishermen in Sumenep Regency. Maritime safety innovation has become a solution and an answer to the existing problems. SiKaPal (Maritime Safety System) is the only innovation that uses AIS (Automatic Identification System) and is available only in Sumenep Regency. Governance innovation can enhance the capacity of public sector innovation because it is often seen as an alternative rather than a complement. The integration of the SiKaPal system and safety mitigation measures serves as an innovation model for more effective ship safety management.

Keywords: Service Innovation, Governance, SiKapal System, Mitigation, Fishermen of Sumenep Regency

1. Introduction

Sumenep Regency has 126 islands within its territory, divided into 19 sub-districts on land and 8 sub-districts on the sea (Sumenep et al., 2015). They are spread out into a cluster of inhabited islands (48 islands) and uninhabited islands (78 islands). The northernmost island is Karamian Island, located in Masalembu District, approximately ±151 nautical miles from Kaliangget Port. The easternmost island is Sakala Island, approximately ±165 nautical miles from Kaliangget Port. Geographical Position: Sumenep Regency is located between 113° 32' - 116° 16' East Longitude and 4° 55' - 7° 24' South Latitude. Therefore, it can also be called an island regency, which still has a lot of homework to complete by the Sumenep regency government.



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As an archipelago, Sumenep Regency naturally has a population that works as fishermen (Sumenep et al., 2015). Due to its location as an archipelago, most residents depend on the sea for their livelihoods (Eha, 2024). According to the East Java Provincial Maritime Affairs and Fisheries Service, in 2019, there were 40,167 fishermen spread across Sumenep Regency (Collins et al., 2021). This data indicates that many residents of Sumenep Regency work as fishermen (Latief, 2021). The large number of fishermen in Sumenep Regency also makes it a challenge for the Sumenep Regency government to continue fulfilling their rights. Maritime safety is a key issue under the Sumenep Regency government's purview.

Denhardt stated that the orientation of public service is focused on the safety of fishermen whose livelihood depends on their fish catches as a way to help meet their daily basic needs (Cunha et al., 2025). Through the SiKapal management, the Sumenep government believes that there is a service reform that supports citizen safety by allowing them to be aware early in mitigation of maritime accidents. The new service, with a more flexible and adaptive system involving the community in its implementation, will facilitate the government's work in achieving more optimal service and governance.

Recognizing this, the Sumenep Regency government understood that this issue needed serious study, resulting in a public service innovation initiated by the regency government. This is because shipping safety is crucial and central to all aspects of the shipping world (Mursidi, 2023). According to data from the Regional Communications and Information Agency, Sumenep Regency's geographical area comprises 30% land and 70% sea. Our problem is that emergency rescue at sea is suboptimal and takes time. In 2022, Sumenep Regency had a history of maritime accidents, including an accident involving a fuel tanker in the Sepudi area, a passenger ship (KMP) in Sapeken, the KLM Anugerah in Arjasa, the Fajar Nusantara in Sepudi, and the KLM Arta Jaya in Masalembu (Afifuddin, 2023). And considering the unpredictable sea conditions and the difficulty of accessing fishermen involved in accidents, the massive maritime accidents in Sumenep Regency, along with the recent global sinking of the Tampomas ship in Masalembu waters, are also indicators of the gigantic marine accident rate in Sumenep Regency.

Based on initial observations, maritime accidents remain high, as evidenced by frequent news reports reported by (Detik Jatim, 2024) about fishermen who go missing in maritime accidents in Sumenep Regency because their boats were struck by passenger ships, and similar incidents occur every year (Muhamad et al., 2025). This is further exacerbated by unpredictable sea conditions and the difficulty in accessing fishermen who experience accidents.

The government's innovation in response to issues occurring in Sumenep Regency has led to the creation of the SiKaPal (Maritime Safety System) program, a tangible manifestation of the Sumenep Regency government's concern. It has even received a top 45 award for public service innovation at the national level. This system also received two awards from the 2023 APDI (Indonesian Regional Government Appreciation) Awards: the Satya Lencana Wirakarya Award 2023, and the Madura Award 2023 (Menteri PANRB, n.d.). Ship governance has a direct and highly significant positive impact on maritime safety performance. If transportation governance, such as transparency, accountability, independence, and fairness, is well-established, this can impact performance improvements in marine security (Jackson & Lasse, 2020). This technology-based service system requires shared responsibility. As a new service focused on aquatic safety, it certainly requires the involvement of all parties to minimize



problems in its implementation, for example, in terms of the financial strength for the acquisition of the SiKapal system. Through the 112 Call Center, Sumenep has innovated a device that can receive information sent by ship, making it helpful in mitigating maritime accidents (Manap, 2020). This system, which is still ineffective and inefficient in addressing naval safety, has been transformed into SiKaPal (Maritime Safety System), a more solution-oriented system for addressing naval safety issues.

Seeing the effectiveness and efficiency of SiKaPal's operational use, the Sumenep Regency government, through the Communications and Information Office, has added 50 SiKaPal units to boat or vessel owners in 12 sub-districts: Sapeken, Raas, Nonggunong, Gayam, Giligenting, Pasongsongan, Arjasa, Kangayan, Dungkek, Bluto, Batang-batang, and Ambunten. Therefore, researchers are interested in researching how the SIKAPAL (Maritime Safety System) Model can mitigate maritime safety in Sumenep Regency. Maritime safety determines shipping safety and is the most crucial aspect to consider because it concerns human safety and lives. This is evidenced by previous research, such as the study on implementing K3 (Lumadja et al., 2024), which is still not representative and provides solutions when applied to island regions like Sumenep Regency. Maritime safety is a crucial aspect of the marine industry, which continues to develop along with technological advances (Mursidi & Sarjito, 2024). Maritime safety is vital for the government to fulfill, especially as a service provider obligated to provide a sense of security for its citizens who come into contact with the sea or shipping (Natsir, 2025). Therefore, the government is required to innovate to provide the best possible service. This also refers to and implements Regulation No. 21 of 2015 of the Minister of Transportation of the Republic of Indonesia concerning Maritime Safety Standards (Zhang et al., 2020).

2. Methods

This study uses a qualitative descriptive approach with an empirical case study design, supported by a literature review and normative analysis. Primary data were obtained through in-depth interviews with fishermen, government officials, and system managers, while secondary data were collected from accident reports, policy documents, and media sources. Data were analyzed using the interactive model of Miles, Huberman & Saldaña (2019) (data reduction, data display, and conclusion drawing). In addition, normative analysis was used to examine maritime safety regulations (e.g., Minister of Marine Affairs and Fisheries Regulation No. 21/PERMEN-KP of 2015).

3. Results and Discussion

a) Shipping work safety mitigation system

SiKaPal (Sailing Security System) launched on September 23, 2024 (ANTARA, 2024), a maritime safety mitigation system is crucial for the government as a service provider (Astinayanti et al., 2024). Mitigation innovation in preventing maritime accident rates has become important for the government to address; here are examples of accidents in several areas of Sumenep and other regions in Indonesia. The table below shows maritime accident cases in the Sumenep area and maritime accidents in several different regions in Indonesia.



Table 1.
Example of maritime accident cases that occurred in the territory of Indonesia

Region	Indicator (year)	Number	News source
Sumenep (in the working area of the Surabaya Tax Office)	case (2019)	example 17 cases	The KM Arim Jaya (Dungkek) tragedy; the issue of disorderly manifest.
	case (2023)	example -	KLM Putri Kuning collided with the rig; search for the crew of KM Vision Global (Des 2023).
	case (2024)	example -	The Sinar Marlena ship sank (Batang-Batang). (Kapal & Hilang, 2025)
Kendari (Sultra)	SAR 'ship accident' (2023)	operation 43 cases	KPP Release Kendari/ANTARA.
Natuna (Kepri)	SAR 'ship accident' (2023)	operation 15 cases	KPP Release Natuna/ANTARA.
Bangka Belitung	SAR 'ship accident' (2023)	operation 8 cases	KPP Release Babel/RRI.
Manokwari (Papua Barat)	SAR 'ship accident' (2023)	operation 11 cases	Rilis Manokwari/ANTARA/VOI. KPP

Source: processed by researchers, 2025

The secondary data in the table above comes from social media, collected from news about maritime accident cases in the Sumenep and Surabaya regions and other areas in Indonesia (Murni & Buka, 2025). As an archipelagic region, Sumenep Regency also requires such a system to meet the needs of its community (Yanto & Aprilian, 2023). The majority of the population of Sumenep Regency, who are fishermen, impacts the number of maritime accidents (Firmansyah et al., 2024). Therefore, a mitigation system is needed to ensure the safety of many fishermen in Sumenep Regency (Yanto & Aprilian, 2023).

The history of maritime accidents experienced by fishermen in Sumenep Regency, such as those involving a fuel oil carrier in Sepudi, a passenger motor vessel (KMP) in Sapeken, the KLM Anugerah in Arjasa, the Fajar Nusantara motor vessel in Sepudi, and the KLM Arta Jaya in Masalembu (Afifuddin, 2025), prompted the Sumenep Regency government, through the Communication and Information Office (Diskominfo), to launch SiKaPal (Naval Safety System), which addresses the maritime safety issues of fishermen in Sumenep Regency (Tamim & Ismail, 2020). The table below shows the accident numbers collected by the researchers:



Table 2. before and after the SiKapal system was implemented

Before Accident				After Accident			
Year	Number	Type	location	Year	Number	Type	location
2022	5	the accident of the fuel oil transport ship	Sapeken Island			Accident of the Motor Sailing Ship (KLM)	Arjasa Island
–				2025	2		
2023		Passenger Motor Ship	Sapeken Island			Sampurna	
		ship accident (KLM)	Arjasa Island			The large motorboat	Raas Island
		anugera				is on fire.	
		motorboat	Sapudi Island				
		Fajar (KM)					
		Fajar					
		Nusantara					
		Ship (KLM)	Masalembu				
		Arta Jaya	Island				
2024	2	Fishing boat	Gili Iyang				
		Fishing boat	Legung				

Source: Secondary Data from DISKOMINFO Sumenep October 2025

The findings above indicate the success of the SiKapal system as an effort by the Sumenep Regency government to detect and address maritime accident issues early on. Comparing the periods before and after the implementation of SiKapal shows the achievement of services oriented towards the safety of fishermen or users of sea transport services in Sumenep Regency. This is also supported by primary data processed by the researcher in the table below.

Table 3. Results of interviews at the research location

No	Findings	Field data collection	Preliminary Analysis
1	Perceived benefits of innovation	"Using SiKapal is faster; previously, processing permits could take two days, now it is completed in just one hour." – (Informant P1, Port Officer. Sumenep, September 9, 2025)	Innovation is considered to provide a relative advantage according to Rogers' (2003) concept.
2	Fishermen's initial understanding of SiKapal	"At first we didn't know about SiKapal, we thought it was just a regular app, but after the training we realized that it could help prevent accidents." (FK	The initial level of awareness is low, so intensive socialization is needed to increase



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No	Findings	Field data collection	Preliminary Analysis
3	Easy to use	Informant, Fisherman of Arjasa Village, Sumenep, September 9, 2025 When the signal is not good, especially on small islands, the application often cannot be opened (Informant LT, Fisherman of Kangayan Village, Sumenep, September 9, 2025)	the perception of benefits. Technological barriers become a factor of resistance to adoption in the SiKapal program
4	Social cultural existence	and "The older fishermen prefer the old way, sir, they said they are afraid of pressing the wrong button on the phone when requesting help from the SiKapa program." – (FGD Informant, Fishermen Group, Arjasa Village, Sumenep, September 9, 2025)	Resistance arises due to generational differences and levels of digital literacy

Source: processed by researchers, 2025

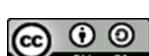
The secondary data above emphasizes minimizing maritime accident rates in the Sumenep regency. Then, to evaluate the above incidents, the Sumenep regency government continues to innovate so that the number of marine accidents can be resolved. It also serves as an appropriate maritime safety mitigation system for implementation in Sumenep Regency, an archipelagic region (Dafa et al., 2022). Several innovations, such as the ISM Code, VTS stations, and VHS, have previously been tried to address naval safety issues. However, these systems would not adapt well to the archipelagic region when implemented in archipelagic regions (Galih Tri puji laksono & Agustina Sari, 2021). SiKaPal combines all existing technology systems and uses the AIS system, which is the first to be used in Sumenep Regency, among other areas of Indonesia (Indrayani et al., 2021).



Image 1. AIS technology of KaPAL Sumenep

Source: Secondary Data from the Sumenep DISKOMINFO 2025

In addition to the novelty of the invention, SiKaPal provides a sense of security not only for fishermen carrying out their work (Hidayat, 2020), but also for family members waiting at home who can feel secure about the safety of their relatives' maritime operations, as their actions can be monitored through a monitor (Hidayat, 2020). This allows optimal maritime



safety mitigation efforts to be achieved, in line with the initial design orientation of SiKaPal, which was to serve as a marine safety mitigation system (Darmin et al., 2024).

b) SiKaPal as a shipping innovation for safety

Maritime safety innovations provide solutions to existing problems. Maritime safety innovations will also address the problem formulation raised in this research. Several important findings can be identified regarding the role of maritime safety innovations in maritime security (Mursidi, 2023).

SiKaPal (Sailing Safety System) is the only innovation using AIS (Automatic Identification System) found in Sumenep Regency, and no other innovation like it is found anywhere else in Indonesia. AIS (Automatic Identification System) is a Very High Frequency (VHF) radio transmission system that transmits data via VHF Data Link (VDL) to automatically send and receive information to other vessels, VTS stations, or SROP. Vessel traffic monitoring is one of the necessary indicators to monitor the position, speed, and direction of operating vessels to mitigate maritime safety. This can also be done through the SiKaPal system, which the Communications and Information Department directly monitors. This data is crucial for preventing potential maritime accidents during operations (Assets et al., 2024). The following is an image of the maritime navigation mitigation technology system district.

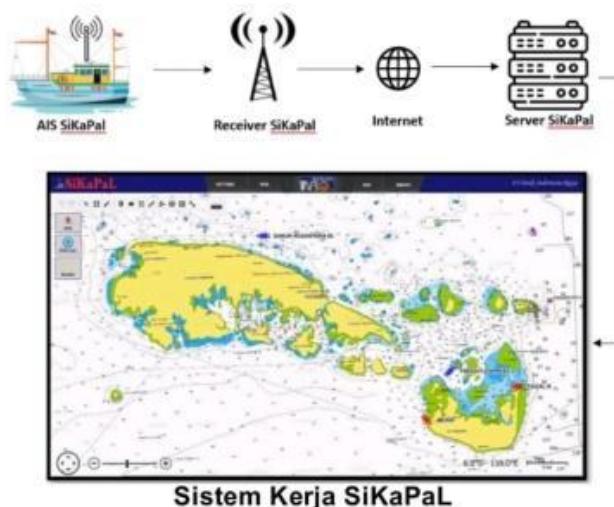


Figure 2.

Performance design of technology for shipping mitigation systems in Sumenep

Source: Secondary Data from the Sumenep DISKOMINFO 2025

Therefore, maritime issues related to improving shipping safety can be addressed through the massive implementation or use of SiKaPal Currently (Hendrawan, 2022), 20 SiKaPal units have been distributed, and the Sumenep Regency government continues to add more units and update the SiKaPal system to make it easier for fishermen to operate.

c) Accelerating service innovation in maritime safety management

Governance innovation serves as a bridge or a tool for research analysis; from a European perspective, this is also an important aspect to develop (Setianto et al., 2021). Ostrom's



adaptive governance model (Elinor Ostrom) emphasizes the importance of adaptive governance, where innovation policies are designed based on the local context and involve communities in the decision-making process (Roslin et al., 2022). Rogers' Diffusion (Yugi et al., 2025) of Innovations theory in innovation suggests that there are 5 aspects to achieve service innovation. In relation to this matter, the researcher then added interviews based on those aspects, with findings in the field, in the table below:

Table 4. Results of interviews at the research location

Theory Component	Findings in Research	Interpretasi
Compatibility	Young fishermen are more receptive, whereas older fishermen are still reluctant to switch from the manual system.	A very low level of compatibility with conservative groups causes resistance to change.
Relative Advantage	Fishermen consider SiKapal to be faster and more transparent in handling fishing permits.	Relative advantages drive an increase in the adoption rate.
Trialability	The government provides free demos and training	Improving SiKapal users' trust
Complexity	Difficulties in internet access and limited digital literacy are the main obstacles.	High complexity thus slows down the diffusion of innovation.
Observability	Fishermen who have used it can show tangible results	accelerate adoption among fishing communities

Source: Results of interviews with informants and users of the SiKapal system.

The interviews and observations were conducted in October 2025. Innovation governance can enhance the innovation capacity of the public sector because it is often viewed as an alternative, not a complement (Kristina et al., 2024). Several public administration theories, such as new public service theory, administrative reform, contingency theory, innovation theory, institutional theory, and governance theory, help establish a positive correlation between interactive governance and innovation in the public sector (Maruapey, 2019). Based on the explanation above, SIKaPal (Maritime Safety System) has implemented an awareness of the importance of innovation governance in its implementation. As we know, the innovation governance used by SIKaPal already complies with the principles and theories relevant to this matter.

Accelerating service innovation in maritime safety governance involves various strategic steps to improve efficiency, effectiveness, and security in the marine industry. SiKaPal, for example, has implemented this in its system, and the Sumenep Regency Communication and Information Office facilitated implementation. SiKaPal can take several approaches, including digital technology, training and education, collaboration between agencies, and regulatory innovation (Iswanto et al., 2024). Safety Management System, Public Awareness, and Data Use



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and Analytics. By integrating these innovations, it is hoped that the Maritime Safety System (SiKaPal) can be significantly improved, reducing the risk of accidents and protecting the maritime environment (Putra Nugraha et al., 2024).

d) SiKaPal system integration and safety mitigation as a model of innovation and governance

Integrating the SiKaPal (Navigation Safety Information System) system and safety mitigation measures serves as an innovative model for more effective ship safety control. Key points of this integration are SiKaPal Development, Safety Mitigation, Coordination and Collaboration, Education and Training, Evaluation and Continuous Improvement, and Supporting Technology. Implementing this innovation model, it is hoped that ship safety governance will address existing challenges more proactively while improving all maritime users' safety (Mursidi, 2023). Then, the researcher formulated the SiKapal model based on its advantages and compared it with similar program models. Below are the details:

Table 5. SiKapal Model, its advantages and Comparison with Other Models in Indonesia

Comparative Aspect	SiKapal Model	Other Application Models
Governance Approach	The SiKapal Model combines technological innovation and adaptive governance at the local government level.	The SIAKAP Model (Maluku, 2021) is still oriented towards administrative innovation and has not yet addressed the adaptive aspect.
Innovation Focus	Integration of the digital application (SiKapal) with the governance of maritime licensing services in island regions.	The E-SAMUDRA Model (South Sulawesi, 2022) only focuses on document digitization without cross-agency system integration.
Community Participation	A participatory approach through training and fishing groups as change agents.	The Digital Fisherman model (Bali, 2020) emphasizes a top-down approach from the government without community participation.
Result	Public service efficiency has improved, as well as the increase in digital literacy in coastal communities being better achieved	Most other studies have not shown a chain effect on increasing community capacity.

Source: processed by researchers, 2025

In the context of Rogers' theory, the diffusion of innovation is not only seen as the spread of technology but also as a social and institutional transformation. Therefore, this research is more advanced because it simultaneously integrates the technology innovation model with adaptive governance. Local governments have a dual role as both innovators and facilitators in the adoption process.



4. Conclusion

Based on the results and discussions through data collection and interviews, there is an explanation regarding SiKaPal, an innovative public service product from the Sumenep Regency Communications and Information Office, prioritizing the people of Sumenep Regency, especially in the maritime sector. SiKaPal has an up-to-date system that experts competently design. It includes a receiver and server that make SiKaPal and AIS more advanced. SiKaPal's operational objectives are to ensure public safety, allowing them to send information easily in the event of a maritime accident. The 112 call center can immediately respond to signals sent by ships experiencing difficulties at sea. SiKaPal is the most effective solution and alternative for fishermen in Sumenep Regency. The government should continue to strive to evaluate the governance and services of SiKaPal in line with the increasingly advanced technological developments. From this SiKaPal model, researchers hope there will be active collaboration oriented towards the involvement of all stakeholders in achieving services that are community-oriented.

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