

Executive Information System for Monitoring Indonesian Maritime Security

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Executive Information System for Monitoring Indonesian Maritime Security

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Abstract. The Republic of Indonesia Unitary State has twelve institutions authorized to supervise and safeguard Indonesia's seas, since 2014 the Indonesian marine surveillance and security model has been coordinated by the Indonesian Sea Security Agency (Bakamla). The problem in Bakamla is that information needs are fast, complete and appropriate to synergize the implementation of patrols with other institutions, these problems can be overcome by developing an Executive Information System (EIS). The purpose of this paper is to develop and implement EIS to monitor Indonesian maritime security as a support system for strategic decisions for leaders in Bakamla. The method used is waterfall which in the process includes concept design, identification, analysis, design, coding, testing, implementation and maintenance. The findings of this study are executive information systems for Indonesian maritime security based on the Single Agency Multy Task, so that it is useful for strategic decision makers to improve Indonesian maritime security. The originality of the paper has been able to integrate several fields of science, including: maritime security, information systems, decision support systems, programming used is PHP and MySQL Database.

1. Introduction

The Republic of Indonesia (NKRI) is an archipelagic country consisting of 17,504 islands and has a coastline of 81,290 kilometers. As an archipelago with 80% of the sea area and 20% of the land area, threats to sovereignty and territory of Indonesia are at sea. The percentage of threats is higher because Indonesia's geographical position is in world trade traffic. Every day there are hundreds of ships passing through Indonesian waters through the **Sea Lanes of Communication (SLOC)** and **Sea Lines of Oil Trade (SLOT)**. The Indonesian sea has a very important function for the Republic of Indonesia, namely, the sea as a unifying media of the nation, the sea as a transportation media, the sea as a resource medium, the sea as a defense and security media, and the sea as a media of diplomacy [1].

With a vast sea area and large natural resource potential, it is a big challenge and responsibility for Indonesia to be able to maintain the security of its marine area from various kinds of crimes. Several types of crimes, such as drug trafficking, terrorism, piracy, sea pollution, illegal fishing, illegal logging, illegal crossing, and illegal immigrants have not been properly dealt with by Indonesia and still continue to threaten Indonesia's marine area [1].

Indonesia has twelve law enforcement agencies at sea, out of the twelve there are six institutions that have patrol boats as law enforcement tools in the sea by conducting patrols at sea, namely: the Navy, Indonesian National Police, Ministry of Defense, Ministry of Maritime Affairs and Fisheries, Ministry of Transportation and Directorate General of Customs and Excise. There are six other marine law enforcement agencies that do not have patrol boats,

namely: Ministry of Foreign Affairs, Ministry of Home Affairs, Ministry of Law and Human Rights, Attorney General's Office, Ministry of Finance and State Intelligence Agency [2].

So far, these twelve institutions have carried out their duties and functions, but have not been able to run optimally. This shows that law enforcement, security and safety at sea carried out by patrol units from various institutions have not been able to be optimal because each agency has different policies, facilities, human resources, not in an integrated system, and not in command and control units [3]. So that in its implementation there is often overlapping of authority and friction between institutions and even sectoral egos among these institutions. So that the Government changed Bakorkamla to Bakamla. The establishment of the Marine Security Agency (Bakamla) is a mandate of Law No. 32 of 2014 concerning Marine Affairs. Bakamla has the authority to synergize the implementation of security, safety and law enforcement patrols in the sea [2], [4].

This study aims to integrate Indonesia's marine security information system by building an information system that can be accessed in an integrated manner by twelve institutions, so as to be able to monitor **crime in the Indonesian sea** area. The Executive **Information System (EIS)** is an interactive computer-based system, which enables executives **to access data and information, so that problems can be identified, exploration of solutions, and the basis for strategic planning processes** [5], [6].

EIS integrates data that comes from internal and external data sources, then transforms the data into useful report summaries. This report will be used by leaders and executive levels to quickly access reports from all

institutions that have legal authority in the Indonesian sea, so that knowledge can be obtained that is useful for the executive. This report is used to find alternative solutions to managerial problems and make planning decisions to improve Indonesia's marine security.

By utilizing the EIS, leaders can decide on the right actions in response to an event or in anticipating a crime event in each of Indonesia's territorial waters. In addition, EIS must provide accurate information to users to improve problem identification, decision-making processes, and extensive analysis of events. For organizations, the use of EIS must have an impact on the effectiveness of the decision-making process [7], [8].

This paper is a scientific study that contains the development of executive information systems to monitor crime in the Indonesian sea. The development of executive information systems to monitor crime in the sea of Indonesia enables leaders to be able to access all the data and information needed so as to increase efficiency in data searches and assist in strategic decisions to reduce the level of crime that occurs in Indonesia's marine areas.

2. Literature Review

Several studies on maritime security and Executive Information Systems (EIS) have been carried out by several researchers, namely: Integrated maritime security policy requires the involvement of many actors in decision making, two major actors from the state sector and the civil sector [9]. Security for the outermost islands can be improved by a model of government institutional strengthening between the center and the regions, supported by increasing human resources and improving people's welfare by utilizing the potential of the outermost islands [4], [10]. The concept of the World Maritime Axis is the concept of Maritime Security itself with characteristics

that stand out and focus on three aspects namely economic security, environmental security and human security [4], [11], [12].

Executive Information Systems (EIS) are one type of information system management to facilitate and support the information and decision making needed by senior executives by providing easy access to information from both inside and outside that is relevant to organizational goals. This is usually considered as a form of decision support systems (DSS) [13], [14].

EIS emphasizes the appearance of images and interfaces that are easy to use by users. EIS offers reports and search capabilities. In general, EIS is an information system that can be used as a decision support system that helps executives analyze, compare and highlight important marine security variables so that they can monitor violations at sea and identify potential crime in some areas [15], [16], [17].

EIS helps executives find data that matches user-defined criteria and promotes insight-based and understanding information. EIS can distinguish between important data and rarely used data, and track various key important activities for executives. After realizing the benefits, people have implemented EIS in many fields, especially manufacturing, marketing, management and finance [6], [13], [18].

EIS has been developed by combining with several smart computing methods, namely: forecasting, artificial intelligence, smart business, decision support systems and Internet of Thing (IoT). EIS is widely used to help solve problems of human resources, finance, management, business, health and others [8], [14], [19], [20].

3. Methodology

This study aims to develop an executive information system to integrate violation data in each institution that has legal authority in the Indonesian sea, thus helping the Government determine policy decisions in order to improve Indonesia's maritime security.

3.1. Executive Information Systems

The Executive Information System is designed to help executives find information needed when they need it and in whatever form is most useful. Implementation of the Executive Information System can be seen in Fig.1, Users can request information, and display the desired information. The drill down capabilities available on this system allow executives to see more detailed information. Drill down means that executives can start from a quick glance and then gradually take more detailed information [5], [14].

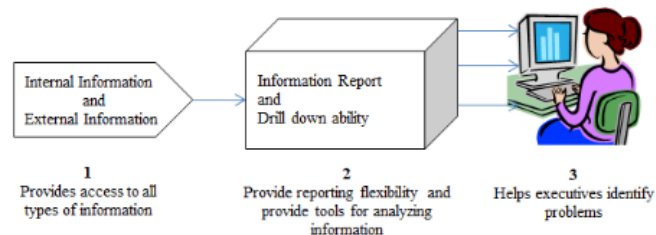


Fig.1: Executive Information System Model

The Executive Information System is the implementation of an Organizational Information System, which can be divided into subsystems based on how users are grouped within the organization. The characteristics of information technology and data needed by EIS, as well as the objectives of EIS, it can be concluded that an EIS has the following characteristics [20], [21]:

1. According to the needs of the executive.

2. Easy to use.
3. Has the ability to drill down.
4. Supports external data needs.
5. Can help in situations that have a high degree of uncertainty.
6. Having a future orientation.

All systems have advantages and disadvantages. However, it all depends on the use and the user. The Executive Information System (EIS) also has its own advantages and disadvantages.

The advantages of the Executive Information System are as follows: (a) make it easier for executives to use their experience, (b) provide timely data delivery from company summary information, (c) the information provided is easier to understand, (d) offers efficiency to make decision, (e) conducting data screening for management, (f) improving information examinations, and (g) being able to access and integrate broad range of internal and external data.

Weaknesses of the Executive Information System as follows: (a) have limited functions, cannot carry out complex calculations, (b) require more costs to make implementation, (c) the system is large, so it is difficult to regulate it, (d) can meet information needs for senior executives, and (f) executives may face too much burden to make their statements.

3.2. Marine Security

There are twelve institutions that play a role in law enforcement in the Indonesian sea, but in fact Indonesian sea security is inadequate. Bakorkamla was formed with the hope of being able to become the coordinator of the institution, but there were some weaknesses in Bakorkamla so that it could not function as coordinator optimally. The new government of Joko Widodo revitalized

Bakorkamla to Bakamla, giving this organization greater authority. This policy also changed the institutional system from multi-agent to single-agent [2], [11], [22].



Fig.3: Bakamla synergy with twelve institutions that have legal authority at sea

(Source: Bakamla RI, 2016)

In accordance with Law No. 32 of 2014 concerning maritime affairs, Bakamla has command and control over the implementation of security, safety and law enforcement operations in the territorial waters of Indonesia and Indonesia's jurisdiction [2], [4]. One of the functions of Bakamla is to synergize patrol implementation carried out by twelve agencies that have authority in the sea as shown in Fig 3.

3.3. Waterfall Methods

The research method applied in the development of the EIS Bakamla is the waterfall method. Waterfall method is a systematic and sequential model of information system development. The waterfall method has stages as shown

in Fig. 4. The phase of system development begins with analysis and definition of needs followed by system design, implementation, testing and maintenance [23], [24], [25].

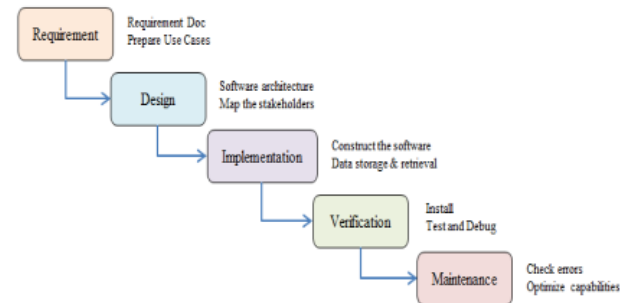


Fig. 4: Waterfall method

In development is the waterfall method has several stages as follows:

1. Need analysis
System services, constraints and objectives are determined by the results of consultations with users which are then defined in detail and function as a system.
2. System design
Stages of system design allocate the needs of hardware and software systems by forming the overall system architecture. Software design involves identifying and describing the basic system of software and its connections.
3. Writing program code
At this stage, software design is realized as a series of programs or program units. Testing involves verification that each unit meets specifications.
4. Testing the program

The individual units of the program are combined and tested as a complete system to ascertain whether or not it matches the software requirements. After testing, software can be sent to the customer.

5. Implementation and maintenance

This stage is the longest. The system is installed and used in a real way. Maintenance involves error correction that is not found at later stages, improving the implementation of the unit system and improving system services as new requirements.

The superiority of the software development model approach with the waterfall method is a reflection of the practicality of engineering, the quality of software is maintained because of its structured and supervised development [24]. On the other hand this model is a type of model that is a complete document, so the maintenance process can be done easily.

4. Result and Discussion

The collection of violation data at sea which is distributed by several work units of law enforcement agencies often experiences delays which hamper the reporting process and decisions made by the Indonesian Maritime Security Agency as a command center.

After the data is collected, the next process is to summarize and analyze the data to be used by the executive as information for decision making. So that the time needed for the report making process cannot be determined because it is related to the time of data collection and information validity.

The model report submitted to the Bakamla leadership already has a reporting format set out in the Regulations. But it does not exclude Bakamla leaders who want to see different forms of reporting from the specified format. This decision is set out in the form of a warrant that will return

to each institution to be distributed to each work unit. The model of recording and reporting of crimes in the Indonesian sea is shown in Fig. 5.

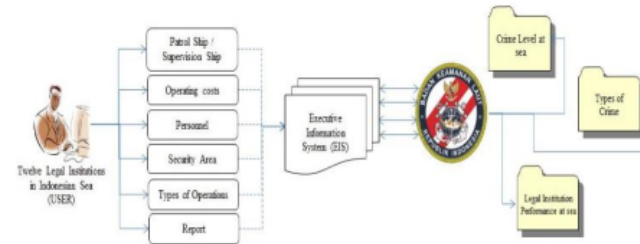


Fig.5: EIS marine security model

Based on Fig. 5, the stages of the reporting process regarding violations occurring in several areas of the work unit can be reported by patrol boats or surveillance vessels that have succeeded in arresting perpetrators of violations in Indonesian waters. The report will be inputted by each institution into the Bakamla executive information system, the violation event will be input based on the type of violation, the area of the violation and the accumulation of State losses due to the violation.

Reports entered in each institution will be summarized and validated by each executive at the institution. After the report is validated, the report resume is made in the form of daily, weekly, monthly, three months, monthly, and yearly. The report will be analyzed by the executive from the head office so that it becomes an input containing a summary of the problem, and actions that must be taken against the problem to be resolved. The results of the resume of the types of violations occurring in the Indonesian sea can be seen in table.1.

In general, the types of violations that occur in the Indonesian sea area consist of illegal fishing, pirate,

smuggling, damage ecosystem, oil disposal, illegal sailing, illegal migrant and borderline illegal.

Table 1. Types of violations in the Indonesian sea area

Code	Types of Crime	Western region	Central Region	East Region
P001	Fish theft	19	10	12
P002	Theft of fish uses bombs	10	10	5
P003	Catching fish using bombs	10	15	0
P004	Robbery	19	4	6
P005	BMKT theft	13	0	0
P006	Fuel oil smuggling	4	16	10
P007	Goods Smuggling	34	7	0
P008	Animal Smuggling	7	4	0
P009	Timber Smuggling	8	6	0
P010	Human Smuggling	5	12	0
P011	Miras smuggling	5	6	6

P012	Drug smuggling	9	8	0
P013	Weapon Smuggling	0	0	5
P014	Ecosystem Damage	6	12	0
P015	Waste disposal	0	0	5
P016	Sail without permission	16	4	15
P017	Immigration	0	0	0
P018	Customs	0	0	0
P019	Regional boundary violations	0	4	0
P020	ZEE Crime	0	0	0
Total		165	118	64
Percent		48%	34%	18%

Based on table 1. Indonesia's marine security area is divided into three maritime security areas, namely: the western region, the central region and the eastern region. Regional division is a strategy to facilitate the implementation of security operations in Indonesian maritime affairs. The Western Region consists of (Jakarta, Banten, Lampung, Tarempa, Batam, Natuna, Belawan and Sibolga). The Central Region consists of (Cilacap,

Yogyakarta, Bitung, Manado, Balikpapan and Pangkep). The Eastern Region consists of (Kupang, Tual, Ambon, Merauke and Jayapura). The division of the maritime security area has been implemented in the EIS application as shown in Fig. 6.

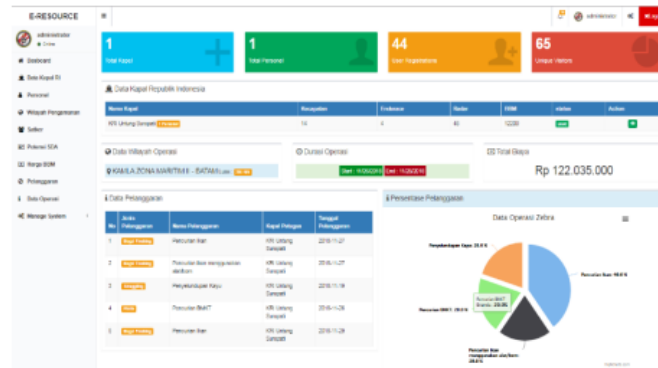


Fig. 6: Security operation results

The results of monitoring violations for the western region recorded in the executive information system were 165 cases, the most widespread violations were (smuggling of goods: 34, fishing theft: 19, robbery: 19 and documentless shipping: 16). For the middle region there were 118 cases, the highest distribution of violations was (smuggling of fuel oil: 16, fishing using bombs: 15, human smuggling and ecosystem damage: 12 and fishing theft: 10). For the Eastern region there were 64 cases, the highest distribution of violations (documentless shipping: 15, illegal fishing: 12 and fuel oil smuggling: 10). The results of the percentage violation in table 1 show that violations in the West are 48%, the middle region is 34% and the eastern region is 14%, this is strongly influenced by several factors, namely: potential natural resources, border areas, ZEE areas, and including ALKI I and II.

With the EIS application, Bakamla as an institution that coordinates Indonesian maritime security and supervision will be easier to manage resources in several other institutions. This EIS application greatly helps the Government to manage and improve maritime security in several regions, especially strategic areas. This EIS will also be able to control the costs of maritime security as well as the management of resource ships and patrol boats.

5. Conclusions

In this paper an executive information system has been successfully developed with the waterfall method to monitor crimes occurring in the Indonesian sea. Based on the results of the evaluation of the implementation of EIS, it can be concluded that EIS has fulfilled the needs of leaders and users to monitor the crimes that have occurred in the Indonesian sea. Based on the results of the EIS resume on crime in the Indonesian sea. The percentage of crimes in the West is around 48%, in the middle region 34% and in the eastern region 18%. The high number of violations in the western region is influenced by border factors between countries, ALKI I and ALKI II, the potential for natural resources is mostly in the West. It is expected that with this system, strategic decision making for safeguarding Indonesia's seas will be faster and on target.

This paper focuses on research in technical aspects, so that further research needs to consider non-technical aspects, such as organizational aspects, resources and other aspects. An in-depth study of non-technical factors is needed to strengthen and support the improvement of Indonesia's marine security in an integrated manner

between Government agencies that have legal authority in the Indonesian sea.

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