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Analysis of Unmanned Vehicle Findings Towards Maritime Security and Defence

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***Abstract*: Indonesia is the largest archipelago country in the world with vast maritime territory needing security and defence strategies. Indonesia has 4 strategic straits including the Sunda strait, Lombok strait, Makassar strait, and Malacca strait. Aside from Indonesia's inherent beauty, seaglider findings are still one of the main problems on Indonesian waters. Possible data obtained from seaglider findings can be important information for undersea operations. The vehicle can reach the bottom of the sea and use sensors to detect depth, oxygen, undersea objects, and other data. The sensor sends data and position of the vehicle to the surface through satellite, for survey needs or hydro-oceanography purposes. In this study, we used NVivo method, a qualitative data analysis software developed by Qualitative Solution and Research (QSR) International. Besides that, we also applied Soft System Methodology (SSM) to obtain the industrial or overall system overview to determine the industry's improvement strategy. It is an evaluation method conducted not only by comparing one model to another but also comparing conceptual model to reality. The qualitative analysis theory used in this study was Miles and Huberman theory. Based on the study results, we found that Indonesia needs underwater defence to stay safe by using several defence strategies such as intelligence readiness upon enemy attack, improve ship force readiness, and increase the fleet's speed. Therefore, to be able to defend ourselves, we need to be ready including all security personnel and defence facilities.**

***Keywords*: Unmanned Underwater Vehicles (UUV), sea glider.**

1. Introduction

Indonesia is the largest archipelago country with vast maritime territory raising concerns towards state security and defence. Indonesia has 4 strategic straits including the Sunda strait, Lombok strait, Makassar strait, and Malacca strait. However, aside from its beauty, seaglider findings are still one of the difficult issues regarding Indonesian waters. A seaglider is defined as a deep-driving Autonomous Underwater Vehicle (AUV) which is an underwater vehicle with no crew and is useful for oceanography data mission finding in the sea.

Data findings from seagliders in Indonesia can be used as important information for underwater operations. The findings from underwater unmanned vehicle in Indonesian territory according to military observers are forms of threat towards Indonesia's sovereignty. A seaglider can go under the sea and use sensors to detect depth, oxygen, underwater objects, and other data. The sensor will send data dan position of the vehicle to the surface using satellite. This vehicle also can collect data for survey or hydro-oceography purposes. For industrial needs, the vehicle can detect fertility of the ocean, oxygen, methane, underwater natural gas, and also can record the sounds of migrating fish. Therefore, we need an initial detection strategy by the Navy to improve the state's maritime defence in Indonesian waters.

Based on Law No. 34 Year 2004 on National Armed Forces, the army's main mission is to maintain the independence and integrity of the Indonesian Republic based on Pancasila and The 1945 Constitution in order to protect the people and country from all threats and intrusions concerning the country's integrity.

Ajita et al., 2021 reported that in the past two years, the fishermen had found seagliders in Indonesian waters at least 3 times. In 2020, a fisherman found a seaglider floating in the sea at 07.00 WITA in the waters of Manjapahit village, Selaya Island. A fisherman also found a similar subject in the Masalembu waters, Sumenep island, Madura Island, and Tengger island in Riau Islands in 2019. As one of the comprehensive systems in security and defence, the Navy is operating under Law Number 34 on National Armed Forces Year 2004 in performing its duties.

Armandos et al. stated that the use of state territory with or without notice should acquire supervision from the central and district government. The district government also plays an important role in state defence and not only solely the responsibility of the authority of state or military defence. Article 40 Government Regulation Number 68 Year 2014 on Management of National Defence Areas mentioned:

1. Management of defence area usage through surveillance, monitoring, and compliance.
2. Management of defence area usage as mentioned in verse 1 is performed by the central government and/or district government according to its authorities.

There are several strategies in maritime defence. First, the staggering speed of enemy attack must be countered with speed of intelligence readiness. Secondly, the speed of ship attack must be countered with the speed and mobility of a fast ship. Third, the ship readiness must be with force ability. Fourth, the speed of enemy fleet must be countered with an also speedy state fleet. Based on the narration, we decided on the title

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"Analysis of Unmanned Vehicle Findings towards Maritime Security and Defence".

Problems:

1. Frequent findings of unmanned vehicles in Indonesian waters.
2. How to identify technical specifications and capabilities of the unmanned vehicles?
3. What data that we can possibly collect with the unmanned vehicles?
4. What are the potential threats of foreign unmanned vehicles towards Indonesian maritime defence?
5. There has not been a quick detection system available related to foreign unmanned vehicles operating in Indonesian waters.
6. We need an integrated intervention strategy involving all related stakeholders.

2. Study Method

According to Wahidmurni, 2017, a qualitative study method is used to find the answers to study problems correlated with data as narratives from interview activities, observation, and document research. To be able to elaborate well on the approach and type of study, author's presence, study location, data source, data collection technique, data analysis, and finding verification in a proposal and/or study report, we need a thorough understanding of each concept.

Dewi & Hidayah, 2019 explained there are 5 techniques of data collection in a case study including documentation, direct observation, involved observation (participant observation) and physical artefacts. Each one completes the other. This is the power of a case study compared to other qualitative methods.

The qualitative data collection method in this thesis was in-depth interview. The interview technique was used to collect qualitative data and was conducted between the author and resource persons to obtain the needed information for the study. It can be in the form of direct interview or online if not possible.

There were 3 experts who was chosen as resource persons:

1. An expert in underwater unmanned vehicles.
2. An expert in maritime law.
3. An expert in hydro-oceanography.

1) Law on UUV

According to Prof. Dr. Jimly Asshiddiqie, S.H., in (Rohman et al.), law enforcement certainly must start with law making activities and followed by socialization which are often ignored and considered not important but actually has the utmost importance.

The UN Convention on the Law of the Sea 1982, which had been ratified by Indonesia into Law Number 17 Year 1985 on UNCLOS authentication, is a comprehensive international agreement on international law about maritime activity including research activities. Along with the advances in science and technology, new research model emerges such as researches using unmanned vehicles or UUV which has not yet been regulated.

Illegal use of UUV is very harmful to the country requiring legal actions and preventions to avoid territorial intrusions using unmanned vehicles in its waters.

In Chapter XIII UNCLOS 1982 which regulated Marine Scientific Research (MSR) not only including the specific use of UUV in oceanic studies, but especially about state authority in giving consent for MSR activities on national jurisdiction including the advances in technology in the research such as UUV usage. Besides that, UUV is also used by developed countries for scientific maritime activities (military/espionage activities).

In effort to maintain law and safety at sea as shown in the state laws. There are 17 National State Laws which regulates strong law enforcement at sea:

1. Law Number 1 Year 1973 on Indonesia's Continental Shelf (State Gazette Year 1973 Number 1, Addendum Number 2994);
2. Law Number 5 Year 1983 on Indonesia's Exclusive Economic Zone (State Gazette Year 1983 Number 44, Addendum Number 3260);
3. Law Number 17 Year 1985 Authentication of United Nations Convention on the Law of the Sea 1982 (State Gazette Year 1985 Number 76, Addendum Number 3319);
4. Law Number 5 Year 1990 on Natural Resources and Ecosystem Conservation (State Gazette Year 1990 Number 49, Addendum Number 3419);
5. Law Number 6 Year 2011;
6. Law Number 16 Year 1992 on Fish and Plants Quarantine (State Gazette Year 1992 Number 56, Addendum Number 3482);
7. Law Number 6 Year 1996 on Indonesian Sea Territory (State Gazette Year 1996 Number 73, Addendum Number 3647);
8. Law Number 17 Year 2006 on Revision of Law Number 10 Year 1995 on Customs (State Gazette Year 2006 Number 93, Addendum Number 4661);
9. Law Number 32 Year 2009 on Environment Protection and Management (State Gazette Year 2009 Number 140, Addendum Number 5059);
10. Law Number 22 Year 2001 on Natural Oil and Gas (State Gazette Year 2001 Number 136, Addendum Number 4152);
11. Law Number 2 Year 2002 on National State Police (State Gazette Year 2002 Number 2, Addendum Number 4168);
12. Law Number 45 Year 2009 on Revision of Law Number 31 Year 2004 on Fishery (State Gazette Year 2009 Number 154, Addendum Number 5073);
13. Law Number 12 Year 2008 on Second Revision of Law Number 32 Year 2004 on District Government (State Gazette Year 2008 Number 59, Addendum Number 4844);
14. Law Number34 Year 2004 on National Armed Forces (State Gazette Year 2004 Number 127, Addendum Number 4439);
15. Law Number 26 Year 2007 on Territory Management (State Gazette Year 2007 Number 68, Addendum Number 4725);
16. Law Number I Year 2014 on Revision of Law Number

27 Year 2007 on Management of Coastal and Small Island Regions (State Gazette Year 2014 Number 2, Addendum Number 5490);

17. Law Number 17 Year 2008 on Sailing (State Gazette Year 2008 Number Addendum Number 4849);

From the aspect of maritime law enforcement regulation, Indonesia has 13 maritime stakeholders. Seven departments have independent maritime task force (on patrol) and 6 others do not. In Ajita et al., the law enforcement departments with task forces are the Navy; State Police, Ministry of Transportation Directorate Hubra, Ministry of Maritime and Fisheries - General Directorate PSDKP; Ministry of Finance - Customs General Administration; Bakamla and Eradication for Illegal Fisheries (Satgas 115). All 7 law enforcing departments perform sea patrol according to each own regulation.

2) The Function and use of UUV

Underwater unmanned vehicle (IUUV) or known as seaglider is similar to a drone. A seaglider is able to collect various data from the sent location. This means that the seaglider can provide the condition of the Indonesian ocean. According to Credence Research, the seaglider can operate from a few hours to a few days. For diving ability, this vehicle can dive from 200 to 1,000 meters. In (R, n.d.), the navigation system in unmanned vehicle are coordination equipment, sensor, and control with a trajectory from the initial position to target location with no accident or in other words, it has the ability to avoid existing obstacles.

The seaglider can be equipped with many sensors to monitor temperature, salinity, current, and other sea conditions. This information creates a complete overview on ocean conditions which cannot be detected from satellite or large research ships.

There are many glider designs to operate in water. But this vehicle in general has the ability to travel longer without needing repairs.

The seaglider operates at difficult to reach areas. With a relatively lower cost, the seaglider can still collect data during extreme weather such as in the midst of a storm. After data collection for the determined period, the glider finishes its journey. The glider then emerges and sends its position to be retrieved.

3) Qualitative Analysis Theory: Miles and Huberman Method

According to Miles and Huberman, the analysis was differentiated into several steps:

1. Data reduction as the suitable simplification step for easier information access. The data collected will be categorized into very important, not very important, and not important.
2. Next, the researcher can keep which data is useful and dispose the unneeded one. Therefore, data will be clearer and simpler for the next step.
3. Simpler data will be presented in graph, chart, etc. The purpose is to be able to be conveyed and understood easily by others. This will also help the readers in absorbing information.
4. Conclusion drawing is the data information collected from the data presentation using certain techniques. The conclusions can be placed last or as end note so the readers can find the conclusion from the research.

4) The Position of Seaglider in International Law

Is the underwater unmanned vehicle can be classified as a ship in terms of international law of the sea? There are some rules in the relevant international convention about the definition or criteria to determine what exactly is a “ship”. Although “ship” and “ship” are often used in UNCLOS, the definition is not clearly stated and just a prerequisite for the agreement. The lack of definition seems to give the possibility to consider unmanned sea vehicles as a “ship”. Here are some definitions of a ship from various international regulations:

1. According to Article 3 in International Law Year 1972 to Prevent Sea Collision, the “ship” includes all description of water vehicles including non-displacement vehicles, wing-in-ground-effect vehicles, amphibious vehicle, used or able to be used as water transportation. This definition marks the manmade nature of the ship and focuses on the basic characteristics of a ship as a mode of transportation.
2. According to Article 2 United Nations 1986 Convention on Conditions for Ship Registration, “ship” means every self-propelled sea-going ship used in international sea trade for goods transportation, passengers, or both with exception of ships listed with less than 500 tonnes gross weight.
3. This definition rules out objects of cargo ship and minimum boundaries for kabel appli. Ship definition from the American Branch of International Law Association (ABILA) is more concise: a ship is defined as manmade vehicle able to sail including submarine. According to this definition, the most important feature of a ship is its ability to sail on or be underwater.

After the flag country decided the ship’s state as a “ship”, other countries must accept that the mentioned ship sent by the flag country is able to perform navigation and other rights given to the ship. Therefore, it is considered that UNCLOS regulates how each country uses their ships but leaves a question on ship definition which must be determined by the national law (Mahardika et al.,).

5) NVIVO Method

In this research, the author chose to use NVivo method in the data analysis process. In Amelia Sidik & Bodhiya Wijaya Mulya, NVivo is a qualitative software data analysis developed by Qualitative Solution and Research (QSR) International. QSR itself is the first company to develop qualitative data analysis software. NVivo started from the software NUD*IST (Nonnumeric Unstructured Data, Index Searching, and Theorizing) in 1981.

NUD*IST at first was created by a programmer named Tom Richards to help his wife, Lyn Richards, who was a sociologist and qualitative researcher. In this study, we used NVivo version 8 released in March 2008. NVivo is an application used to analyse qualitative data which in qualitative studies rarely used automation system for qualitative data analysis. Usually, the qualitative researcher will manually analyse the data using data tabulation, reduce data, perform data coding, data presentation,

and verification.

In NVivo, the source of analysed data is categorised into four. First, the internal data source (internal); secondly, external data source (external); third, memos during data collection (memos), and lastly framework matrices. Internal sources in this context are all qualitative data sources that can be included in NVivo, such as recordings, interviews, interview transcripts, photos, survey data tables, websites, databases, and videos.

Therefore, NVivo is used as a tool for researches using qualitative data assuming the researchers understands the data which will be analysed.

Besides that, NVivo also ensures easy, effective, and efficient coding to make everything easier because in NVivo all sources are saved in one place although the files are at different locations in one project. The link created enables temporary retrieval in manual coding. In NVivo, there are also some benefits such as it can make auditable footprint, is more explicit than reflective, and increases transparency.

6) Soft System Methodology (SSM) Method

Soft System Methodology (SSM) method is conducted to look at the industry or system at a whole to be used to determine the industry's improvement strategy. It is an evaluation method not only comparing one model to another but comparing conceptual model with reality (Mahardika, H. et al).

This comparison enables to find the disadvantages from the conceptual model and directly improves the model so there is no difference between conceptual model and real-life activity. SSM can be called as the correct methodology to explain the purpose of an organisation and later on to make a human system design to reach organisational goals.

The SSM process can be conducted through 7 steps starting from identification of clarification of the unstructured problem then portrayed it in a conceptual model then compare to the real-life situation to identify change and help improve the conceptual model.

The steps are as mentioned:

1. The first step in SSM method is to find a problematic situation then convert it into rich picture for better understanding.
2. Step 2 is to define the problem clearly by collecting data and information continued with problem formulation and presentation in the form of a rich picture.
3. Step 3 is to formulate a relevant system correlating the problem with existing system then build a human activity system using CATWOE analysis.
4. Step 4 is to build a conceptual model based on element identification on the step to formulate system to reach the goal.
5. Step 5 is to compare the model to real life situation to find new ideas that can be implemented for conceptual model improvement.
6. Step 6 is the improvement step through identification of steps to generate systematic and doable changes after comparison to real- life situation.
7. Step 7 is the implementation step to take action through changes in the previous steps.

7) Unmanned Underwater Vehicles (UUV)

In Ermayanti et al., Unmanned Underwater Vehicle (UUV) is every vehicle able to operate underwater without manpower. This vehicle is categorised into two including Remote Operational Vehicle (ROV) operated with remote control. In Jeremia Humolong Prasetya Nainggolan (Nainggolan, 2018), the application of military Unmanned Underwater Vehicles (UUV) in foreign maritime zone is an issue in maritime law needed to be addressed and comprehensively handled. There is no law framework yet about this technology.

In Yuliyanto, 2018, UUV kinematics analysis can be done by determining the coordinate sides of the vehicle. There are 2 coordinate system which are earth-fixed reference and body-fixed reference. Types of UUV itself is categorised into two. Rachim et al., mentioned AUV (Autonomous Underwater Vehicle) as a type of unmanned underwater vehicle which moves automatically while ROV (Remote Operated Vehicle) is an unmanned underwater vehicle which moves using remote intervention by humans.

The legal state of Unmanned Underwater Vehicles (UUV) used in a military operation in the sea is unclear according to the international law and therefore depends on the country's perspectives. However, UUV has been used by various countries for many military purposes such as monitoring, espionage, landmine clearance, and transportation. Besides that, UUV can be used for survey needs or finding oceanography data and industrial purposes. More specifically, UUV can also view underwater fertility, oxygen, methane, underwater natural gas, oxygen, and record fish sounds during migration.

International Maritime Law Convention or Law of the Sea 1982 which has been ratified by Indonesia into Law Number 17 Year 1985 on UNCLOS authentication, an international agreement which is a comprehensive international legal aspect on maritime activities including research activities. Along with advances in science in technology, new model research emerges such as studies using unmanned vehicles or UUV which usage has not been yet regulated.

Illegal usage of UUV is very harmful for the country so the state needs to take legal actions and steps to prevent territorial violations with UUV entering its waters.

3. Results and Discussion

Identification of factors related to threats of unmanned vehicle findings is an early detection strategy by the Navy to increase maritime defence in Indonesian waters. There are several strategies in maritime defence which can be applied:

1. Speedy enemy attack must be countered with intelligence readiness from national defence.
2. Increase the ships force readiness with destructive ability towards enemy attack.
3. Increase the fleet's speed. Therefore, to survive from the attack we must be ready including personnel or defence facilities.

4. Research Analysis Results and Conclusion

In the course of 3 years, there had been 3 findings of foreign seagliders in Indonesian waters. Technology wise, not all public or private departments are able to detect operating underwater seagliders. However, a few times the seaglider was able to be detected was because the underwater equipment was broken or had a system malfunction so it accidentally surfaced. In the late 2020, a fisherman in Majapahit Village, Selayar Islands found a floating seaglider. Still in the same year, a fisherman found similar vehicle in Masalembu, Sumenep, Madura, and in 2019 at Tengger Island, Riau Islands. Other than that, a tank-like vehicle was also found in Natuna. However, until now there was no official confirmation from officials.

The technical specifications of the underwater vehicle had not been revealed yet to the public because some equipment needed further research. It is possible that the equipment was used for underwater research by the military or other civilian offices. But there were no party claiming the existence of the vehicles. Seagliders usually have two wings each 50 cm long. The length of the seaglider is 225 cm with a rear antenna of 93 cm, a sensor, and two surveillance cameras. Meanwhile, a torpedo-like drone seaglider which was found in the Selayar had such specifications: length 2.25-meter, material: aluminium, wings: 2 (50 cm), propeller: 18 cm, antenna: 93 cm, and a camera.

The seaglider is autonomous with programmed movement patterns. It is controlled remotely with GPS coordinated to follow the current and surfaced to send recorded data to the satellite. The main vehicle used underwater sensor. The sensor will create an algorithm and a coding system which will be translated by several equipment into usable data. In several vehicles, there are also underwater cameras to produce underwater images to complete the data obtained by the vehicle.

The vehicle can collect data as needed from the vehicle operator especially in underwater condition. It includes seabed condition, upper and lower current condition, tide, salinity, temperature, sea level, oxygen level, phytoplankton concentration, hydrography, ocean ecosystem, and water biota and can even detect the existing volcanoes and dangerous areas based on the possible geological conditions able to be researched.

How far and long the unmanned vehicle can operate depends on the ability and type of vehicle itself. It can reach hundreds of kilometers from the launching point according to the system support ability. The duration also depends on resources and energy of the vehicle to stay at sea. Some can survive for weeks and some are prepared to operate for months and years. But in general, the seaglider has a maximum operation distance up to 4,900 km with 279 days of operational durability.

Technology wise, not all public or private offices in maritime regions has the ability to look for data or the underwater operating vehicle. However, the unmanned vehicles can be detected with active or passive sonar but can be difficult because the material is very small at sea. This can work but we must add the sonar ship power because Indonesia is a maritime country with 70% sea territory. The detected seagliders also were broken underwater vehicles or with system malfunction so they accidentally surfaced.

A few things can be the cause of the unmanned vehicle entering Indonesian waters. First, it can be coincidence where the UUV was carried away by the current and separated from the control ship into Indonesian waters. But it can also be on purpose which was illegal by the military or foreign private sector to spy and study the potential of sea resources in Indonesian jurisdiction. The vehicle was launched by its user from out of Indonesian territory to prevent from being noticed.

UNCLOS 1982 has not yet regulate specifically about the use of UUV. But there is a statement in UNCLOS which stated the usage of maritime territory that can be a reference in the sea as Indonesia's legal territory on usage of UUV. Attention to legal matters is related to the need of the operator and user. If it is used for legal activities, there should be administrative processes with the government's permission. But if it is for a certain party's needs then they might ignore the rules for their own benefits.

There is no accurate data on the user country because usually it cannot be identified due to its illegal situation and there was no factory or production information. Up until now, there has not been a legal statement from the Navy or the government about the research results on the seaglider findings so it is inconclusive for country of origin or production although from the seaglider's technical specifications it is very much similar with China's Haiyi UUV.

Until now, there are no protest note sent by the government through Foreign Affairs Ministry to a certain country identified as the seaglider's owner in Indonesian waters. However, according to some opinions, there were some governmental communications through Foreign Affairs Ministry to the certain related department.

The potential threat that might be caused by the unmanned underwater vehicle can be from the military point of view due to the useful intelligent data can be dangerous for other party analysing the state's force. In this case, it will give consequences related to operational planning. Besides that, the freedom of other countries to conduct research on the resource potential in Indonesian waters without detection and prevention can have implications on economy expansion and exploration of foreign strength to use resources to their own benefits with certain scheme and strategies which can be undetected forcing Indonesia to be colonised economically.

Early UUV detection can be conducted using passive or active sonar by increasing the number of sensor ships and placing them in our strategic waters through an integrated system with its equipments. Also, we can place Underwater Detection Device (UDD) at strategic points such as entrance to the Indonesian waters which can be operated all years long and can be monitored real time through Puskodal TNI AL.

The technology that is often used to monitor the use of underwater unmanned vehicle for example are Coastal Intelligence System, Integrated Underwriter Harbors Defence, and Surveillance System and Passive Autonomous Acoustic Surveillance System.

Up until now, it has not yet been revealed to the public because it is still undergoing research by the experts and

competent parties. There are also official press releases related to the Navy Public Hearing with House of People's Representatives (DPR) explaining the findings from seaglider investigations in Indonesian waters. But if we look at the technical indicators, the UUV found by fisherman and secured by the Navy was labelled Shenyang Institute of Automation Chinese Academic of Sciences and assumed a special platform designed to detect non Chineses submarines and record all ships activities in operation in South East Asian waters and north Natuna sea and found CTD (Conductivity, Temperature and Depth) data. Besides that, we understanding the type of vehicle enables us to anticipate and prevent such issues by placing undersea sensors in all Indonesian waters.

There has not yet an official government regulation about underwater unmanned vehicles activities. But it should already be included in the UNCLOS agreement which is related to all regulations in the waters and archipelago such as Indonesia to apply international law in our waters. However, in Law Number 17 Year 1985 on UNCLOS authentication 1982 is explained that in sea territories, foreign water vehicles are not allowed to use threats or violence towards a coastal country's sovereignty, integrity, and independence and cannot conduct a survey or research, disturb communication system, pollute, and other activities which has no direct correlation with peaceful sea passage. Therefore, the use of UUV without permission by foreign countries in Indonesian waters to collect hydrography or oceanography data is considered a violation of law.

The correct policy advice is to regulate the use of underwater unmanned vehicle by foreign countries in Indonesian territories through regulation on underwater drone operation.

If the government wants to regulate in regards of operational foreign vehicles in Indonesia such as the seagliders, it can be put into President's Decree to hasten the process. Because until now the rules on permission usually only apply to some vehicles only such as war ships passing through Indonesian waters. Drafting laws or other regulations and applied operationally towards that vehicle and make UNCLOS as the basic reference. This will emphasize the boundaries on vehicle existence operating in Indonesian waters.

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