



Installation of Vessel Monitoring System and Its Implementation in Nigeria

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ABSTRACT

Illegal harvesting of fish and other criminal activities has necessitated the need to adopt more advanced technologies in monitoring the activities in the sea. To this end, this study specifically explores the installation of vessel monitoring system and its implementation in Nigeria. The study adopted an exploratory survey using purposive sampling method in selecting 50 members of Nigerian Maritime Administration and Safety Agency (NIMASA) to participate in the study. Questionnaire was adopted for data collection and the data collected was analyzed descriptively using mean and standard deviation. The result of the study revealed that installing VMS will allow fisheries management authorities to monitor near real time movements; provide directions for vessel inspections upon detected infringements which limit the costs of routine patrols. It will also improve compliance with fisheries regulations; and enhances the effectiveness of search and rescue missions. The second finding of this study revealed that financing, technical knowhow, availability as well as poor maintenance culture are the primary challenges affecting the installation of VMS in Nigeria. Finally, the study revealed that installation and implementation of VMS will minimize criminality on Nigerian seas by discouraging illicit maritime activity, improving obedience with fisheries regulations by providing regular location and vessel activity information, as well as by tracking the movement of ships through satellite nonstop to identify illegal presence. Based on these findings conclusions were drawn and recommendations made.

Key words: Vessel monitoring system, Installation, Implementation

Introduction

There is documented evidence of how renewable resources like fish are overexploited, to which end, measures are undertaken to prevent irreversible damage to depleted stocks due to improper management (Watson & Haynie, 2018). Minimizing exploitation led to the implementation of policy tools such as catch quotas and fishing effort limits. For implemented policies to be effective, resources such as air patrol crafts, sea patrol vessels and personnel are important (Chang Liu & Song, 2009). However, the costs of these resources are high, which brings about limitation to effective enforcement. Among the various tools and policies that have been formulated or developed, the one considered important to the management of fisheries is satellite or remote Vessel Monitoring Systems (VMS) (Chang, et al, 2009). It is a system which enables the monitoring of fishing vessels by authorities from land-based stations. It enables the verification of the legality of a catch (Tembaletu, 2009).

Vessel monitoring system also known as VMS is an important tool employed in the management of fisheries. It is used in the maritime sector to fight against IUU fishing, by tracking and monitoring their activities. Effective implementation of VMS can enable the detection, deterrence and elimination of illegal fishing globally, as well as provide important information, which cannot be gotten from the use of traditional methods, to aid effective implementation of management measures that can aid sustainability of fisheries. The advancements in technology have improved the functionality of VMS, which enable it possible to be consolidated into fisheries management. Internationally and locally recognized, VMS is used by authorities to monitor thousands of fishing vessels. However, its effectiveness is subject to the regular monitoring and sharing of VMS data for enforcement purposes (VMS Brief Whitepaper, 2016). The use of VMS significantly minimizes the delay associated with paper reporting, as well as the tendency for manipulated or false data, through the use of its feature, which allows the electronic transfer of reports in real time. There have been successful implementations of VMS in the fisheries sectors of some countries; however, there are still evidences of challenges associated with its implementation in Nigeria.

Statement of problem

The objective of VMS in fisheries is rooted in the management and conservation of resources (FAO 1998). The benefits inherent in the implementation of VMS include improvement in regulation compliance through the provision of vessel activity information, improvement in data communication, and use in search and rescue missions (Tembaletu, 2009). The formulation and implementation of VMS in Nigeria as well as other countries necessitated by the act of overfishing carried by humans, which directly or indirectly threatens marine fishery resources. The effect of overfishing also diminishes the capacity to produce maximum yield consistently. A lot of coast al states in developing countries such as Nigeria, are unable to afford the satellite vessel monitoring systems (VMS) needed for monitoring of turbulent waters. Thus, this inability to effectively monitor and enforce policies encourages

fishing by foreign fishing vessels and unauthorized persons, which contributes to the collapse of marine fish stocks. To this end, this study examines the installation of vessel monitoring system and its implementation in Nigeria.

Research objectives

The study specifically aims to;

- Identify the advantages of installing vessel monitoring system in Nigeria.
- Identify the challenges involved in the installation of vessel monitoring system in Nigeria.
- Determine the extent to which the installation and implementation of VMS will minimize criminality on Nigerian seas.

Research questions

1. What are the advantages of installing vessel monitoring system in Nigeria?
2. What are the challenges involved in the installation of vessel monitoring system in Nigeria?
3. To what extent will the installation and implementation of VMS minimize criminality on Nigerian seas?

Literature review

There is a tendency to overexploit renewable resources hence the necessity to manage fisheries to ensure that the society recognizes the potential of its fisheries resource. Poor regulation as regards marine rules and systems can deplete marine resources such as trawling at fish houses without allotting chances for the fish to breed which can damage the fish house. There are many cases of misconduct where foreign vessels illegally trespass international waters (Waseso et al 2018). Such situations of crimes are known as Illegal, Unregulated and Unreported Fishing (IUUF) which are prevalent, contributing to overfishing, bycatch and other issues which decrease long-term fishery yield, unfavorably impact ocean wildlife, and reduce the earnings of legitimate fishermen (Fujita et al., 2018).

By strengthening existing marine and fisheries resource surveillance systems, over exploitation of fisheries resources can be prevented. Fishery monitoring is important for addressing these issues and allowing fisheries to attain their full potential for food production, revenue and job creation, while protecting ocean ecosystems. Monitoring systems generate the data needed to ensure that fishery regulations are complied with and goals aimed are achieved. It produces data needed for scientific stock assessments, which can then be used to fix sustainable catch limits (Fujita et al., 2018). Different policy tools can be applied such as satellite or remote Vessel Monitoring Systems (VMS) which can be installed and activated continuously when fishing (Soemarmi et al., 2020).

Concept of Vehicle Monitoring System (VMS)

A vessel monitoring system (VMS) is a program for surveilling fisheries, whereby the equipment connected on a fishing vessel provides information about the vessel's activities and position. VMS allows monitoring from land-based stations, real time movements of fishing vessels by fisheries management authorities enabling verification of the legality of a catch with respect to the fishing area. It also provides for directed vessel inspections when violations are detected thus regulating the costs of routine patrols. Vessel monitoring system (VMS) improves the capacity to monitor fishing vessel movements and assess fishing fleet behaviour such as fishing locations and spatially-explicit economic decision-making (Watson & Haynie, 2018). It communicates vessel locations at consistent intervals and facilitate monitoring of speeds, locations, changes in bearing and other facets of vessel behaviour that can show the time and locations of vessels that are fishing (Watson et al., 2018).

The general purpose of the VMS in fisheries includes improving obedience with fisheries regulations by providing regular location and vessel activity information; improving scientific information regarding the status of fish stock; enabling transfer of data to land based stations; providing information in cases of emergency for search and rescue operations; providing targeted inspections that enable patrol vessels to be deployed where infringements are discovered.

Empirical studies

Ferreira and Martins (2019) carried out a research that involved creating an edge computing approach on a local VMS, in which the only data transmitted is the relevant one that can signify abnormal behaviour while the remaining data is put in storage and transmitted only at ports when communication systems are accessible at lower prices. They applied this approach to a fishing control process and findings showed substantial communication savings and that using more stable fishing techniques and fishing areas cause higher savings.

Soemarmi et al. (2020) investigated how vessel monitoring system is used as fishery ship obligations in Indonesia by using a normative juridical approach aided by some examinations and findings of violations and the extent of compliance of fishery business vessels in fulfilling the vessel administration conditions. The findings showed that the government had made attempts to control fraudulent practices through an advanced technological device called the Vessel Monitoring System (VMS)/Fisheries Vessel Monitoring System, which can keep track of the movement of ships through satellite nonstop in order to identify fishing that does not conform to the permission. For that reason, installing VMS is necessary and important if fishing vessels aim to do business in the country.

Torres-Irineo et al., (2021) made use of data from a trial Vessel Monitoring System (VMS) project tested in a small-scale fleet in the Southeastern Gulf of Mexico and learnt the role environmental factors play in the distribution of potential fishing grounds for the fleet using a correlative modeling approach. They were able to obtain tracking data of 1,608 day-to-day fishing trips from vessels that functioned in four states using the VMS for 7

months. The results also revealed that net primary production and sea surface temperature were the key drivers that shaped the spatio-temporal potential distribution of fishing grounds at the site of study.

Theoretical framework: Theory of Cost-Benefit Analysis (CBA)

Cost-benefit analysis aims to provide a dependable procedure for appraising decisions as regards their consequences. This might seem like a clear and practical way to proceed, but it is definitely not the only one. Cost-benefit analysis which evidently embraces a vast field, proposes clear guidelines for evaluating the decisions of government in diverse fields. It helps to evaluate all the possible costs and returns that might be generated from a project. The result of the analysis will determine whether a project is fiscally feasible (Hayes, 2021). Regarding the installation and implementation of vehicle monitoring system, this analysis will help to determine how beneficial it will be.

Methodology

The study is an exploratory survey, in which purposive sampling method was used in selecting the Nigerian Maritime Administration and Safety Agency (NIMASA), given its role as Nigeria's apex maritime regulatory authority. Random sampling method was used in selecting 50 respondents for the study based on the willingness, availability and knowledge of the issue under study. The source of data collection was questionnaire structured with a four point likert scale format containing the questions formulated to guide the study. The data collected was descriptively analyzed using mean and standard deviation.

Data Presentation, analysis and discussion

1. What are the advantages of installing vessel monitoring system in Nigeria?

Table 1: The respondents' opinion on the advantages of installing vessel monitoring system in Nigeria

Statement	SA 4	A 3	D 2	SD 1	Total (SA*4) + (A*3)	Mean \bar{x}	Decision To accept if ≥ 2.5
VMS allows fisheries management authorities to monitor near real time movements	21	24	0	5	156	3.1	Accepted
VMS provide directions for vessel inspections upon detected infringements which limits the costs of routine patrols	21	29	0	0	171	3.4	Accepted
VMS improves compliance with fisheries regulations	27	19	2	2	165	3.3	Accepted
VMS enhances the effectiveness of search and rescue missions	17	33	0	0	167	3.3	Accepted

Field survey, 2021

The table above indicated that the mean of each of the statements is above the benchmark of mean (\bar{x}) ≥ 2.5 . This implies that all the items were accepted as the advantages of installing vessel monitoring system (VMS) in Nigeria. Accordingly, installing VMS allows fisheries management authorities to monitor near real time movements; provide directions for vessel inspections upon detected infringements which limits the costs of routine patrols; improves compliance with fisheries regulations; and enhances the effectiveness of search and rescue missions. This result therefore indicates that VSM is essential in the fisheries management in Lagos state. The result confirms earlier studies such as Soemarmi et al., (2020), Watson et al., (2018) and VMS Brief Whitepaper, (2016) who also identified similar advantages of installing VMS in fisheries management.

2. What are the challenges involved in the installation of vessel monitoring system in Nigeria?

Table 2: The respondents' opinion on the challenges involved in the installation of vessel monitoring system in Nigeria

Items	SA 4	A 3	D 2	SD 1	Total (SA*4) + (A*3)	Means \bar{x}	Decision To accept ≥ 2.5
Affordability of its varying financial aspects	30	17	3	0	180	3.6	Accepted
The technical attributes of the VMS units	17	24	0	8	140	2.8	Accepted
The availability of VMS supplies	27	17	0	6	159	3.2	Accepted
Poor maintenance facility	25	16	5	4	148	3.0	Accepted

Field survey, 2021

The result from the study above indicated that all the items in the table are accepted as the challenges involved in the installation of vessel monitoring system in Nigeria given that the items exceeded the benchmark below which the items were rejected. As indicated in the table therefore, this study concluded that installation of VMS is plagued with the following challenges: affordability; the technical attributes of the VMS units; availability of

VMS supplies; as well as poor maintenance facility. The result confirms the revelation by Torres-Irinea et al., (2021) who revealed that VMS requires technical skills; otherwise its effectiveness will be questioned

3. To what extent will the installation and implementation of VMS minimize criminality on Nigerian seas?

Table 3: The respondents' opinions on the extent will the installation and implementation of VMS minimize criminality on Nigerian seas

Items	SA 4	A 3	D 2	SD 1	Total (SA*4) + (A*3)	Means \bar{x}	Decision To accept ≥ 2.5
The level of crime at sea will be minimized	27	21	1	1	177	3.5	Accepted
It will discourage illicit maritime activity	25	19	2	4	157	3.1	Accepted
Improve obedience with fisheries regulations by providing regular location and vessel activity information	37	13	0	0	185	3.7	Accepted
It will track of the movement of ships through satellite nonstop to identify illegal presence.	37	11	2	0	181	3.6	Accepted

Field survey, 2021

The table above revealed that all items exceeded the benchmark and as such were accepted. This implies that the installation and implementation of VMS minimizes criminality on Nigerian seas by discouraging illicit maritime activity, improving obedience with fisheries regulations by providing regular location and vessel activity information, as well as by tracking the movement of ships through satellite nonstop to identify illegal presence. This result confirms that revealed by Soemarmi et al., (2020), Watson et al., (2018) and VMS Brief Whitepaper, (2016) respectively.

Conclusion and recommendations

Illegal harvesting of fish, especially the fingerlings fish that needs to develop for future used is bad to national economic as it can extinct the fishes in the sea. To control illegal fishing, vessel monitoring system was introduced. Its benefits include improvement in compliance to fishing regulation, provision of vessel activity information, improvement in data communication, as well as in search and rescue missions (Tembaletu, 2009). This study therefore investigated the extent of adoption of the installation of vessel monitoring system and its implementation in Nigeria along three research objectives. The first was to identify the advantages associated in installing vessel monitoring system (VMS) in Nigeria. The result of this revealed that installing VMS will allow fisheries management authorities to monitor near real time movements; provide directions for vessel inspections upon detected infringements which limits the costs of routine patrols; improves compliance with fisheries regulations; and enhances the effectiveness of search and rescue missions. The second finding of this study in line with the second research objective meant to identify the challenges confronting the installation of VMS revealed that finance, technical knowhow, availability as well as poor maintenance culture are the primary challenges affecting the installation of VMS in Nigeria. Finally, the outcome of this study revealed that installation and implementation of VMS will minimize criminality on Nigerian seas by discouraging illicit maritime activity, improving obedience with fisheries regulations by providing regular location and vessel activity information, as well as by tracking the movement of ships through satellite nonstop to identify illegal presence. Based on these results, this study concludes that VMS is essential in Nigerian sea to conserve its fishes that are directly or indirectly threatens by illicit maritime activities. This study there recommends collaboration of government and private companies as part of their corporate social responsibility, to sponsor the installation of VMS across all Nigerian seas to enhance adequate monitoring of the activities at the sea. Similarly, the study recommends proper maintenance culture among fisheries management in ensuring that the existing VMS are in good working conditions.

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**INSTALLATION OF VESSEL MONITORING SYSTEM AND ITS IMPLEMENTATION IN NIGERIA
REQUEST FOR INFORMATION**

Dear Respondent,

I am carrying out a study on "Installation of vessel monitoring system and its implementation in Nigeria", and you have been chosen to be part of the study. This questionnaire is only for academic purposes. Kindly select the response which applies to you and all information will be kept confidential

SECTION A

Instructions: Please tick (√) as appropriate where

SA = Strongly Agree (SA), A = Agree, D = Disagree (D), SD = Strongly Disagree (SD)

Key: Strongly agree (4), Agree (3), Disagree (2), and strongly disagree (1).

S/N	ITEMS	SA	A	D	SD
RQ1	What are the advantages of installing vessel monitoring system in Nigeria?				
1	VMS allows fisheries management authorities to monitor near real time movements				
2	VMS provide directions for vessel inspections upon detected infringements which limits the costs of routine patrols				
3	VMS improves compliance with fisheries regulations				
4	VMS enhances the effectiveness of search and rescue missions				
RQ2	What are the challenges involved in the installation of vessel monitoring system in Nigeria?				
5	Affordability of its varying financial aspects				
6	The technical attributes of the VMS units				
7	The availability of VMS supplies				
8	Poor maintenance facility				
RQ3	To what extent will the installation and implementation of VMS minimize criminality on Nigerian seas?				
9	The level of crime at sea will be minimized				
10	It will discourage illicit maritime activity				
11	Improve obedience with fisheries regulations by providing regular location and vessel activity information				
12	It will track of the movement of ships through satellite nonstop to identify illegal presence.				