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Determinants of Computerized System for Execution of Martime Security Systems

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Abstract This paper investigates the determinants of Computerized System for Execution of Martime Security systems at Mombasa port, Kenya:- In particular to establish the effect of Under Water Detection System-Band Radar and Vessel Monitoring system on the Maritime Security Systems. Data was analyzed by: Regression analysis, Structure Equation Modeling; Methods employed were standardized regression coefficient, Variance errors and Covariance. The finding are that: Under Water Detection system had β=0.342, with Ratio Index (2.557); X-Band Radar (β.170)which was low, hence X-Band Radar indicated a weak predictor. Vessel monitoring system had Ratio Index (3.557); Lastly Model_4 (Under water Detection System) had Ratio Index (4.7537). Insecurity and coastline surveillance systems are still wanting; the maritime security of the Western Indian Ocean has also undergone a transformation. Maritime security at Mombasa port is of international importance due to high level of trade routed via the sea; All the same, Kenya has a renewed focus on maritime affairs; the security has also undergone a transformation at Mombasa. Further investigation on proper use of Vessel Monitoring system and X-Band Radar System is required; Installations of more repeaters, access points, setting up demilitarized zones are paramount. The country need to invest in Security; Reinforcement of coastline surveillance systems to improve strong hold of its coast water security, Lastly to attract more international coalitions and partnerships for fighting against Maritime insecurity at Mombasa port.

Keywords Under Water Detection system, X-Band Radar, SEM and S and Maritime Security Systems

Introduction

The Mombasa port is located in the eastern province of Kenya, currently known as the Mombasa County, it is the second largest city in Kenya, it touches the west of Indian Ocean. Kenya shipping industry mints a lot of income per year on Mombasa Port [1]. Insecurity on the Maritime causes a reduction on cruise liners that visits Kenyan waters, research indicate that such normally lead to a drop [1]. Research indicates that Mombasa is a coastlines hub that consists of very unique and important transportation infrastructure, it's a vest tourism catchment that requires good protection from external and internal attacks.

Threats ranging from: maritime interstate disputes, terrorism, trafficking of drugs and illegal goods are the most worrying tasks required to ponder [3-4]**.** As such the port need vest protection for the domain of interest its border control and territorial protection. Research indicate that Kenya's coast line is estimated to be 614 Km, which is 143,000 KM^2 such is said to be exclusive of the Economic Zone, Economic and Social Rights Centre (2015) [2]. Basically the coastline located on the Indian Ocean, has moderate Exclusive Economic Zone (EEZ) [3-4].

The marine fisheries and aquaculture sector contributed up more than 0.54 percent to the country's Gross Domestic Product (GDP) in 2013 with fishing and fish farming employing over 200,000 people [4]. Mombasa port in contrast, has long been contributor to Kenya's economy on its GDP and providing employment, income and food security needs for more than 80% of the Kenyan population [4-5]. Given that Maritime security and law enforcement in the Indian Ocean is of international importance due to the high level of trade routed via the sea this has attracted Kenyan Economy being on a rebound in 2018 [6]. We content that Mombasa port is importance due to the high level of trade which at the same times contributes to Kenya's economy and therefore boosts its GDP.

This study draws a reflection on improved rains, such trackers to a better business sentiment and easing of political uncertainty, economic activity is rebounding after the slowdown in activity in 2017. Research by Kenyan Government Gazette for Economic Update on official statistics, the economy expanded from 4.7 percent in 2017 to 6.0 percent in 2018 supported by improved harvest in agriculture, steady recovery in industrial activity, and still robust performance in the services sector, we content that with Mombasa reinforced with better security will definitely boost the GDP of the country. As a result, real GDP growth reached 5.7 percent in 2018, an upward revision of 0.2 percentage points from the April 2018 Economic Update [6].

Considering the improved rains, better business sentiment and easing of political uncertainty, real GDP growth is estimated to rebound from 4.9 percent in 2017 58 to 5.7 percent in 2018 and rise gradually to 6.0 percent by 2020 as the output gap closes. Growth is projected to 59 remain robust over the medium term [5-6].

GDP growth is projected at 5.8 percent in 2019 and 6.0 percent in 2020, but with increased tourist attraction, secure waters at Mombasa port and strong security surveillance mambas habour will hervest additional GDP to the Country [4, 6]. As it stands now, Kenya is the dominant economy in the East African Community (EAC) and the primary source of foreign direct investment (FDI) for some of the countries of the Community. In recent years, Kenya has made major progress in financial deepening and financial inclusion.

Increasingly, Kenya has become a centre of innovation especially in mobile phone-based financial services, Cereal industries beverages (Tea, coffee, Cocoa, soya), soap industries, Wheat products, Pharmaceutical industries, plastic industries, Milk processing, whose growth and employment opportunities have ignited economic growth in the economy [5-6]. Kenya has also been an important player in the horticulture export market.

The study content that Kenya as a country has a youthful population and is well positioned to reap the population dividend; it recently discovered oil (lodwar) and it is likely to be an oil exporter .we argue that even without oil discovery, the Kenyan economy, with its save ports stands at a very strategic location in the Eastern Africa region, since it has deep waters at its Mombasa port [4]. Kenyan country serves five landlocked countries that are relatively resource rich (Ethiopia, SouthSudan, Uganda, Rwanda, and Burundi) [5]. Study done by the European Commission's as a Joint Research Centre, content that the sea areas of Mombasa need a continuous surveillance and protection. Even though malicious acts against a ship remain confidential and limited are known to the public eye today, it is a matter of vast importance to protect it from exploits. Potential compromise of the ship's systems can lead to injury and loss of life, physical damage to the environment, to the Maritime and port infrastructure [7].

The coastline is still undermined by a wide range of maritime security challenges such as piracy, marine pollution, illegal, unregulated and unreported (IUU) fishing, as well over-exploitation of maritime resources. The nature of these security concerns, in particular the impact of Somali piracy, has resulted in maritime security becoming an emergent priority for the Kenyan government. This is reflected in, for example, the 2014 Security Laws (Amendment Act), that established a Border Control and Operations Co-ordination Committee, work on developing a national maritime security strategy and the establishment of the Blue Economy Implementation Committee in January 2017.

Study by [8], indicate that the Kenya's Indian ocean waters has a high catchment of economic arena, which is an asset to most of East African countries, particular eastern African countries. Such rich harvest are denied or rubbed of by a wide range of maritime security issues such as; piracy, marine pollution, illegal, and unreported fishing cases. The nature of these security challenges in particular the Somali piracy has put on spot maritime

security, such has emerged to be an emergent priority for the coastline, this therefore it urges the Kenyan government on the alert.

Kenya also has established Marine Protected Areas (MPAs) divided into National Parks and National Reserves, with Malindi and Watamu Marine Parks and Reserve first established in 1968. According to International Maritime Organization [9], there are at present four marine National Parks and six marine National Reserves. The marine parks are fully protected with no extraction or fishing allowed whereas the marine reserves allow restricted fishing rights under specific conditions. Dissatisfaction among local artisanal fisher communities on the negative impact of marine parks in Kenya has led to the creation of ad-hoc Locally Managed Marine Areas (LMMAs) to conserve fisheries and marine resources and as a way of securing alternative livelihood activities [8, 10].

Threats to Maritime and Mitigating Systems

Drug Trafficking: The abuse of narcotic drugs is a very old problem in human history but the issue of narcotic drug trafficking has only occupied the attention of the collective international community for about a century during which time the illicit activity has evolved at a staggering pace, forcing law enforcement techniques and mechanisms to evolve just as rapidly Since the upsurge of Somali piracy in 2005, multiple external capacity building projects have been initiated in Kenya to help develop indigenous maritime security capacity. These have focused primarily on building coastal patrol capability (e.g.by EUCAP NESTOR), enhancing the judicial and legal capacity to prosecute and imprison suspected maritime criminals (e.g. UN Office on Drugs and Crime)and training and equipment provision to enhance Maritime Domain Awareness [10].

Illicit Trade for Small Arms and Light Weapons*:* As indicated, the illicit trade in small arms and light weapons (SALW) is heavily linked to the illicit drug trade. As such its impact is as hard-hitting and far-reaching as the illicit drug problem. There is a distinction to be made however between the illicit trade in weapons and the secret trade thereof. Governments supplying arms secretly to groups in foreign countries are not necessarily acting illicitly, although, if the proper procedures of the receiving state have not been followed that state may well regard the action as illicit in the context of interference in its domestic affairs.

The coast of Mombasa stands high chances of threats because Drug Trafficking, Illicit Trade for Small Arms and Light Weapon. Research show that its not only Mombasa coast which is vulnerable to such threats [10]. Globally such threats are common as confirmed by [11], his study he confirms that a number of threats has attracted attention in the Asia Jemaah Islamiyah, such include the South-East Asia, which is linked to the Moro Islamic Liberation Front and yet another group known as Abu Sayyaf Group deply which found in the [11-13].

Human Trafficking Human trafficking: This means trafficking in persons, and is internationally regarded as "the recruitment, transportation, transfer, harboring or receipt of persons, by means of the threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation.

Research show that the Kenya Maritime Police Unit (MPU) identifies small arms smuggling, cattle rustling, drug trafficking, child trafficking, influx of refugees, threats of terrorism, illegal fishing and trawling, and contra-bound activities as 'maritime threats to national security' [12, 16]. In terms of beefing up external capacity building, the country has also contributed in terms of promoting an integrated approach to maritime security measures and maritime law enforcement in Kenya, which includes supporting Kenya's national capacity to perform coastguard functions through inter-agency cooperation and development of maritime strategies and contingency plans [14, 16-17]. Kenya joined up hands works with international governments on a bilateral basis including with Denmark, Norway, South Africa, the United Kingdom and the United States [17-18].

Terrorism

There is no standard, internationally agreed definition of terrorism. However, it would seem that it is universally viewed as involving a violent or destructive act underpinned by political motivations. There is, nonetheless, disagreement as to the context in which acts involving these elements may be accurately. Study by [19] Kenya,

like many countries in the world, is struggling with the task of terror attacks perpetrated by a mix of international, regional and local terror networks including the Al Qaeda, ISIL, Boko Haram and Al Shabab. As a Leading country in the fighting against terrorism in the horn of Africa, the country of Kenya continues to produce the greatest brunt of terrorism amongst East and Central countries in the region.

The attacks on Kenya by Al Shabab have dramatically spiraled after Kenya deployed its military to Somalia in October 2011 in the hope of diminishing the capacity of Al Shabab to launch attacks in Kenya. Since then hundreds of people have been killed and many more injured and property destroyed in multiple terror attacks mainly in Nairobi, the Coastal and Northern Kenya regions. Notable attacks include; the September 2013 Westgate mall attack in which 67 people were killed, June 2014 attack in Lamu, Mpeketoni which led to 68 deaths, November bus attack in Mandera killing 28 people, December 2014 attack in Mandera in which 36 quarry workers were killed and the April 2015 attack on Garissa University College in which 148 students died Study by [12, 16, 19].

Study by [16, 19] show that the Kenya security agencies have continued to conduct abusive operations against individuals and groups suspected to be associated with terror attacks in various parts of the country. The counterterrorism operations are being conducted by a combined contingent of Kenya Defense Forces (KDF), National Intelligence Service (NIS), Kenya Wildlife Services (KWS), County Commissioners, Deputy/Assistant County Commissioners, Chiefs and various units of the National Police Service including the Anti-Terrorism Police Unit (ATPU), Kenya Police Reservists (KPRs), Rapid Deployment Unit (RDU) of the Administration Police, Border Patrol Unit (BPU) and the General Service Unit (GSU).

Under Water Detection and Communication system

Research by [12-13], attest that the design and Implementation of Underwater Acoustic Micro-Modem Based on a Low-Power Micro Controller Unit. This Micro Modem is cylindrically shaped micro-modem offering an optimal directional beam of light; the beam flashes a heavy lighting component. The Micro Modem has a pattern with a 3 dimensions of design. Its type of system which operates on an ARM Cortex M3, which is hinged on the micro-modem. The system is known as modulator demodulator, just like any other modem, it also provides fast digital signal processing which at the same time supports the flexibility of multiple interfaces with other peripherals and a spherical transducer for the implementation [16-17]. The modem is able to send data wirelessly up to the length of 70 m with a data rate of approximately 0.2 kbps, this is on terms of 4.5 watt a power consumption rate, Research done by [14, 20] attest that the modem known as a billing system which is capable to perform the duties of a router, its able to route, cast bills i.e. water bills, electricity bills, internet bills but at the same time it does an acoustic communication applications (it also performs a low-power consumption, micro size, low cost, omni-directivity [12, 13, 20]**.**

X-Band Radar

Traditional approaches for accomplishing this kind of mission include using wave buoys, pressure wave gauges, acoustic wave gauges, airplane or satellite video or radar observation, land-based HF band radar and X-band radar [14]. X-band radars have a frequency range from 9.41 to 10.5 Ghz. Thus, the wavelength of X-band radars varies from 2.8 to 3.2 cm in air. This is a rather important information because this particular wavelength is approximately equal to the ripple wavelength existed on the water surface when the wind speed is more than 3 m/s. Although the ripple waves are not the target for the measurements, they are coexisted with the much large gravity waves, which is the target of the measurements [14-15, 20].

Complementing the point measurements of such in-situ sensors, remote-sensing instruments such as synthetic aperture radar (SAR) [14], high frequency (HF) radar [15], and X-band marine radar [16–18] have been developed as alternative approaches over the last few decades. Particularly, X-band marine radar has been rapidly developed as an ocean remote sensor since it can image both the spatial and temporal variations of the sea surface with high resolutions. Furthermore, X-band marine radar is widely installed on ships for navigation purposes. If reliable wind and wave measurements can be obtained from such radars, the costs associated with traditional in-situ sensors such as anemometers and buoys can be significantly reduced. Thus, land-based or ship-borne X-band marine radar has garnered wide attention.

This scatter waves are usually referred as the "sea clutter noise" from radar's point of view because the scatter waves are not the target of a regular radar system. Because the closer the ripple wavelength and the EM .The first three kinds of techniques are well-developed techniques for direct observation of water surface elevations or water particle velocities for estimating wave conditions. The first attempt of using X-band radars for wave observation was reported by [15]. At that time, radar images were recorded on papers, and then digitized for wave data analysis. Since that attempt, continuous effort on the development of X-band radar wave observation system has produced several commercial.

These techniques were first developed and followed the available wave theory (mainly the linear wave theory). Thus they are prevailed in the wave measurement market. These techniques, however, require the deployment of a sensor or a series of sensor in the water, and thus, are expense for maintenance. In areas that fishing activities are heavy, interference with fishing activities is inevitable and often ends up with valuable instrument lost [16]. If it is a land-based system, *e.g.*, a High-Frequency (HF) radar or X-band radar, the operation cost is relatively inexpensive, especially for the X-band radar if the required study area is within a radius of 3 to 5 km. HF radars are mainly used for large area currents and wave measurements [17]. The instrumentation cost is also big, on the order of millions for a system

This study content that X-band radar applies short Electromagnetic waves which interacts with water ripples on top of the gravity waves. The operation range of X-band can be estimated as far as 50 km, such normally happens if boosted, though its capable to go up to 200 km when operating with an antenna array. Research shows that radars can be grouped with a low resolution. Research done on HF radars show that unlike the radar, the X-band radars are widely used for the vessel monitoring within the water and basically for navigation purpose.

Study by [20-21] attest that Sea state monitoring by X-band radar systems has become increasingly interesting, also due to its spatial resolution, it is slightly higher than the resolution of the relatively more common high-frequency (HF) coastal radars'-band radar systems offer an improved operational flexibility; due to their small dimension, low weight, and easy installation, it is possible to install them even on a movable platform and from there to scan the sea surface with high temporal and spatial resolution. The author attest that such formulates the Hypothesis as: H2: X-Band Radar has effect on Maritime Security at Kenya, at Mombasa Port [26-27]. This study contends that self-efficacy is limited to a particular domain of activity such as different hardware or software configurations. Thus, individuals with high computer self- efficacy generalizability would expect to be able to use different packages and different systems while those with low computer self-efficacy generalizability would perceive their capabilities to be limited to a particular software package or computer system.

Vessel Monitoring System

A Vessel Monitoring System (VMS) **i**s a satellite-based monitoring system which provides data on the location, course and speed of vessels to the fisheries authorities at regular intervals. According to the European Commission (EC) Regulation No2244/2003, fishing vessels with total length greater than 15 meters are obligated to be equipped with a VMS. Similarly, all coastal European Union (EU) countries are required to set up systems that are compatible with each other, so that countries can share data which the EC can easily monitor [23, 29].

The analysis of VMS data provides spatial and temporal grids about fishing effort, which is necessary information for management purposes. VMS is unique to facilitate Scientific purposes, such include "good quality" estimates of fishing effort that are required so as to design management plans for the operation of different fishing gears and for modeling purposes. Maritime Spatial Planning Directive - Vessel Monitoring System when analyzed becomes a major control for the Monitoring Control and Surveillance (MCS) programmes at national levels. [29] raised high premium on the management and sustainability of the marine environment., as a major control for the Monitoring Control and Surveillance of the marine domain.

[23] attest that VMS data can be a significant input for several modeling purposes, The analysis of Vessel Monitoring System data can be a significant input for several modeling approaches combining VMS data with bathymetry, environmental and oceanographic data, fisheries data (catches, landings, discards), sea bottom types and habitats.

Vessel tracking is vital to the MDA effort, both when vessels are at sea and when they are in coastal areas, inland waterways, and ports. Vessel tracking at sea involves either using national technical means or requiring vessels to carry equipment that broadcasts radio signals with information about their identity, position, speed, and course. When radio signal broadcasting systems were originally developed, however, they were used primarily for such purposes as search and rescue or improved navigation safety, not homeland security.

High Frequency Radars

HF radars measure ocean surface velocities by emitting a vertically polarized electromagnetic signal toward the electrically conductive ocean surface [22]. The outgoing signal is coherently backscattered by surface gravity waves whose wavelengths are half that of the transmitted signals. Wavelength (i.e., 6-m ocean wavelengths for 24–27-MHz systems) and travel directly away from or toward the transmitter. This coherent, strong return of energy at a precise wavelength (Bragg scattering) allows the radial velocity (away from the receiver) of the surface water to be inferred from the Doppler shift of the returning signal [23]. The operation range of High Frequency (HF) is large (normally on the order of 50 km, and can be extended to 200 km with an antenna array) but with a relatively low resolution [22-23].

Doppler velocities, 'these spectra provide estimates of velocities observed along each range circle. Successive spectra for each range circle are normally averaged over a time interval (e.g., a 30-min average every 10 min or a1-h average every ½ h) to reduce noise and attain an ensemble average of the complex signal voltages at each Doppler velocity. Second, from these averaged range circle spectral estimates, for each measured Doppler velocity within the region of the strongest returns (the ''first order region''), the complex signal voltages from each of the three antennas are used with a direction-finding algorithm [Multiple Signal Classification (MUSIC) [22-23].

HF radars measure ocean surface velocities by emitting a vertically polarized electromagnetic signal toward the electrically conductive ocean surface [23]. The outgoing signal is coherently backscattered by surface gravity waves whose wavelengths are half that of the transmitted signals. Although the Hi-Res Sea from Codar Ocean Sensors is claimed having the capability of measuring waves, the web page cited in this paragraph, however, stated that other devices are needed for measuring directional wave spectra. Unlike HF radars, X-band radars are widely used for the vessel navigation [21-23].

Intrusion Detection System

An intrusion detection system can provide advance knowledge of attacks or intrusion attempts by detecting an intruder's actions. In this respect, intrusion detection systems are a powerful tool in the organization's fight to keep its computing resources secure. Study by [23, 29] considers the term intrusion detection as: "The process of identifying and responding to malicious activity targeted at computing and networking resources." An intrusion detection system attempts to uncover behavior or configurations that are, indicate, or could lead to malicious activity [29]. Unfortunately, such a broad definition would lead you to believe that nearly anything, including papers describing system hardening, constitute intrusion detection systems.

An intrusion detection system (IDS) is composed of hardware and software elements that work together to find unexpected events that may indicate an attack will happen, is happening, or has happened. An intrusion detection system (IDS) examines system or network activity to find possible intrusions or attacks. Intrusion detection systems are either network-based or host-based; vendors are only beginning to integrate the two technologies. Network based intrusion detection systems are most common, and examine passing network traffic for signs of intrusion. Host-based systems look at user and process activity on the local machine for signs of intrusion.

Research Design and Methodology

Target Population

The populations of study comprised of employees at Mombasa Ports Authority records there are 95 employees in the department of Detection Sensors Officers, Maritime Officers, Maritime superintendent, under Water Security Officer Sander Water Security Officer the study will be done in Kenya, at Mombasa Port within

departs namely; financial services, telecommunications, and sectors, namely; financial services, Telecommunication.

Table 1: Target Population

Maritime Employees	Target population
1. Detection Sensors Officers	10
2. Sea control officers	8
3. Maritime officer	10
4. Traffic Control officers	10
5. Harbor Officers	12
6. Under Water Security Officers	10
7. Day / Night surveillance	20
8. Transport signals officers	15
9. Total	95

Sampling Technique

This research paper employed cluster and random sampling technique to extract employees. The purpose of the method is to maximize survey precision, given a fixed sample size. Sampling technique is known as the means of choosing an optimum sample in order to achieve the parameters for analysis. The purpose of the method is to maximize survey precision, given a fixed sample size.

Data Analysis, Finding and Discussions

To examine how X-Band Radar affect Maritime Security Systems

This study employed Standardized Regression Weights to examine the effect of X Band Radar. The study preferred standardized regression weights since they enabled this study to compare directly the effect of independent variable (X-Band Radar) on the dependent variable – Maritime Security Systems [16]. The standardized regression weights by X-Band Radar was (β =0.170) i.e. 17%, it indicated that X-Band Radar is weak predictor of Maritime Security Systems, though with a path statistical significance 0.001 hence $p < 0.05$. Hence it has a significance difference. Similar studies by [16-17] found out that there was a significance difference on Maritime Security Systems, the antenna on the top of the radar that continuously rotates and flashing. Study by [18] show that computer technology has created a strong necessity for organizations, government and specifically in terms of security on coastlines, however, in the absence of effective utilization of these technologies, such as Network access points (Routers, Modems, Radio receivers), Circuit closed TV (CCTV) and computers systems are unable to enhance increased organization performance

To investigate effect of Vessel Monitoring system on Maritime Security Systems

The study considers the Vessel monitoring system basically an independent variable which is operationalised by the Maritime Security Systems. Results indicated that after analysis it proved that, the standardized regression of Vessel Monitoring system was (β=0.8), this was equivalent to 80%. Hence the Standardized Regression Weights had strong effect on Maritime Security System. Vessel Monitoring system therefore a strong predictor of Maritime Security Systems, however its path of statistical significance was 0.000 hence $p < 0.05$, this was less than the probability threshold (0.05) indicating that it had a significant difference, the Null hypothesis is therefore rejected. Similar studies by [18], established that Vessel Monitoring system was developed to perform the safety and efficiency of Maritime traffic, showed results which indicated a strong predictor of Maritime Security System.

$H0_1$: Under Water Detection system has no effect on Maritime Security Systems

Results as extracted from the analysis show that the Under Water Detection system gave standardized Regression Weights of 0.35p=0.001, the results proved that there was positive statistical difference its null hypothesis was rejected and alternate accepted, results also indicated that the Under Water Detection system was a weak predictor (0.35) which is 35% of the Maritime Security systems.

$H0_2$: X-Band Radar has no effect on maritime Security Systems

Results indicates that X-Band Radar had Standardized Regression Weights of (0.110), p = 0.000 <0.05 indication a positive statistical significant difference of X-Band Radars on Maritime System. Other studies by [19] found out that X-Band Radar had significant influence on Maritime System and also experienced a frequency range from 9.41 to 10.5 Ghz. X-Band Radar it had a positive statistical difference, hence Null hypothesis was rejected Under Water Detection system is a weak predictor = 0.11 (11%) of Maritime Security systems, the Null hypothesis was rejected alternate hypothesis was accepted since sign was 0.001 (which indicated that its p< 0.05.

Study by [18] further established that the wavelength of X-Band Radars varies from 2.8 to 3.2 cm in air. This study argues that this is Key since the data extracted conforms with the wavelength, which is equivalent to the ripple wavelength. This ripple wavelength is from the water surface, such happens when the velocity of the wind speed is approximately greater than 3m/s such will affect the Maritime System [19-20].

$H0_3$: Vessel Monitoring system has no effect on Maritime Security System

Results indicates that X-Band Radar raised Standardized Regression Weights of (0.110), p = 0.000 <0.05 this shows a positive statistical significant difference. This study rejects the null hypothesis and accepts the alternative hypothesis since p<0.05. In other words X-Band Radar significantly affects Maritime Security Systems.

To investigate the effect of Vessel monitoring system on Maritime Security Systems

The study investigated on the effect of Vessel Monitoring system as an independent variable with the Maritime Security Systems as dependent variable. The standardized regression weights of Vessel Monitoring system raised a value of β = 0.49 this (49%). Similar study by [22-23] content that the preferred standardized regression weights enabled the comparison direct to the Vessel Monitoring system, which in this case is a strong predictor of Maritime security Systems.

Comparison of Split Vessel Monitoring system Model

This study considered a split Vessel Monitoring system Model since it has performed well in terms of its factor loading, considering its error variances which were unique in their results: e1=0.03, e2=0.01, e3=0.02, e4=0.02 and lastly e4=0.04 as indicated in (fig. 1).

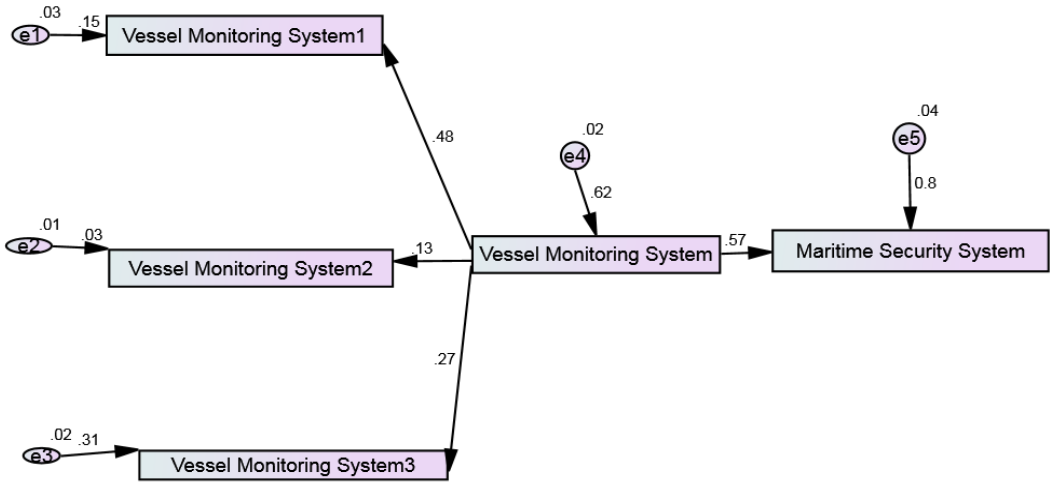

Figure 1: Split Vessel Monitoring System Model

R_2=0.8 (indicating that Regression weight) for 3 split Vessel Monitoring system are able to report 0.8 (80%). Results on Vessel Monitoring system show that variance error difference in e3–e2 =0.03 -0.01 =0.01 it yielded the higher variance error difference which was low, the variance error difference on e1-e2 = 0.03 - 0.01 =0.02 was high with a difference of 1 compared , while variance error difference on e2-e1= 0.03-0.01 =0.02 yielded the higher variance error difference, this was equal to e1 and e2 causing a variance on Maritime Security Systems which in total loaded the standardized regression weights (0.50) which equivalent to 50% per unit

increase on Maritime Security Systems. A similar study by [29], *Comparative Fit Index (CFI)* is an incremental fit index that is an improved version of the NFI.

The Tucker Lewis Index [11] is conceptually similar to the NFI, but varies in that it is actually a comparison of the Normed chi-square values for the null and specified model. The author asserts the importance of the *GFI that it* can fall outside the range 0–1.0. Values greater than 1.0 can be found with just identified models or with over identified models with almost perfect fit; negative values are most likely to happen when the sample size is small or when model fit is extremely poor. Another index originally associated with AMOS is the adjusted goodness-of-fit index [29-30]. It corrects downward the value of the *GFI* based on model complexity; that is, there is a greater reduction for more complex models.

Model comparison by Indices

X-Band System Model Comparison by Indices

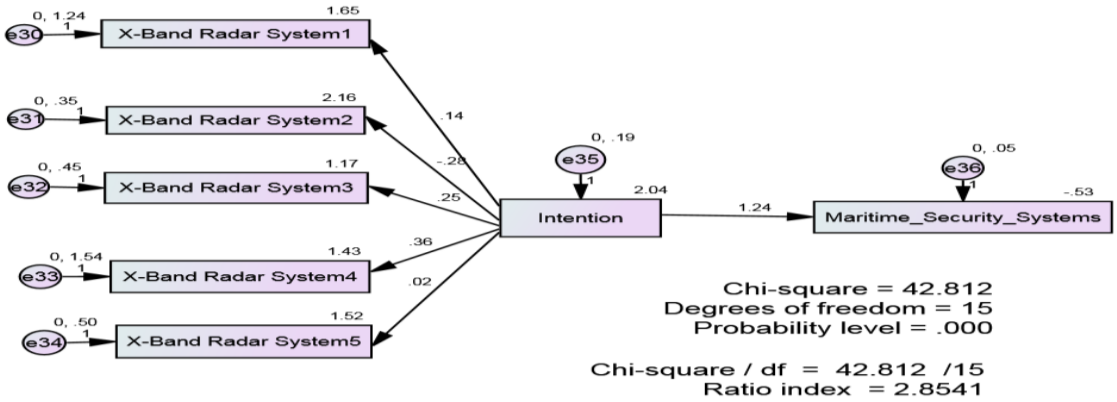

Figure 2: Comparison of X-Band Radar split Model

Comparison of split Model Results in table above indicate that, Model_2 (X-Band Radar System) was on overall the best fit with the ratio index (2.8541),this was < than 5, similar results by [15-16], finding show that the relative chi square ratio is out to be > 5 for an acceptable model such reflects good fit or acceptable fit.

Conclusion

This study concludes that X-Band Radar is predictor of Maritime Security Systems. The Model_2 and Model_3 fit < than 5, according to the ratio theory the Vessel Monitoring system is rated as a strong model compared to X-Band Rader System and Under water system. The standardized regression weights of Vessel Monitoring system was β =0.49. All the three systems had their Null hypothesis rejected and alternate hypothesis accepted since a departure from p=0.05. In general Vessel Monitoring system had highest contribution while Band Radar had the lowest also said to be a weak predictor of Maritime Security Systems.

While Kenya has a renewed focus on maritime affairs, the maritime security of the Western Indian Ocean has also undergone a transformation since the upsurge of maritime piracy around 2008.Weak maritime governance structures have facilitated a range of maritime security threats beyond piracy, such as illegal fishing and drug smuggling, that are interlinked and in some cases interdependent. Maritime security and law enforcement in the Indian Ocean is of international importance due to the high level of trade routed via the sea. It is an indication of lack of a policies to regulate the activities of the sea has precipitated economic loses to the Kenyan government due to high rates of transportation cost, trade cost and insurance.

Recommendation

This study recommends further investigation for proper use in the Maritime Security Systems, utilizing more than two or three theories in future would be appropriate, future research would also have to look at the capabilities of the Maritime Security Systems in more detail such as expanding study areas. Examining a large number of ministries will be a better approach to the future. Further investigation for proper use in the Maritime Security Systems, utilizing more than two to three theories in future would be appropriate, future research would also have to look at the capabilities of the Maritime Security Systems in more detail such as expanding study

areas. The government of Kenya should set up systems that are compatible with each other, so that countries can share data and the EC can easily monitor that rules.

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