ISSN
2443-2415

INTERNATIONAL CONFERENCE ICMST 2020 on Maritime Science and Technology

PROCEEDING

ICMST 2020

INDONESIA NAVAL TECHNOLOGY COLLEGE

INTERNATIONAL CONFERENCE ON MARITIME SCIENCE AND TECHNOLOGY

The 4th ICMST - STTAL

FIELD :

1. Operation Research.
2. Logistics Management.
3. Policy and Strategy.

SURABAYA SEPTEMBER 24th , 2020

PROCEEDING

INDONESIA NAVAL TECHNOLOGY COLLEGE
POSTGRADUATE INTERNATIONAL CONFERENCE

“The 4th International Conference on Maritime Science and Technology”

Field :

1. **Operation Research.**
2. **Logistics Management.**
3. **Policy and Strategy.**

SURABAYA SEPTEMBER 24th , 2020

POSTGRADUATE STUDIES PROGRAM
INDONESIA NAVAL TECHNOLOGY COLLEGE STTAL

Proceeding

Indonesia Naval Technology College
Postgraduate International Conference

International Conference on Maritime Science and Technology
ICMST 2020

These Proceedings have been published by :

Directorate of Postgraduate Studies Programs
Indonesia Naval Technology College
Bumimoro Krembangan Surabaya, 60178
Telp. 031-99000582 ; 031-3298840, 031-3298076
Fax. 031-99000583
www.sttal.ac.id

ISSN
2443-2415
9 772443 241005

Indonesia Naval Technology College STTAL
Postgraduate International Conference Committee

Condescendent
First Admiral Ir. Avando Bastari
Commander of Indonesia Naval Technology College

Chairman of Committe
Captain Navy Dr. Ahmadi
Directore of Postgraduate Studies Program, Indonesia Naval Technology College

Vice Chairman of Committte
Commander Navy Dr. Okol Sri Suharyo
Chief of ASRO Program Studies, Indonesia Naval Technology College

Secretary
Lieutenant Commander Priyadi Hartoko

Section of Publication/Programme
Lieutenant Commander Arie Marbandi
Lieutenant As’ad Aris
Lieutenant Anton Nugroho

Section of Proceeding
Lieutenant Commander Sukarno
Lieutenant Commander Yudha Sukma
Lieutenant As’ad Aris
Lieutenant Anton Nugroho

Editorial Board
Captain Navy Dr. Ahmadi
Captain Navy Dr. I Made Jiwa Astika
Captain Navy Dr. Adi Bandono
Commander Navy Dr. Okol Sri Suharyo

Local Organising Committe
Lieutenant Commander Rifky Najib
Lieutenant Commander Harry Nurdi
Lieutenant Anton Nugroho
Sergeant Viky Veri
Tajuddin

PREFACE

Dear Authors,
Congratulations on the acceptance of your paper, And thank you for your interest in Postgraduate International Conference, Indonesia Naval Technology College STTAL 2020.

On behalf of the Conference Committee, We would like to formally invite you to attend The STTAL Postgraduate International Conference on Maritime Science and Technology ICMST 2020 on Thursday, September 24th 2020.

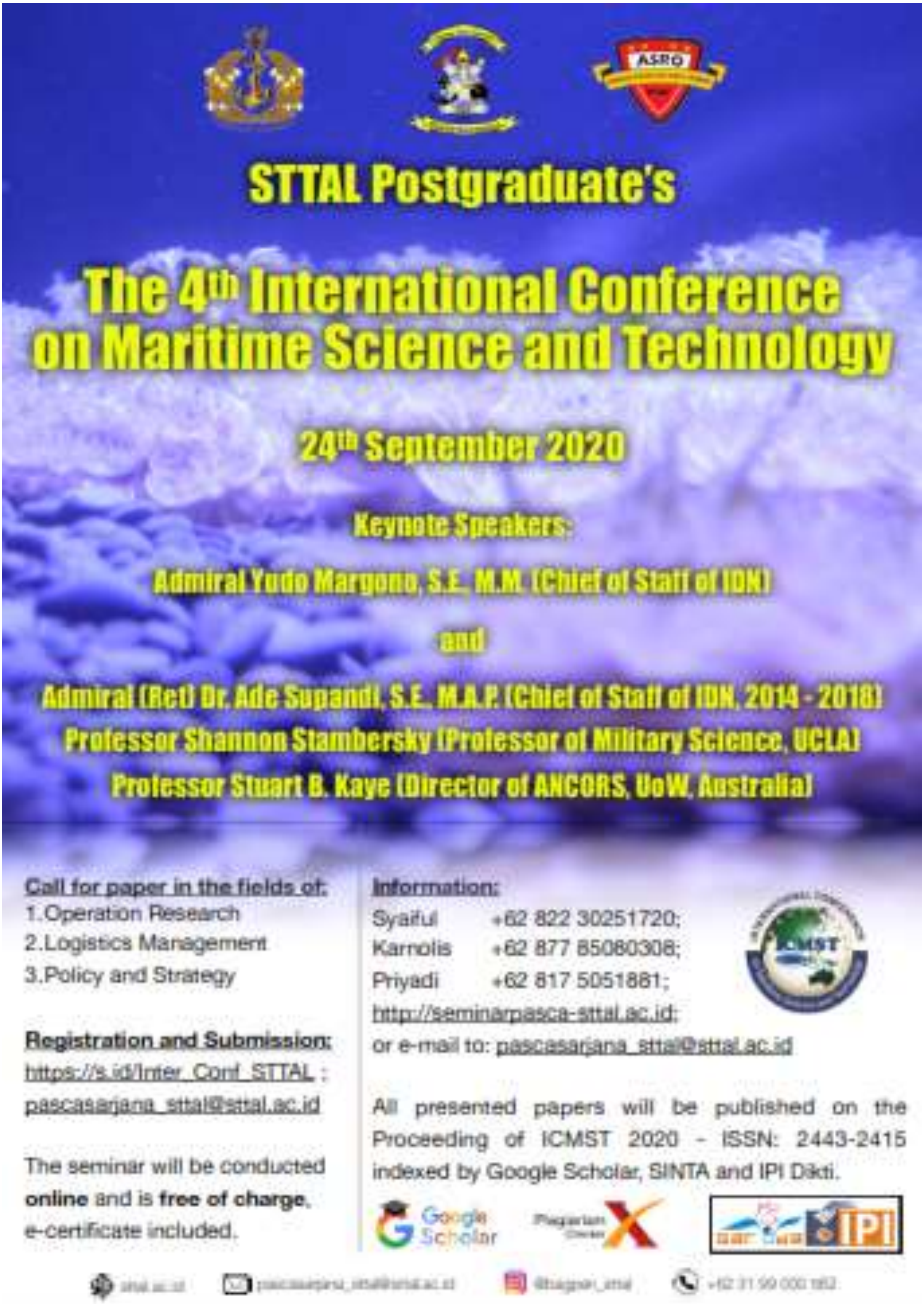
The aim of this international conference is to provide a platform to academics, scholars, researchers and practitioners to present and disseminate the latest innovative ideas, research results, and findings on various aspects of Maritime and Management Science. Presenters will be given the opportunity to have their submissions included in the on-line conference proceedings.

Attendees include educators, students, academic managers, quality assurance and educational system leaders, and researchers. We welcome as many attendees as possible.

We look forward to meeting you on Thursday September 24th 2020.

Surabaya September 24th, 2020
Chairman of Commite,

Dr. Sutrisno, S.T., M.T.
Captain Navy


ASRO
STTAL Postgraduate's
The 4th International Conference on Maritime Science and Technology
24th September 2020
Keynote Speakers:
Admiral Yudo Margono, S.E., M.M. (Chief of Staff of IDN)
and
Admiral (Ret) Dr. Ade Supandi, S.E., M.A.P. (Chief of Staff of IDN, 2014 - 2018)
Professor Shannon Stambersky (Professor of Military Science, UCLA)
Professor Stuart B. Kaye (Director of ANCORS, UoW, Australia)
Call for paper in the fields of:
1.Operation Research
2.Logistics Management
3.Policy and Strategy
Registration and Submission:
https://s.id/Inter_Conf_STTAL ;
pascasarjana_sttal@sttal.ac.id
The seminar will be conducted online and is free of charge, e-certificate included.
Information:
Syaiful +62 822 30251720;
Karnolis +62 877 85080308;
Priyadi +62 817 5051881;
http://seminarpasca-sttal.ac.id;
or e-mail to: pascasarjana_sttal@sttal.ac.id
ICMST
All presented papers will be published on the Proceeding of ICMST 2020 - ISSN: 2443-2415 indexed by Google Scholar, SINTA and IPI Dikti.
Google Scholar
Plagiarism Checker X
IPI

SCEDHULE

International Conference on Maritime Science and Technology
ICMST 2020

Held in STTAL Surabaya, Bumimoro-Morokrembangan, : On Thursday, September 24th 2020

WEBSITE : http://www.seminarpasca-sttal.ac.id/

07.30 - 07.40	Opening Remarks
07.40 - 07.45	National Anthem "Indonesia Raya"
07.45 - 07.50	Opening Prayer
07.50 - 08.00	Executive Remarks by Commander of STTAL
08.00 - 08.30	Keynote Speaker by Chief of Staff on the Indonesian Navy
08.30 - 11.30	**International Conference** / **Seminary** **Speaker** I : Professor Shannon Stambersky (Professor of Military Science, UCLA) **Speaker** II : Dr. Ade Supandi, S.E., M.A.P. (Chief of Staff of IDN, 2014-2018) **Speaker** III : Professor Stuart B. Kaye (Director of ANCORS, UoW, Australia)
11.30 - 12.30	Break
12.30 - 17.00	**Per-Room Seminary,** Presentation by Lecturers & students who send papers, include: **Room I.** *Operation Research Field* **Room II.** *Logistics Management Field* **Room III.** *Policy And Strategy Field*
17.00 – 17.15	Symbolic Delivery of Certificates and Closing

TABLE OF CONTENTS

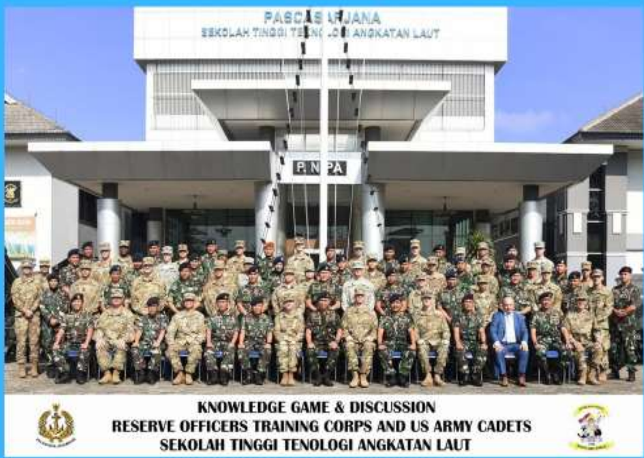
SPEAKERS

FIELD I : OPERATION RESEARCH

FIELD II : LOGISTICS MANAGEMENT

FIELD III : POLICY AND STRATEGY

SPEAKER 1



Leveraging Technology and People to Maintain Security

Shannon Stambersky
Lieutenant Colonel,
US Army (Retired)

Terima kasih!

Agenda

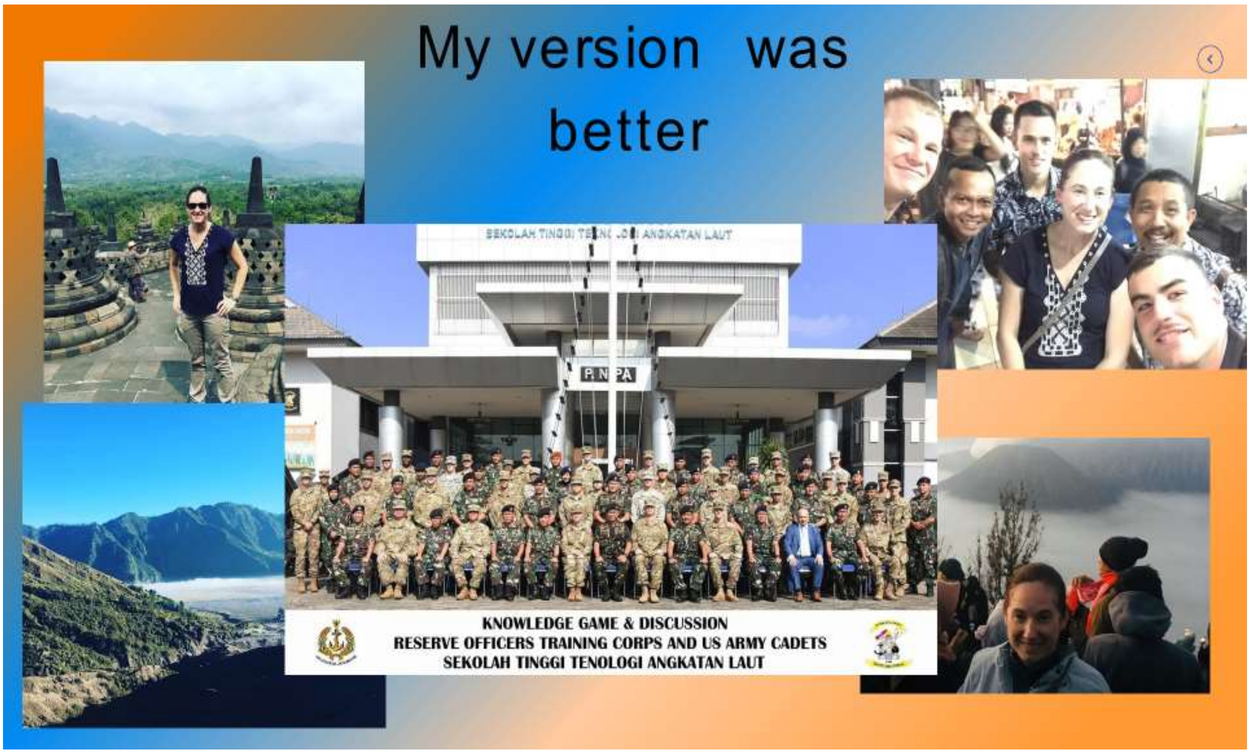
Background and Introduction

Strategic Goals

Leveraging Technology

Questions


What Americans Think of Indonesia


My version was better
KNOWLEDGE GAME & DISCUSSION
RESERVE OFFICERS TRAINING CORPS AND US ARMY CADETS
SEKOLAH TINGGI TENOLOGI ANGKATAN LAUT

About Me

Retired Army Lieutenant Colonel

*Office of Business Transformation, Department of the Army

*Professor of Military Science, UCLA (Mission Commander for Cultural Understanding and Leadership Program to Indonesia)

*Joint Strategic Distribution Officer, Defense Logistics Agency

*Company Commander, 10th Mountain Division (Afghanistan)

*Company Commander, 87th Corps Support Battalion (Iraq)

Currently Business Development and Relationship Manager at Nammo Defense Systems at Picatinny Arsenal, New Jersey

When we cannot know the future, we still want three things....

Security	Terrorism, crime, cyber threats, environment, economics
Stability	Sovereignty, peace, politics
Solidarity	Beneficial partnerships, unity

What do we Leverage?

People

Investment in training, tough and realistic
Continued formal education and personal professional development

Technology

Commit to modernization
Increase your capabilities and lethality
Be creative

Partnerships

Collaboration on common goals
Training exercises

07

Your Ideas

Question 1

Where do you see your biggest barriers areto modernization?

Question 2

What do you think you should be doing to more of?

Question 3

What has beenthe technology that has helped you themost?

Contact Information

Indonesian Navy visit to Nammo HQ in Norway in 2019

Jørn Amundsen,
Nammo Representative
for Indonesia

jorn.amundsen@nammo.com

Shannon Stambersky,
Business Development and
Relationship Manager, Nammo
Defense Systems

sstambersky@nammo.us

SPEAKER 2

MEMBANGUN TEKNOLOGI MARITIM YANG BERDAYA SAING UNTUK MENUJU NEGARA MARITIM YANG DIGDAYA

Oleh: Laksamana TNI (Purn) Dr Ade Supandi, S.E, M.AP[1]

Pendahuluan

Indonesia yang memiliki 2/3 wilayahnya berupa lautan dan terletak di posisi persilangan dunia sudah tentu harus memprioritaskan pembangunannya ke arah maritim. Menurut Teori Sir Walter Raleigh (1554-1618), siapa yang menguasai laut akan menguasai perdagangan/kekayaan dunia dan akhirnya akan menguasai dunia.[2] Tentunya Indonesia tidak memiliki hasrat ekspansif untuk kuasai dunia, karena bertentangan dengan filosofi Pancasila yang menghendaki perdamaian dunia.

Prinsip Indonesia dalam mengelola lautnya yang seluas 6,2 juta km persegi ini lebih ditujukan untuk kepentingan nasionalnya. Terutama dalam melindungi bangsa Indonesia, memajukan kesejahteraan umum dan mencerdaskan kehidupan bangsa.[3] Sehingga Indonesia perlu membangun kekuatan maritimnya. Hal itu senada dengan pandangan Geoffrey Till yang mengemukakan bahwa *output* dari kekuatan maritim ialah untuk kesejahteraan suatu bangsa.

Menurut dia, kekuatan maritim dapat dikelompokan menjadi dua bagian, yaitu sumber kekuatan (*sources*) dan unsur-unsur kekuatan (*elements*). Hubungan antara sumber-sumber kekuatan dan unsur-unsur yang menentukan kekuatan laut dari suatu negara sangat erat dan saling menentukan. Sumber-sumber kekuatan meliputi: geografi, sumber daya, komunitas maritim dan pemerintahan. Sedangkan unsur-unsur kekuatan meliputi armada kapal sipil/militer, teknologi, dan pangkalan/pelabuhan.[4]

---

[1] Disampaikan dalam Seminar Internasional berjudul “The 4th International Conference On Maritime Science and Technology’” yang diselenggarakan oleh Sekolah Tinggi Teknologi Angkatan Laut (STTAL), 24 September 2020.
[2] Aritonang, S., Laksmono, R., & Hardiyanto, B. (2017). OPTIMASI PENGAMANAN TRANSPORTASI KOMODITAS STRATEGIS DALAM MENDUKUNG KEAMANAN MARITIM DI SELAT MALAKA DAN ALUR LAUT KEPULAUAN INDONESIA I. *Ketahanan Energi, 3*(1).
[3] Amanat Pembukaan UUD 1945 Alinea IV
[4] Till, Geoffrey. (2004) Sea Power: A Guide for the Twenty-First Century, London: Frank Cass Publishers.

Dengan kata lain, untuk bisa memanfaatkan laut sebagai sumber kemakmuran bangsa maka diperlukan *tools* – perangkat teknologi yang mumpuni. Begitu juga untuk mengantisipasi adanya ancaman di laut, maka kemutakhiran teknologi sangat diperlukan. Dengan demikian, fungsi laut sebagai *security belt* dan *prosperity belt* dapat diwujudkan yang selaras dengan cita-cita luhur bangsa Indonesia.

Teknologi di bidang kemaritiman berkaitan dengan sarana dan prasarana untuk kepentingan *monitoring* (pemantauan), *control* (pemeriksaan), *surveillance* (pengamatan), dan *command and control* atau komando pengendalian (Kodal).[5] Elemen-elemen tersebut berkaitan erat dengan penerapan teknologi mutakhir yang ditetapkan melalui sebuah strategi - kebijakan yang komprehensif guna mendukung pembangunan ekonomi di laut.

Secara harfiah, teknologi terdiri dari *technoware* yang menyangkut peralatan fisik, *humanware* merupakan pengguna technoware, *infoware* merupakan dokumen informasi dan *orgaware* merupakan teknologi yang melekat pada organisasi.[6] Menurut Ahmad (2014), teknologi mencakup peralatan yang digunakan baik untuk produksi, komunikasi, informasi dan kontrol.[7]

Dalam kaitan dengan teknologi ini, persoalan lain yang mengemuka dihadapi Indonesia adalah aksesibilitas dan konektivitas pulau-pulau kecil dengan *mainland* dalam membuka keterisolasian. Hal itu berkaitan pada permasalahan maritim kontemporer yang menyangkut konektivitas yang erat kaitannya dengan pemerataan serta pertumbuhan ekonomi.

Pada level ini, kebutuhan masyarakat kepulauan menghadapi banyak persoalan teknologi, begitu pula dengan persoalan teknologi di tingkat negara. Misalnya seperti

[5] Munaf.D dan Susanto. (2014) Geopolitik dan Geostrategi. Jakarta: PT Gramedia Kompas Utama hal 11.
[6] Safrudin MN, Susilo FH, dan Ciptomulyono U. (2019). Pengukuran Kontribusi Komponen Teknologi Pada Kapal MM Menggunakan Metode Kombinasi Teknometrik Dan Analytical Hierarchy Process (AHP). Jurnal Seskoal 1-2
[7] Ahmad S. (2014) Technology in Organizations. *Int, J. Res. Bus. Manag.* 2:2321-886

teknologi untuk pertahanan dan keamanan di bidang kemaritiman, terutama dalam pengamanan Alur Laut Kepulauan Indonesia (ALKI).[8]
Dengan menerapkan teknologi diharapkan tidak ada lagi istilah 'anak tiri' bagi daerah-daerah Tertinggal, Terpencil, Terluar dan Perbatasan (3TP) di Indonesia. Hal tersebut tentunya sangat selaras dengan visi Pemerintahan Joko Widodo pada tahun 2014 untuk mewujudkan Indonesia sebagai Poros Maritim Dunia, di mana konektivitas menjadi tulang punggungnya. Sehingga visi ini mengandung nilai kedaulatan negara di laut baik dalam penegakan hukum, pertahanan-keamanan, sosial politik, maupun ekonomi.

Melihat fenomena itu, pengembangan dan kemandirian teknologi sangat penting dilakukan oleh Indonesia dalam menghadapi segala ancaman di laut dan pembangunan ekonomi untuk mewujudkan kedaulatan maritimnya. Berkaca juga dengan negara-negara maju yang mampu mengelola lautnya, pada umumnya mereka diawali dengan penguasaan teknologi terlebih dahulu.

Dengan merintis pembangunan teknologi secara *holistic* dalam bidang maritim sangat terbuka peluang Indonesia untuk menjadi negara maju yang menguasai lautan, bukan dalam arti untuk ekspansi dan berperang, tapi mengelola potensinya untuk kepentingan bangsa. Oleh karena itu, pembangunan teknologi maritim yang mandiri, inovatif dan berdaya saing menjadi kata kunci dalam perwujudan negara maritim yang digdaya dalam bingkai visi Poros Maritim Dunia.

Pembahasan

Dalam membangun teknologi yang sangat diperlukan pertama-tama ialah adanya inovasi. Dengan adanya inovasi tersebut maka akan berpengaruh pada kualitas dari teknologi beserta dengan modifikasinya.

Guna menuju ke arah sana maka perlu manajemen teknologi. Menurut hamid et.al (2012) terdapat 8 prinsip dalam manajemen teknologi, yaitu *technology development,*

---

[8] Pardosi, A. S. (2016). Potensi dan Prospek Indonesia Menuju Poros Maritim. *EJournal Ilmu Hubungan Internasional*, *4*(1), 17-26.

technology improvement, technology leadership, technology patnership, technology pioneering, technology integration, technology value dan *technology standart*. [9]

Melalui sinergitas Kementerian/Lembaga, Perguruan Tinggi, BUMN dan BUMS serta masyarakat luas, manajemen teknologi dengan prinsip di atas harus mampu dikelola dengan maksimal. Selanjutnya tinggal memprioritaskan begaimana untuk mencapai percepatan yang akurat dalam pencapaian hasilnya. Pencapaian itu tentunya ditujukan untuk menjadikan Indonesia sebagai negara maju yang berdaya saing global.

Prinsip itu sejalan dengan penentuan tingkat daya saing negara yang dituangkan pada peringkat *Global Competitiveness Index*, di mana terdapat 3 (tiga) klaisifikasi kelompok dalam suatu negara yang menjadi tolok ukurnya. Kelompok pertama merupakan persyaratan dasar yang diperlukan negara untuk berkompetisi, antara lain kelembagaan, infrastruktur, kondisi ekonomi makro dan tingkat pendidikan serta kesehatan masyarakat yang dianggap sebagai penggerak utama pertumbuhan ekonomi.

Kemudian kelompok kedua adalah faktor yang berkolerasi terhadap peningkatan efisiensi dan produktivitas ekonomi seperti pendidikan tinggi dan pelatihan (kualitas sumber daya manusia), kinerja pasar yang efisien, serta kesiapan teknologi di tingkat nasional maupun lokal. Sedangkan kelompok ketiga adalah faktor inovasi dan kemajuan proses produksi lokal berkorelasi terhadap tingkat inovasi sebuah negara.[10]

Teknologi dan inovasi memiliki indikator antara lain kecanggihan, kemanfaatan dan efektivitas. Kusumo dalam Rahmasari (2016) menyatakan bahwa inovasi sebagai transformasi suatu ilmu pengetahuan menjadi produk yang baru, yang bisa juga diproses dalam bentuk jasa. Inovasi juga meliputi proses teknis, fisik, dan pengeahuan

---

[9] Hamid S-R, Chew B-C, Halim S. 2012. What's the Principles of Technology Management-Eliciting Technology Management Principles through Expert opinion. Int. J. Innov.Manag. Technol. 3:631-636. Doi:10.7763/IJIMT.2012.V3.310

[10] Bappenas (2015) dalam Laporan Implementasi Tol Laut, Kementerian PPN/Bappenas, Direktorat Transportasi, Jakarta.

yang bertujuan untuk mengembangkan produk baru atau produk yang sudah ada dalam meningkatkan efektifvitas teknologi.[11]

Dalam bidang kemaritiman, pembangunan teknologi dengan pengembangan inovasi tidak dapat dipisahkan. Suatu sistem teknologi yang memiliki daya saing untuk mengelola dan memanfaatkan laut akan berimplikasi kepada perwujudan fungsi laut sebagai *security belt* dan *prosperity belt.* Sehingga pembahasan di sini, penulis lebih mengulas kepada keutamaan teknologi untuk keamanan maritim dan pembangunan ekonomi maritim.

a. Teknologi untuk Keamanan Maritim

Keamanan maritim menjadi salah satu tolok ukur pencapaian negara maritim. Indonesia yang memiliki 3 ALKI dan 4 *choke points* dunia, sudah tentu aspek keamanan maritimnya menjadi sorotan dunia internasional. Pencapaian keamanan maritim intinya untuk menghalau segala ancaman di laut yang berdampak pada kepentingan nasional.

Secara teoritik, ancaman *(threat)* akan terjadi apabila ada perkalian antar unsur I (*intention*), C (*capability*), C (*circumstance*). Sebaliknya, anacaman akan bernilai dengan nol, apabila salah satu unsur dari *intention, capability,* dan *circumstance* sama dengan nol. Besaran ancaman sangat tergantung pada besaran tiap elemen, dan pekerjaan intelijen (yang mengumpulkan informasi) untuk meniadakan ancaman atau memperkecil (*minimizing*) ancaman sehingga tidak memiliki daya merusak bagi negara.[12]

Maka dari itu, guna mengatasi tingkat ancaman di laut yang semakin kompleks, kemutakhiran teknologi sangat menunjang dalam keberhasilan operasi keamanan maritim di perairan Indonesia. Terlebih dalam era Fifth Generation Warfare (5GW)

[11] Rahmasari, L. (2018). ANALISIS PENGARUH PENERAPAN TEKNOLOGI INFORAMASI DAN INOVASI TERHADAP KEUNGGULAN BERSAING SERTA DAMPAKNYA TERHADAP KINERJA PERUSAHAAN FREIGHT FORWADING. *JURNAL SAINS DAN TEKNOLOGI MARITIM*, *18*(1), 65-75.
[12] Mangindaan R. (2014) Membangun Intelijen Maritim Indonesia. Jurnal Maritim edisi Desember, 17

atau peperangan generasi kelima seperti sekarang, adanya *accelerated warfare* atau peperangan terakselerasi menjadi ciri utamanya.

Dunia militer pun saat ini tengah mengembangkan sebuah konsep *Network Centric Warfare* (NCW) yang bertujuan untuk mendiseminasi informasi operasional dan tempur melalui jaringan terpusat dan sistematis. NCW memungkinkan satuan yang terpisah secara geografis untuk berbagi informasi mengenai keadaan operasi terkini.

Menurut Smith, NCW secara umum terdiri atas tiga aspek teknologi yaitu teknologi sensor, teknologi informasi dan teknologi persenjataan.[13] Oleh karenanya, potensi pengembangan aplikasi teknologi informasi yang terus berkembang dan tidak memiliki batasan penggunaan di laut melalui Reseach & Development (R&D) harus dilakukan dengan baik dan benar.

Teknologi pengawasan keamanan di laut berkaitan dengan *technology development, technology improvement, technology pioneering,* dan *technology integration.* Di mana prinsip-prinsip tersebut dapat dikombinasikan menjadi suatu desain teknologi yang tepat guna, yakni desain teknologi yang mengandalkan otomatisasi sistem melalui alat tanpa awak (*unmanned system*) yang terus memantau titik-titik strategis di perairan Indonesia.

Lebkowsky dalam Santoso et. al 2017, menyatakan bahwa otomatisasi sistem itu dapat diintegrasikan dengan tujuan meningkatkan kemampuan operasi pengamanan dari segi efisiensi bahan bakar, ramah lingkungan, keamanan, kenyamanan, dan keselamatan kapal melalui cara yang efektif untuk monitoring, data *sharing, maintenance, solution*, sampai berkembang menjadi sebuah *intelligent system.*[14] Variabel-variabel itu sangat dibutuhkan dalam membangun *maritime intelligent system*. Secara umum, *maritime intelligent system* ditujukan untuk mengurangi atau meniadakan ancaman di laut.

---

[13] Smith Jr, EA.2001. *Network Centric Warfare: What's The Point*? Review 54. No.1, Rhode Island: Naval War College

[14] Santoso, A., Lin, J., Kusuma, I. R., & Koenhardono, E. S. (2017, December). Penerapan Sistem Elektronik Terintegrasi pada Rancang Bangun Kapal Patroli Buatan Dalam Negeri untuk Meningkatkan Kemandirian Bangsa didalam Menjaga Kedaulatan Maritim. In *Seminar MASTER PPNS* (Vol. 2, No. 1, pp. 225-228).

Dengan laut yang luas dan banyaknya pulau, teluk, serta selat di perairan Indonesia khususnya di ALKI III (perairan Indonesia timur) maka perangkat alutsista yang efektif ialah dengan menggunakan teknologi tanpa awak yang dipasang di setiap titik-titik strategis. Begitu pula dengan intensitas patroli dari kapal-kapal milik TNI AL, Bakamla, Polair dan lainnya juga harus lebih intensif dan terpadu.

Alutsista seperti kapal-kapal patroli beserta amunisi dan personelnya dalam Sistem Senjata Armada Terpadu (SSAT) masih diprioritaskan untuk diperbanyak unitnya. Kendati secara biaya, penggunaaan alutsista berbasis konvensional itu jauh lebih besar ketimbang penggunaan otomatisasi sistem teknologi untuk pengawasan. Adapun penggunaan kapal patroli lebih diutamakan untuk meng-*intercept* kapal atau oknum yang telah terdeteksi melakukan pelanggaran di laut.

Sehingga operasi menggunakan kapal patroli bisa diminimalisir untuk menghemat bahan bakar dan keperluan personel. Selain itu, dengan menggunakan otomatisasi sistem teknologi bisa dilakukan selama 24 jam 7 hari penuh. Sedangkan dengan patroli secara manual hanya terbatas pada waktu-waktu tertentu, sementara ancaman bisa terjadi setiap waktu atau kapan pun.

Pembangunan teknologi keamanan maritim harus disesuaikan dengan perkembangan arus digitalisasi yang tepat guna serta efisien. Hal tersebut juga berpengaruh pada digitalisasi sistem data dan informasi yang berbentuk Big Data atau dikenal dengan *e-government* yang berkaitan dengan pencapaian *good maritime governance.* Karena penguasaan data dan informasi sangat penting dalam proses pengamanan laut sehingga tercipta *Early Warning System* (EWS) untuk mencegah terjadinya ancaman.

b. Teknologi untuk Pembangunan Ekonomi Maritim

Kusumastanto (2014) mengemukakan dalam membahas ekonomi maritim atau kelautan, tidak terlepas dari 7 (tujuh) spektrum strategis sektor ekonomi yaitu (1) perikanan; (2) pariwisata bahari; (3) pertambangan dan energi kelautan; (4) industri maritim; (5) transportasi laut; (6) bangunan kelautan; dan (7) jasa kelautan.[15] Sehingga pembangunan teknologi untuk penopang ekonomi kelautan harus dituangkan dalam ketujuh spektrum tersebut.

Teknologi yang diciptakan pun harus tetap mempertahankan keseimbangan antara kepentingan ekonomi dan keseimbangan ekologi. Teknologi berbasis keseimbangan ekonomi-ekologi harus digunakan sebagai prinsip pokok dalam pemanfaatan kekayaan laut. Misalnya dalam teknologi penangkapan ikan, budidaya ikan dan biota laut, sekaligus teknologi pengolahan yang digunakan.

Teknologi perikanan di negara maju sudah lama menerapkan teknologi *fish finder* yang mampu mendeteksi keberadaan gerombolan ikan di kedalaman. Kemudian ada teknologi *hidro thermal* yang mampu menghasilkan energi listrik dari gelombang air laut yang juga makin berkembang di negara maju. Bioteknologi juga mampu menemukan berbagai bahan bermanfaat untuk alternatif pangan, kesehatan, kosmetik, maupun pertahanan. Itu semua perlu dikembangkan di Indonesia (Supandi, 2018).

Selain itu ada aplikasi teknologi akustik bawah air yang sudah dikembangkan di enagra maju. Menurut Prof. Dr Indra Jaya penggunaan teknologi itu diperlukan dalam pengukuran kedalamalam (bathymetry), identifikasi dan klasifikasi, sedimen dasar laut, pemetaan terumbu karang dan vegetasi bawah air, pemantauan migrasi vertikal plankton, identifikasi jenis kawanan ikan, estimasi densitas dan biomassa stok ikan, pengukuran arus, tinggi paras laut, dan estimasi spektrum gelombang permukaan.[16] Wajib hukumnya bagi Indonesia untuk mengembangkan teknologi tersebut guna menopang industri kelautan dan perikanan nasional.

Jamaluddin Jompa (2014) berpandangan reorientasi dan revitalisasi pengelolaan sumber daya pesisir dan laut Indonesia sangat dibutuhkan untuk mendorong industri bioteknologi kelautan, mineral laut dalam (*deep ocean water*), wisata bahari, energi kelautan, industri pelayaran, dan pengembangan komoditas garam.

[15] Kusumastanto, T (2014) "Penguatan Struktur Ekonomi Maritim Sebagai Mainstream Pembangunan Nasional" dalam PPAL Maritime Review, Jakarta.
[16] Tetap, G. B., IndraJaya, I., & Sastrakusumah, A. S. (2011). Penginderaan jauh sumberdaya dan dinamika laut dengan teknologi akustik untuk pembangunan benua maritim Indonesia.

Selain itu, unsur deposit mineral hidrotermal yang terdapat di dasar laut termasuk kandungan emas, bisa ditemukan di perairan Indonesia. Jadi, jangan pernah berpikir kandungan emas hanya terdapat di daratan. Kalau teknologi dimaksimalkan, kandungan yang bernilai ekonomi tinggi bisa juga ditemukan di laut.

Jompa juga menyatakan areal penggaraman di perairan Indonesia termasuk daerah di Kabupaten Jeneponto, Sulawesi Selatan seluas 37 ribu hektar memiliki potensi yang cukup besar untuk dikembangkan dengan teknologi yang mudah dikuasai. Jika pengembangan ini berhasil, program penanggulangan akibat kekurangan yodium (GAKY) bisa didukung dengan penguatan teknologi pengelolaan areal penggaraman.

Mantan Menteri Riset dan Teknologi (Menristek) Gusti Muhammad Hatta (2011-2014) mengakui, teknologi sangat diperlukan dalam memanfaatkan potensi kelautan Indonesia. Di hulu, penggunaan teknologi tepat guna dapat digunakan dalam memaksimalkan kegiatan pendukung eksplorasi sumber daya alam kelautan dan perikanan.

Teknologi yang bisa digunakan, yakni produksi benih unggul, teknologi alat tangkap, teknologi kotak pendingin, teknologi penunjang energi, dan instalasi pengolahan air. Begitu pula pada bagian proses, teknologi tepat guna digunakan untuk pemisahan daging, tulang ikan, dan pengasapan ikan. Pada pengemasan pun bisa menggunakan mesin pengemas atau *vacuum frying*.

Gusti berharap melalui teknologi tepat guna, sumber daya kelautan nasional dapat dioptimalkan. Apalagi di era digital ini mulai dimanfaatkan untuk pengembangan teknologi di industri kemaritiman Indonesia. Selangkah demi selangkah pemerintah dan swasta mulai mendayagunakan kemajuan sains dan teknologi lewat penggunaan teknologi informasi kelautan. Kendati pemanfaatan teknologi itu bermula dari kenyataan minimnya pengawasan terhadap teritorial laut Indonesia hingga mengharuskan pemakaian teknologi informasi (TI) kelautan (Supandi, 2018).

Untuk penguasaan teknologi galangan kapal nasional dalam beberapa tahun belakangan menunjukkan perkembangan yang cukup membanggakan. Sebagai acuan, berdasarkan *World Shipbuilding Statistics*, edisi Juni 2007, menempatkan Indonesia sebagai salah satu negara pembangun kapal dari 22 negara jajaran dunia.

Penulis berkeyakinan untuk mencapai kejayaan maritim suatu bangsa bisa dilihat dari kemampuan dalam membangun kapal.[17]

Berdasarkan data Kementerian Perindustrian (Kemenperin) tahun 2019, potensi pembangunan kapal di Indonesia sangat besar melalui program peremajaan kapal yang berumur di atas 25 tahun. Dapat dilihat di tabel berikut.

No	Jenis Kapal	Ukuran	Jumlah
1	General Cargo	s/d 10.000 DWT	618
2	Bulk Carrier	s/d 70.000 DWT	21
3	Container	s/d 1.800 TEUs	245
4	Oil Tanker	s/d 30.000 DWT	215
5	Ferry Ro-Ro	s/d 6.000 GT	218
6	Tug Boat	s/d 3.000 HP	336
7	Supply Vassel	s/d 3.000 HP	31
		Total	1.684

Kemudian berdasarkan data Kementerian Perhubungan (Kemenhub) pada proyek pengadaan kapalnegara tahun 2015-2018 yang dikerjakan oleh industri galangan kapal dalam negeri tertera dalam tabel berikut:

No	Tipe Kapal	Jumlah Kapal	
		APBN	APBN-P
1	Coastal Cargo Pasenger 750 DWT (Kapal Perintis)	6	
2	Coastal Cargo Pasenger 500 DWT (Kapal Perintis)	2	
3	Coastal Cargo Pasenger 200 DWT (Kapal Perintis)	2	
4	Navigation Ship (Kapal Induk Perambuan)	5	
5	Navigation Ship (Kapal Pengamat Perambuan)	5	
6	Navigation Ship	10	

[17] Dilihat dari http://samudranesia.id/kejayaan-maritim-suatu-negara-tergantung-dari-kapasitas-membuat-kapal/ diakses pada 7 September 2020 pukul 20.15 Wib.

7	Patrol Ship Class II	2	
8	Patrol Ship Class III (Aluminium)	6	
9	Patrol Ship Class IV	10	
10	Patrol Ship Class V	25	
11	Coastal Cargo Pasenger 2000 GT (Kapal Perintis)		25
12	Coastal Cargo Pasenger 1200 GT (Kapal Perintis)		10
13	Coastal Cargo Pasenger 750 GT (Kapal Perintis)		5
14	Container Ship 100 TEUs		15
15	Small Feeder Pasanger Ship (Kapal Rede)		20
16	Livestock Carrier (Kapal Ternak)		5
	Total	73	90

Menurut Ketua Umum IPERINDO Eddy Kurniawan Logam, pada posisi 31 Oktober 2018 total armada sebanyak 29.928 kapal (45 juta GT), bila dibandingkan dengan bulan Mei 2005 yang total armadanya sebanyak 6.041 unit kapal (5,67 juta GT) maka terjadi peningkatan jumlah armada sebanyak 23.887 kapal. Ia memprediksi jumlah tersebut akan semakin bertambah bila diiringi juga dengan daya beli perusahaan pelayaran melalui pemberian intensif suku bunga pinjaman yang rendah, jangka pengembalian pinjaman yang panjang dan kapal yang sedang dibangun dapat dijadikan sebagai agunan.[18]

Masalah lain yang dikembangkan dalam ekonomi maritim berkaitan dengan teknologi tentunya soal digitalisasi. Saat ini menurut data Direktorat Jenderal Perhubungan Laut – Kementerian Perhubungan sudah ada 33 pelabuhan di Indonesia sudah mengembangkan konsep Inaportnet. Dengan demikian arus logsitik dan konektivitas nasional yang ditopang oleh digitalisasi semakin berkembang.

Menurut Chairman Supply Chain Indonesia (SCI) Setijadi, industri logistik nasional yang menggunakan digitalisasi dapat mendongkrak peringkat Logistics Performance Index (LPI) Indonesia menjadi naik, baik untuk di kawasan maupun internasional.

Perusahaan logistik harus mengikuti trend teknologi yang saat ini sedang berkembang seperti *big data analytics, cloud logistics, internet of things, serta robotics and automation.*

Selain itu, perusahaan juga harus memperhatikan perkembangan sosial dan bisnis seperti *omni channel logistics, digital work,* dan *logistics marketplaces*. Penerapan teknologi *blockchain*, misalnya, dilakukan dengan pencatatan transaksi, pelacakan aset, serta pembentukan sistem yang transparan dan efisien dalam mengelola semua dokumen yang terlibat dalam proses logistik untuk memecahkan silo proses yang terfragmentasi.

Sehingga otomatisasi proses secara umum dapat meningkatkan efisiensi biaya yang relevan hingga 20 persen. Sementara, dalam pengelolaan aset perusahaan, digitalisasi dapat berdampak terhadap peningkatan margin sekitar 5 persen. Maka, secara nasional akan mempengaruhi kinerja *tracking & tracing* yang merupakan salah satu dari enam dimensi dalam Logistics Performance Index (LPI) yang menunjukkan kinerja *international gateways* dan konektivitas dalam negeri.

LPI terakhir (2018) menunjukkan untuk dimensi itu, Indonesia berada pada peringkat 39 dari 167 negara dengan skor 3,30. Di antara negara-negara ASEAN, posisi Indonesia di bawah Singapore (skor 4,08), Thailand (3,47), Vietnam (3,45), dan Malaysia (3,15). Posisi Indonesia di atas Philippines (3,06), Laos (2,91), Cambodia (2,52), dan Myanmar (2,20).

Perbaikan kinerja *tracking & tracing* harus dilakukan bersama oleh para pelaku industri dan pemerintah melalui pengembangan sinergi dalam rantai pasoknya dengan memanfaatkan teknologi informasi yang terdigitalisasi.[19]

Penutup

Tujuan utama dalam penerapan teknologi maritim ialah mewujudkan negara maritim yang digdaya untuk kepentingan nasional bangsa Indonesia, utamanya dari sektor keamanan dan ekonomi. Teknologi juga harus mengacu pada prinsip manfaat, kecanggihan/kemutakhiran, efektivitas dan efisiensi.

Memang tidak mudah dalam membangun teknologi yang berdaya saing. Diperlukan SDM yang mumpuni serta anggaran yang besar dalam mencapai itu. Kendati demikian, ada strategi yang bisa dijalankan dalam kondisi-kondisi keterbatasan tersebut. Hal itu mengingat anggaran untuk Riset dan Teknologi (Ristek) masih kurang dari 1 persen PDB kita. Sementara Prof Rokhmin Dahuri menyebut dana Ristek harus mencukupi, sedikitnya 3 persen dari PDB.[20]

Penggunaan teknologi yang tepat guna serta efisien menjadi jawaban untuk menyiasati kondisi keterbatasan tersebut. Misalnya dalam keamanan maritim, perlu diperbanyak penggunaan teknologi *unmanned system* untuk melakukan tercapainya efektivitas dan efisiensi. Sehingga seluruh sumber daya diarahkan untuk bisa memproduksi teknologi *unmanned system* secara masal.

Dalam ilmu ekonomi jika barang melimpah tentu harga akan terjangkau. Pada contoh teknologi *unmanned system* ini, anggaran yang dikeluarkan oleh instansi-instansi terkait akan semakin kecil dan hasilnya dalam operasi keamanan maritim lebih optimal.

Menurut S.P. Hasibuan (1984), efisiensi adalah perbandingan yang terbaik antara *input* (masukan) dan *output* (hasil antara keuntungan dengan sumber-sumber yang dipergunakan), seperti halnya juga hasil optimal yang dicapai dengan penggunaan sumber yang terbatas. Dengan kata lain hubungan antara apa yang telah diselesaikan dan direncanakan seimbang.[21]

Sebaliknya jika tidak seimbang maka yang terjadi ialah inefisiensi. Sehingga sejatinya, penggunaan teknologi maritim ialah untuk memperbesar manfaat serta keuntungan ekonomi di sektor kelautan, bukan sebaliknya yang justru menimbulkan kerugian besar dan tidak tercapainya tujuan bernegara kita.

[20] Dahuri, R (2017) 'Menuju Indonesia Sebagai Poros Maritim Dunia'. Jakarta: Roda Bahari
[21] Dilihat dari https://www.maxmanroe.com/vid/manajemen/pengertian-efisiensi.html diakses pada 5 Agustus

SPEAKER 3

Maritime Enforcement: Legal Issues arising from Emerging Technology

Professor Stuart Kaye

Australian National Centre for Ocean Resources and Security

4th International Conference on Maritime Science and Technology
Surabaya, 24 September 2020

ANCORS

UNIVERSITY OF WOLLONGONG AUSTRALIA

Outline

- UAVs and surveillance and enforcement
  - Maritime
  - Aerial
- Satellites
- Legal constraints
  - Ships
  - Enforcement
- The Way Forward

Source: https://www.youtube.com/watch?v=Kc23H3-Nvt0

ANCORS

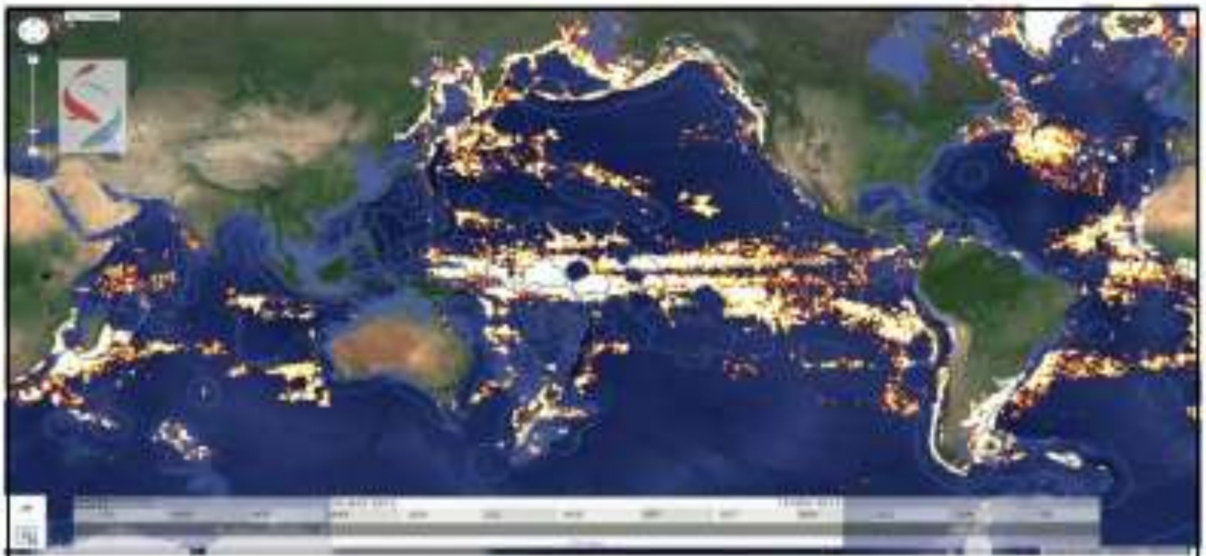
MQ-4C Triton

Range: over 9000 nautical miles at 60,000 feet
Over 30 hours endurance

ANCORS

State	EEZ Size (km²)	Vessels	Area per patrol vessel (per km²)
Kiribati	3.44 million	1	3,442,000
Cook Islands	1.87 million	1	1,870,000
Tuvalu	0.75 million	1	750,000
Fed. States of Micronesia	2.996 million	3	999,000
Marshall Islands	1.990 million	1	1,990,000
Palau	0.604 million	1	604,000

	Patrol Vessel	Surveillance UAV
Initial Cost	$45 – 60 million	$1 million – 20 million
Speed	10 knots (cruising)	90 – 180 knots (cruising)
Compliment	20-25 crew	2-3 operators
Availability	30-90 days per annum	250+ days per annum

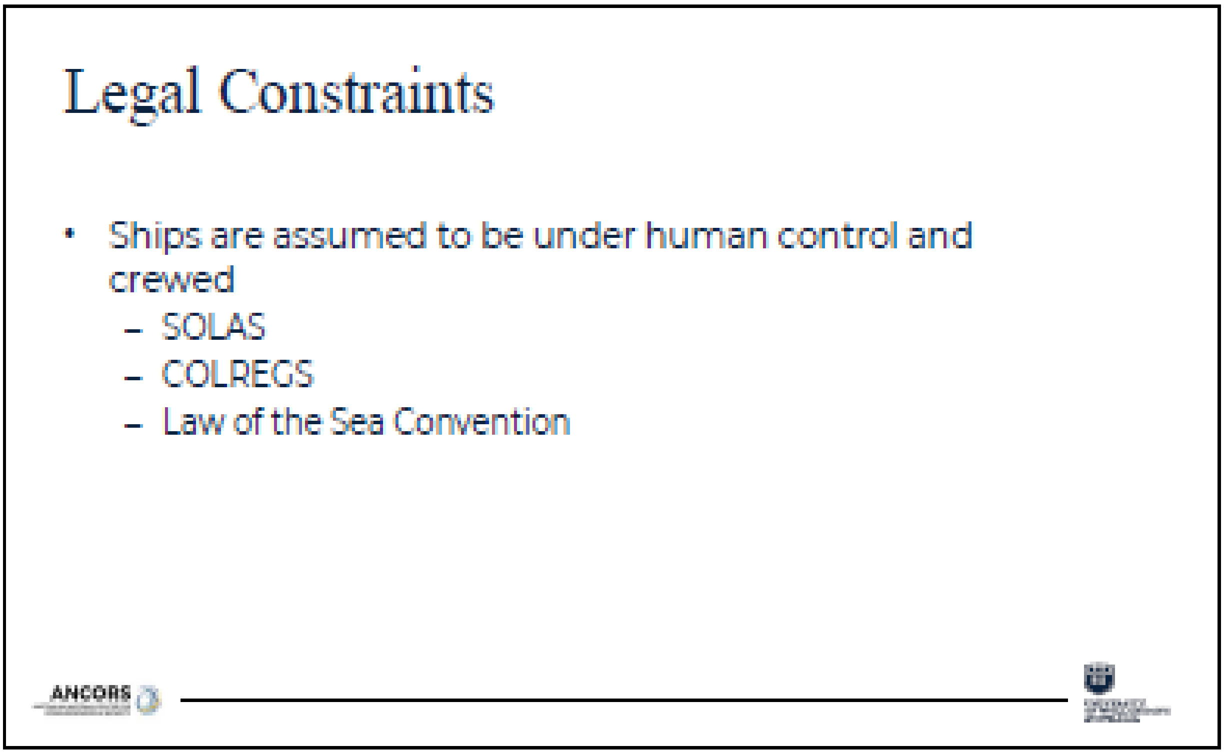


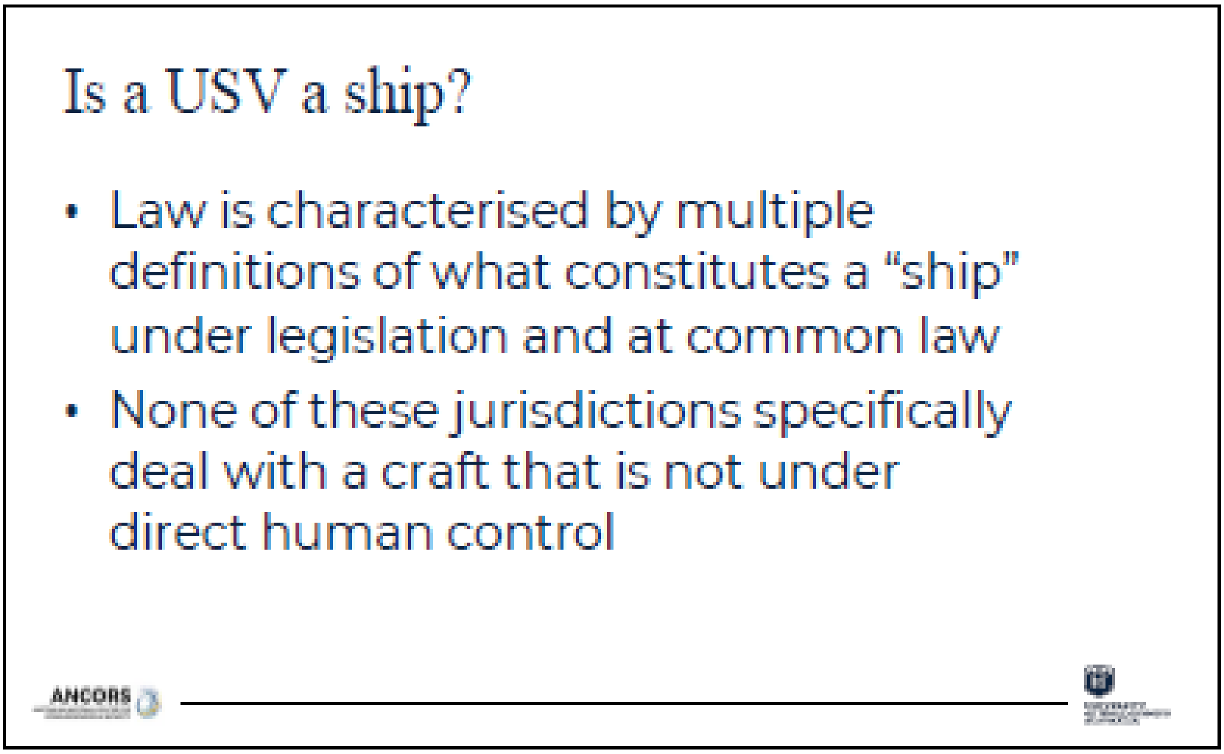
Source: http://www.globalfishingwatch.org/

ANCORS

Source: http://blog.skytruth.org/

ANCORS


Legal Constraints
• Ships are assumed to be under human control and crewed
– SOLAS
– COLREGS
– Law of the Sea Convention
ANCORS


Is a USV a ship?
• Law is characterised by multiple definitions of what constitutes a "ship" under legislation and at common law
• None of these jurisdictions specifically deal with a craft that is not under direct human control
ANCORS

Australia

Admiralty Act 1988 - Section 3

- "*ship*" means a vessel of any kind used or constructed for use in navigation by water, however it is propelled or moved, and includes:
  - (a) a barge, lighter or other floating vessel;
  - (b) a hovercraft;
  - (c) an off-shore industry mobile unit; and
  - (d) a vessel that has sunk or is stranded and the remains of such a vessel; but does not include:
  - (e) a seaplane;
  - (f) an inland waterways vessel; or
  - (g) a vessel under construction that has not been launched.

New Zealand

Ship Registration Act 1992 – Sect 2

- "*ship*" means every description of boat or craft used in navigation, whether or not it has any means of propulsion; and includes—
  - (a) a barge, lighter, or other like vessel:
  - (b) a hovercraft or other thing deriving full or partial support in the atmosphere from the reaction of air against the surface of the water over which it operates:
  - (c) a submarine or other submersible

ANCORS

Other Jurisdictions

United Kingdom - *Merchant Shipping Act 1995* (c. 21) - Section 2

- "*ship*" includes every description of vessel used in navigation;

India - *Merchant Shipping Act 1958*

- "*vessel*" includes any ship, boat, sailing vessel, or other description of vessel used in navigation;

Canada - *Canada Shipping Act, 2001*, SC 2001, c 26

- "*vessel*" means a boat, ship or craft designed, used or capable of being used solely or partly for navigation in, on, through or immediately above water, without regard to method or lack of propulsion, and includes such a vessel that is under construction. It does not include a floating object of a prescribed class.

ANCORS

Other Jurisdictions

Indonesia- *Shipping Law [Law No.17 of 2008]*

- *Article 1(36):*
  - A Ship is a water vehicle with certain forms and types, powered by wind energy, mechanical energy, and other energies, towed or tugged, included as a dynamic-support power vehicle, sub-surface vehicle, and floating equipment and non-removable floating structures.
  - Kapal adalah kendaraan air dengan bentuk dan jenis tertentu, yang digerakkan dengan tenaga angin, tenaga mekanik, energi lainnya, ditarik atau ditunda, termasuk kendaraan yang berdaya dukung dinamis, kendaraan di bawah permukaan air, serta alat apung dan bangunan terapung yang tidak berpindah-pindah.

ANCORS

Common Law

Not a ship

- *Raft of Timber* (1844) 166 ER 749 (raft)
- *Gas Float Whitton No 2* [1897] AC 337 (floating beacon)
- *Steedman v Scofield* [1992] Lloyds Rep. 163 (jet ski)

A ship

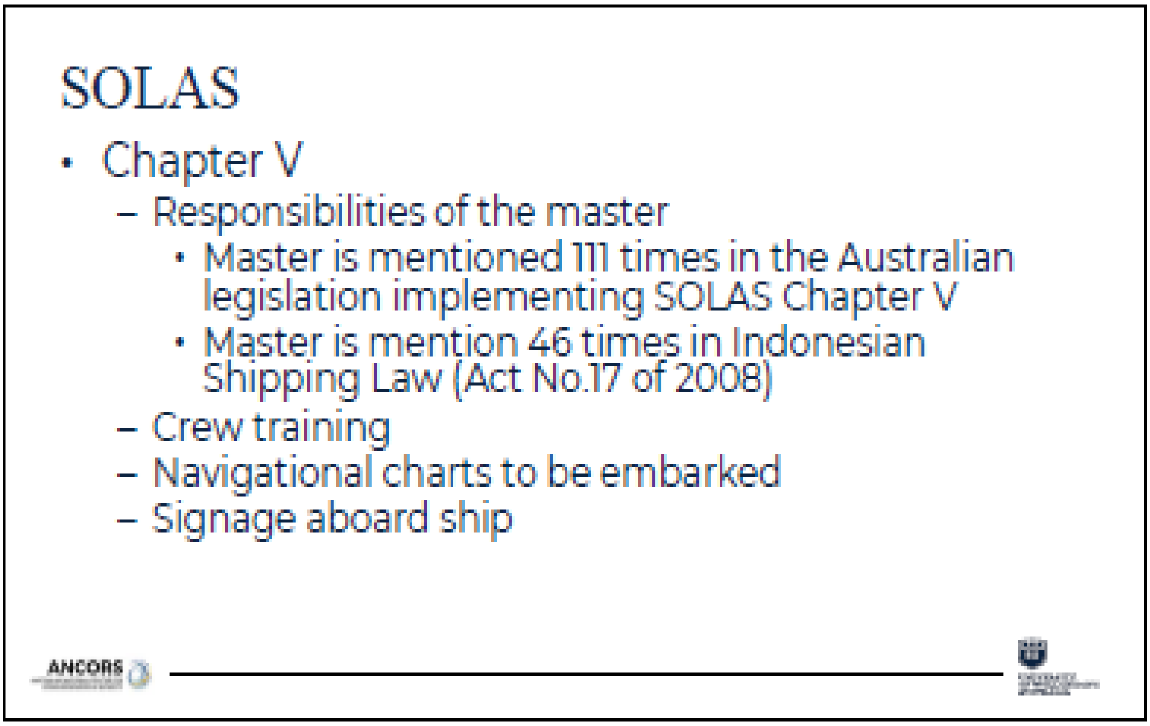
- *The Von Rocks* [1998] 2 Lloyds Rep. 198 (backhoe dredger)
- *Perks v Clark Same* [2001] 2 Lloyds Rep. 431 (jack up rig)

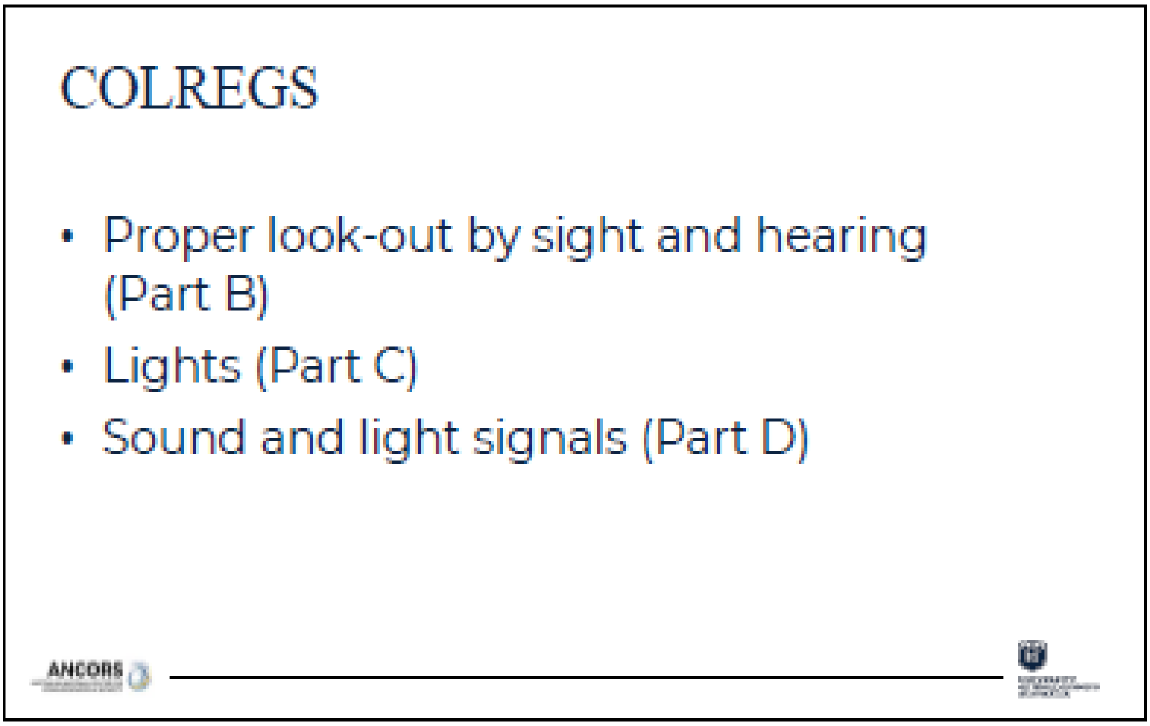
ANCORS

Common Law

- United States Supreme Court in *Lozman v City of Riviera Beach, Florida* (2013) 568 US.
- This case dealt with the status of a houseboat as a ship:
  - "reasonable observer, looking at the home's physical characteristics and activities, would not consider it to be designed to any practical degree for carrying people or things on water".

ANCORS


SOLAS
Chapter V
Responsibilities of the master
Master is mentioned 111 times in the Australian legislation implementing SOLAS Chapter V
Master is mention 46 times in Indonesian Shipping Law (Act No.17 of 2008)
Crew training
Navigational charts to be embarked
Signage aboard ship
ANCORS


COLREGS
Proper look-out by sight and hearing (Part B)
Lights (Part C)
Sound and light signals (Part D)
ANCORS

Law of the Sea Convention – Art 94(4)

(b) that **each ship is in the charge of a master and officers** who possess appropriate qualifications, in particular in seamanship, navigation, communications and marine engineering, and that the crew is appropriate in qualification and numbers for the type, size, machinery and equipment of the ship;

(c) **that the master, officers and, to the extent appropriate, the crew are fully conversant with and required to observe the applicable international regulations** concerning the safety of life at sea, the prevention of collisions, the prevention, reduction and control of marine pollution, and the maintenance of communications by radio.

ANCORS

Law of the Sea Convention – Art 110(2)

In the cases provided for in paragraph 1, the warship may proceed to verify the ship's right to fly its flag. To this end, it may send a boat under the command of an officer to the suspected ship. If suspicion remains after the documents have been checked, it may proceed to a further examination on board the ship, which must be carried out with all possible consideration.

ANCORS

Assumptions

- The law assumes a physical presence to detect an offence
- The law assumes a physical presence to enforce the law
- States will enforce their own law in their own jurisdiction

ANCORS

Hot Pursuit

- *Saiga (No.2)*
  - A radio message as an auditory signal?
    - Position of the Tribunal not explicit (para. 147-148), although implicitly not sympathetic
    - See the separate opinion of Judge Anderson (penultimate paragraph)
  - "good reason to believe that the ship has violated the laws and regulations"
    - Would circumstantial evidence from a satellite be sufficient?

ANCORS

State	EEZ Size (km²)	Vessels	Legislation for receiving electronic evidence
Kiribati	3.44 million	1	None
Cook Islands	1.87 million	1	Physical records only
Tuvalu	0.75 million	1	None
Fed. States of Micronesia	2.996 million	3	Records from data can be received into evidence (Title 12, FSM Code)
Marshall Islands	1.990 million	1	Yes – Evidence Act, 1989 as amended
Palau	0.604 million	1	Yes – Criminal Procedure (Title 18)

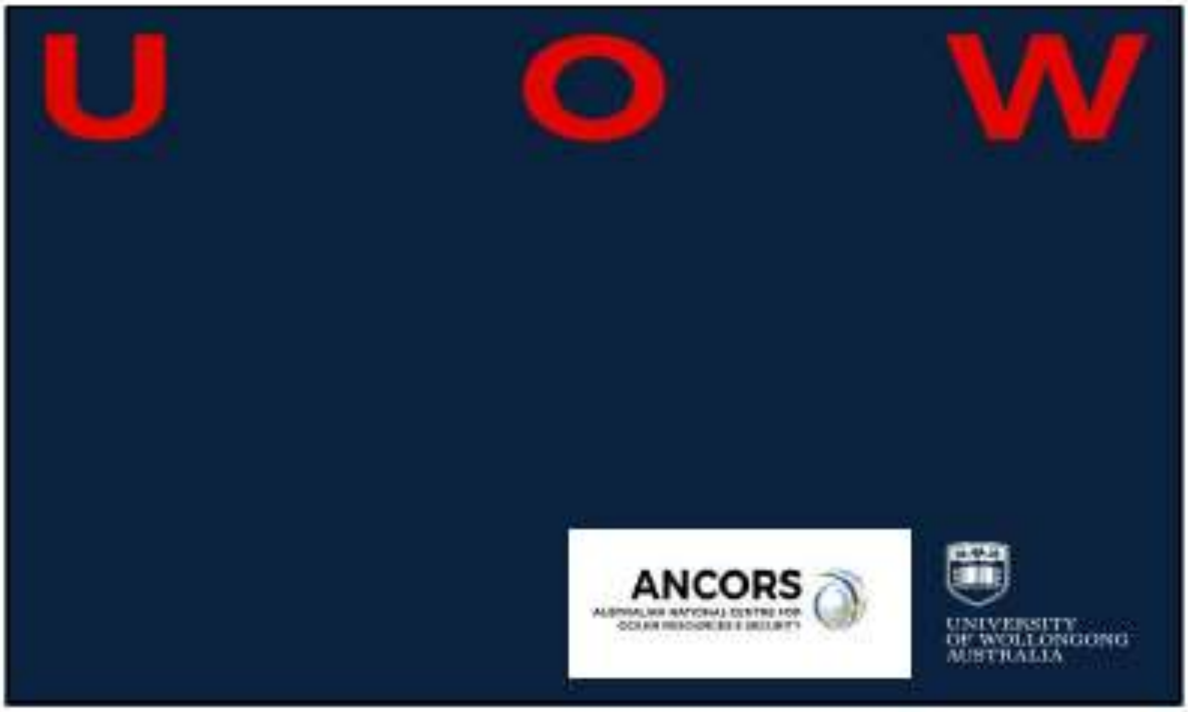
ANCORS

WCPFC

- **Adopted by FFC74, May 2010**
- **Mandate**
  - In recognition of the need for comprehensive monitoring, control and surveillance (MCS) arrangements to ensure the integrity of fisheries management frameworks, Forum Leaders committed themselves and their governments to "the development, with the assistance of the Forum Fisheries Agency (FFA), a comprehensive regional monitoring, control and surveillance strategy."
- **Purpose and Scope**
  - The primary purpose of this strategy is to support compliance with fisheries management frameworks and associated measures at national, sub-regional, regional and WCPFC Commission levels to ensure the long term sustainability of oceanic fish stocks and associated economic benefits flowing from them to Pacific Island Countries.

ANCORS


The Way Forward
Increasing use of VMS and AIS
Extension of security architecture to fishing vessels?
Improving capabilities
First successful prosecution by Kiribati of a vessel detected fishing in the Phoenix Islands Protected areas based entirely on satellite sourced evidence
Need for legislative updating to take account of technology
Possibilities for cooperation in enforcement
Port State Measures Agreement
ANCORS


U
O
W
ANCORS
UNIVERSITY OF WOLLONGONG AUSTRALIA

FIELD I

OPERATION RESEARCH

OPTIMIZATION OF KOARMADA I OPERATION PATTERN IN FACING THREAT OF TERRITORIAL VIOLATION IN NATUNA SEA WATERS

Yoyok Eko Hadi Wijaya[1], Avando Bastari[2], Abdul Rahman[3]

[1,2,3]Indonesian Naval Technology College, STTAL,
Bumi Moro, Moro Krembangan Surabaya - 60178, Indonesia
e-mail: yokhadiwijaya48@gmail.com

ABSTRACT

Operation to secure border areas is an effort and activity to ensure the upholding of state sovereignty at land, sea and air borders with other countries, from all forms of threats and violations including survey and mapping activities. The limited ability of the KRI and the budget provided by the state as well as the need for security of Indonesia's maritime border areas, resulted in the need for a demand for thoughts on optimizing the deployment of KRI at the Aju bases and the operations sector in Natuna Sea waters, by taking into account the type of KRI, speed, endurance, radar coverage and costs. operation. So that the resulting composition of the KRI deployment at the initial base and the border area security operations sector in the waters of the Natuna Sea. This research discusses the optimization of the deployment of KRI at the initial base and in the operational sector in border area security operations in the Natuna Sea waters, to provide an optimal compromise solution between two different objective functions, namely coverage area and operating costs. This problem solving uses the Competitive Profile Matrix approach with the help of superdecision software for weighting the objective function. While the optimization of the KRI power distribution uses the transshipment model method, Goal Programming and Weighted Goal Programming, where all algorithms of the approach are resolved silmutaneously in a syntax using Lingo 11 optimization software.The result of this optimization is that the average coverage area effectiveness is achieved. 450,913 mil2 and the average operating cost efficiency is 40% of the stipulated budget.

Keywords : *Border Area Security Operations, CPM, Optimization Model, Transshipment, Goal Programming, Weighted Goal Programming, Coverage Area, Operating Costs.*

1. INTRODUCTION

The working area of Fleet I Command, which stretches from Sabang waters covering all Sumatra waters including the Malacca Strait to the Sunda Strait and the Natuna Sea, has a high level of vulnerability to law violations and security disturbances at sea. This is because these waters are mostly passed by international shipping and are bordered by neighboring countries. Conflicts that often occur are violations of maritime boundaries, unilateral claims by neighboring countries and other illegal activities. This potential border problem can cause problems related to the legal, economic, social, cultural, defense and security sectors of the country.

The dynamics of the development of the strategic environment, both global, regional and national, have created an increasingly complex spectrum of threats with implications for national defense. Several things that have an impact on security stability in various regions need to be examined, including the policy of the new President of the United States which has had a broad impact on instability in various regions, the increasing tensions in the South China Sea; increased North Korean nuclear weapons and missile development activities; Rohingya humanitarian crisis; changes in the international political map that have led to new problems such as Middle East refugees, conflicts in Iraq, Syria, Yemen, Somalia and Nigeria; the more pressing and unsafe the position of ISIS in Syria and

Iraq, however, they formulated a power base in various countries through acts of terror including Southeast Asia by establishing the Southeast Asian Islamic State in Sulu, Philippines; increasing disease outbreaks, natural disasters and environmental damage; the struggle for energy sources, conflicts of interest, developments in information and communication technology present cyber threats; and other prominent non-traditional security issues, such as efforts to disarm weapons of mass destruction which are placed as one of the crucial issues in global security issues. The development of this strategic environment has an impact on Indonesia's geostrategy and geopolitics in the region. The various problems faced today have implications for shifting the dimensions of threats, both physically and non-physically.

The dimensions of physical threats are military, non-military, and hybrid threats which are categorized as real and not yet real threats. Real threats are threats that are being and must be faced, such as: terrorism and radicalism; separatism and armed uprising; natural and environmental disasters; border territorial violation; piracy and theft of natural resources; epidemic of a disease; cyber and intelligence; distribution and abuse of narcotics; as well as other threats that can interfere with national interests. Meanwhile, the threat is not yet real, namely open conflict (conventional warfare) which is unlikely to occur in the next few years, but still needs to be watched out for in order to prepare national defense early. Meanwhile, the non-physical threat dimension is in the form of ideological threats in terms of communism, socialism, liberalism and radicalism.

Faced with the development of the strategic environment that has occurred in the South China Sea, Natuna Waters, Karimata Strait and land and sea border areas, it is deemed necessary to optimize the title of strength of the marine dimension in the region.

Operations to secure border areas in accordance with the guidebook for the implementation of security operations for border areas (Perpang TNI number: Perpang / 173 // XII / 2011), are all efforts and activities to ensure the enforcement of the country's territorial sovereignty in land, sea and air borders with other countries, from all forms of threats and violations, including survey and mapping activities. The objective is to maintain integrity and prevent and eliminate all forms of threats that may arise in the land, sea and air border areas between the Republic of Indonesia and other countries. While the objectives of the operation relating to the maritime border area are as follows:

a. The maintenance of the integrity of the sea area at the border of the Republic of Indonesia with other countries.
b. The creation of security stability along the maritime borders of the Republic of Indonesia and other countries.
c. Prevention of all illegal activities and / or use for illegal activities in the maritime border area between the Republic of Indonesia.
d. Implementing law enforcement in the maritime border area between the Republic of Indonesia and other countries.

Based on the above, the Indonesian Navy in this case Koarmada I as the operational executing command with the main task of carrying out force projections to carry out marine operations which include marine combat operations and amphibious operations both to support sea control and to achieve strategic objectives in the context of enforcing sovereignty and law at sea. The limited capacity of the KRI and the budget provided by the state as well as demands for securing the territorial waters of the Republic of Indonesia for the assignment of ships in the sectors of the maritime border area security operations in the waters of the Natuna Sea have resulted in the need for a demand for ideas about the deployment of the Indonesian

Navy, in this case the KRI to the Aju base and in the operational sector to secure the maritime border area in the Natuna Sea waters.

Marine security patrols are presence operations at sea that have strategic value for the existence of national sovereignty and maritime security in the Indonesian national jurisdiction. Security disturbances and crimes at sea in the form of illegal fishing, illegal logging, violations of Indonesia's territorial territory and theft of other natural resources require the presence of patrol boats, to safeguard the entire Indonesian archipelago from threats both from within and from abroad.

The following table is data on violations that occurred in the waters of the Natuna Sea.

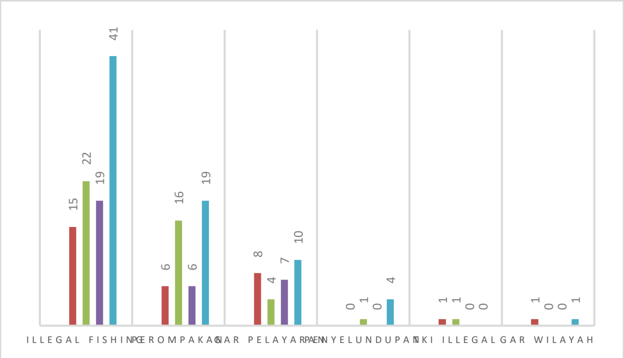


Figure 1. Graph of marine safety violations data 2015-2019

The graph above shows the success of the Indonesian Navy patrol boats in catching criminals at sea. The graph also shows that the type of illegal fishing crime is in the top rank and is increasing every year followed by piracy and shipping violations.

The limited capacity of KRI owned by Koarmada I and the budget provided by the state as well as demands for securing the Indonesian marine area on the assignment of ships in marine security operations sectors in Natuna waters resulted in the need for thinking demands on the optimal distribution of patrol boat assignments, so that the type and type number of supports in safeguards in the operating sectors.

The assignment of elements of the Indonesian Navy in carrying out security operations in border areas is also closely related to logistical support. And one of the logistical functions of the Indonesian Navy is support for base facilities directed to meet the needs of operational units consisting of rebase facilities, maintenance and repair facilities, replenishment facilities, personnel care facilities (rest / recreation).), and base development facilities. The Indonesian Navy base as an integral component of the SSAT is one of the spearheads in carrying out support for border area security operations, so that the Indonesian Navy base will play a very significant role in the success of supporting the Indonesian Navy operations title. In the current operation tactic as a policy of efficiency in the operation title, the tactic of waiting with the base as the waiting point for Indonesian Navy ships is carried out. So that according to its function and position, the base is a strategic component in carrying out the maintenance and maintenance functions of materials and personnel and can provide support for the reaction speed of the action element, namely the ship to the position of the incident at sea.

This research was conducted to optimize the criteria associated with the implementation of border area security operations, these criteria are: coverage area and operating costs. Looking for interdependent relationships or influencing each other between one criterion and another, then calculating the weight of each of these criteria. This study also aims to find the target value of each objective function in accordance with the existing constraints, as well as to find the importance weight of the objective function. The objective function of this study are: maximizing the KRI coverage area and minimizing operating costs.

With the presence of multi criteria in the implementation of border security operations in the waters of the Natuna Sea, this study uses the Multi Criteria Decision Making (MCDM) method. The MCDM method used is the Competitive Profile Matrix (CPM). The Competitive Profile Matrix (CPM) method approach is used to determine the relative weight of criteria or objectives in the implementation of border security operations in the waters of the Natuna Sea, where the relationship between the criteria is dependence or interrelated. The weight assessment in the CPM method is carried out based on the results of a questionnaire to experts / experts so that alternative priority weights will be obtained in relation to the implementation of border security operations in the Natuna Sea waters.

The transshipment method in this study is used to describe the KRI assignment flow, that KRI moves from the main base before heading to the operations sector, the KRI will go through the transshipment point / intermediate point in this case the aju base. Goal Programming method in this research is used to find optimization, in the form of effectiveness and efficiency of the target value of each objective function, namely: maximizing the coverage area and minimizing operating costs.

Goal Programming aims to drink the distance between or deviation (deviation) from the goals, targets or targets that have been set with efforts that can be taken to achieve these targets or objectives satisfactorily in accordance with the existing constraints, in the form of: KRI allocation in the operational sector, capability coverage area (KRI radar), mileage, fuel consumption, operating costs, KRI endurance. While the Weighted Goal Programming method is used to align the value of the weighted goal / goal with the achievement of the weighted goal / goal, resulting in a solution that is more representative of the preferences of decision makers on the goals / goals. Where all the decision variables, objective functions, constraints of the three optimization methods (transshipment, goal programming, weighted goal programming) are resolved silmutaneously in a syntax using optimization software, resulting in an optimization model for compromising decision-making (compromise solution) in implementation. operations to secure maritime borders in Natuna Sea waters.

1.2. Problem Formulation

Based on the background and research gap above, the problems that can be formulated in this study are as follows:

a. How to optimize the criteria related to the implementation of security operations in border areas in order to be effective and efficient?

b. How to develop an optimization model for border area security operations by Koarmada I in the waters of the Natuna Sea?

c. How to implement a combination of CPM, Transshipment, Goal Programming and Weighted Goal Programming methods to find a compromise solution of the objective function?

1.3 Limitations and Assumptions

Considering some limitations from limited data sources and time, this study is limited to:

- Territorial violation (garwil) is a violation of territorial borders committed by ships of foreign countries.
- Does not discuss base operational costs.
- Alert implemented in maritime security operations is standby III (peacetime)
- Did not discuss the patrol boat weaponry.

Assumptions :

- Everything related to research and its results related to threats that exist from countries around the North Natuna Sea Region, can be facilitated by their needs.
- All patrol boats operating in a ready condition (not being repaired and maintained).

2. LITERATURE REVIEW

2.1. Previous research

Literature reviews are conducted to support problem solving and to deepen theoretical knowledge that will be used in solving problems in this study. As for some references to research studies that have been carried out previously which have similarities in object, problem formulation and method are as follows:

Ming and Yang (2007) examined the allocation of resources in a transportation infrastructure project in Thaicung City, Taiwan using the ANP method and Goal Programming. Selection of a transportation infrastructure project is a process of identifying several project alternatives with the aim of maximizing organizational profits and allocating resources according to the limitations contained in the resources themselves, namely: planning and design should not be more than 24 days, construction time should not exceed 35 months, the budget costs no more than $ 320, and the administration fee is not more than $ 42. This study uses ANP and Zero-One Goal Programming (ZOGP) methods. The ANP method is used to select project alternatives based on the relationship between the criteria and the weight of these criteria according to the assessment of experts in the selection of transportation infrastructure projects that have been determined through group discussions, namely: land use, planning and design, definition of management and maintenance infrastructure, travel requests, financial analysis, proposals and promotions. Alternative projects are: special express bus lane (P1), traffic signal control system (P2), and parking structure (P3). After going through the weighting process using AHP, the weight of each project (P) is obtained, as follows: (P1, P2, P3) = (0.342,0.484, 0174). Meanwhile, ZOGP is used to calculate the achievement of the objective function of the project according to the limits specified above. From the application of the two methods above, it is found that P2 and P3 are the chosen alternatives, with a total cost of $ 300, planning and design for 24 days, construction work for 34 months, and administration costs of $ 42.

Singgih S (2007), examines the selection of suppliers using the Integrated Fuzzy AHP method and Weighted Fuzzy Goal Programming Approach. The purpose of this study is to accommodate the preferences of decision makers by giving weight to fuzzy goals, so the method developed is called weighted fuzzy goal programming. This method is to solve the problem of international supplier selection. The objective functions developed are minimizing the percentage of defects, minimizing late delivery, minimizing purchase prices, and maximizing business relationships. The constraint functions include total demand, supplier's maximum supply capacity, owner estimate purchase price, and minimum order quantity. This method produces a solution that is more representative of the preferences of decision makers on international supplier selection when compared to the FGP method where the preferences of the decision makers are expressed in weighted values. The value assigned to goals can show a harmonious relationship between the value of the weighted goal and the achievement of the aspirations of the weighted goal. The greater the value of the weighted goal, the higher the achievement of the aspirations for the weighted goals. As a result, suppliers with a better value for weighted goals will get increasingly higher returns.

Suhirwan (2007). Researching the comparative study of the capability and allocation of the Indonesian Navy KRI, as well as the allocation of its bases in order to secure the sea area of western Indonesia using the Set Covering Problem method This study intends to compare the ability of KRI to determine the allocation and location of the patrol sector, which is associated with endurance in operating in the patrol sectors that must be secured.

Solving the solution using a mathematical model in the form of Integer Linear Programming and Set Covering with the decision variables used is the assignment of KRI from an initial base in carrying out operations to the patrol sector then returning to the initial base, using a range of ranges according to operational limits and considering area, threats existence and the existence of vital objects that must be secured. The calculation process uses Lingo software. The conclusion is to compare the ability of the five types of KRI to produce one optimal solution and four non-optimal solutions, where the optimal solution is obtained by the KRI KKP class as many as 21 KRI KKP Class to secure the sea area of western Indonesia. Meanwhile, for the allocation of bases of the 20 candidate bases, through the optimization process, there are 13 bases that are suitable to become Indonesian Navy bases.

Okol (2008) examines the Fleet Placement Optimization Model (Case Study of Indonesian Navy Patrol Boats in Eastern Indonesia). In this research, it explains about the optimization of the placement of the Navy patrol boat assignments to the eastern operational sectors and the determination of their placement to support bases, so that the type and number and operational costs are right in security. To optimize these problems the authors apply the optimization method by combining the Linear Integer Programing (ILP) method and the Problem Set Covering method. From the optimization results in the form of the composition of the assignment of 21 patrol boats to 7 Armatim Kamla operation sectors. The maximum coverage area of patrol boats reached is 1,668,765 miles2 with an under deviation of 2.58% of the coverage area or 43,494 miles which has not been covered from the entire operational sector I to. VII (1,668,765 mil2). The optimization result also shows that the minimum operating cost that is achieved for one assignment is Rp. 4,531,018,000, - and does not exceed the operational budget / budget for one assignment (IDR 5,000,000,000).

Chang, et al (2009) examined a historic transportation revitalization strategy project in Alishan using ANP and Zero-One Goal Programming (ZOGP). The method is used to maximize net benefits to society and allocate resources most efficiently. In this study, it was explained that in a project many criteria must be selected and must be considered. This is because the proposed projects have not considered the related criteria, both tangible and intangible. The criteria that must be considered are: benefit, cost, opportunity, risk. Then the interdependence of these criteria must be known through group discussions, then through the experts the criteria are weighted. The integration of the ANP and GP methods for the decision-making process in the railway transport revitalization strategy project in the city of Alishan where the project is multi-criteria, interdependent so that it requires selection and evaluation in its decision making. Where ANP provides a systematic approach to setting the priority of multi criteria and trade offs of objective functions. Then the results of the ANP are used to formulate Goal Programming. With Goal Programming, the deviation from the achievement of each predetermined goal will be sought according to the constraints that have been set, then with the Zero-One Goal Programming formulation, which projects will be selected in accordance with the achievement of the targets of each function will be selected. aim. Through this optimization, 4 (four) projects were selected from the 7 (seven) proposed projects.

Hozairi (2011) optimizes the placement of Indonesian Navy fleets in eastern Indonesia using the Genetic Algorithm (AG) method. This study resulted in an optimization in the form of the composition of the assignment of 27 patrol boats to 7 Kamla Armatim operating sectors, by maximizing the coverage area and minimizing operational costs.

The results of the AG technique are not global optimum but are not easily trapped in the local optimum. The result is an acceptable optimum, that is, a result that has a fair and acceptable optimization. The research resulted in a coverage area of 1,942,929 square miles and an operational cost of IDR 2,853,447,000, thus this optimization model was able to save the state budget by around 48% of the IDR 5,000,000,000 budget.

Iskandar (2015) discusses planning on optimizing the assignment of the Navy Patrol Elements (ships and aircraft) in maritime security operations in the eastern Fleet region and determining their placement to support bases. This study seeks to combine the operational and logistical interests of the Navy Patrol Elements with budget constraints, technical capabilities and maintenance schedules for Indonesian Navy maritime patrol and maritime patrol aircraft, operational sector area, sector vulnerability level and base capability. This optimization study identifies the related decision variables, then determines the objective function and constraints as an optimization model to be developed. Problem solving uses the Integer Linear Programming and Covering Set approach and the calculation uses a tool in the form of a Solver.

2.2 Role of the Indonesian Navy

According to Ken Booth (Marsetio, 2014), the Navy universally has three roles in carrying out its duties, namely: Military role, carrying out state defense in order to uphold state sovereignty at sea, guarding maritime borders with neighboring countries. The role of Diplomacy (Diplomacy Role), to provide support for government foreign policies designed to influence the leadership of other countries in peaceful or hostile situations. The role of the Naval Police (Constabulary Role), enforcing laws at sea, protecting national marine resources and assets, maintaining security at sea.

While the duties of the Navy are in accordance with Law Number 34 of 2004 concerning the TNI, the duties of the Navy are as follows:

a. Carrying out the duties of the Navy in the defense sector;
b. Upholding the law and maintaining security in the marine area of national jurisdiction in accordance with the provisions of national law and international law that has been ratified;
c. Carry out naval diplomacy in the context of supporting foreign policy stipulated by the government;
d. Carry out TNI duties in the development and development of the strength of the marine dimension; and
e. Implementing the empowerment of marine defense areas.

The Indonesian Navy as an integral part of the TNI carries out the duties of Military Operations for War (OMP) in the form of mobilizing and using Indonesian Navy forces to fight against military forces of other countries that carry out aggression against Indonesia, and / or in armed conflict with another country or more, which is preceded by the declaration of war and subject to international war laws. In its implementation, the deployment and use of Indonesian Navy forces are still guided by the Integrated Tri Matra, where the Indonesian Navy's strength is an integral part of the TNI's strength in fighting the military forces of other countries.

2.3 Security of Indonesian Waters

The implementation of safeguarding Indonesian waters is ensuring the integrity of all waters of Indonesia's national jurisdiction and the security of national interests in and or by sea. In the implementation of safeguarding Indonesian waters, it is carried out by :

a. Preventive deployment, namely preparing and placing Indonesian Navy combat forces in vulnerable waters, approaching roads for deterrence, observation and enforcement of sovereignty and the law at sea.

b. Reactive deployment, namely preparing and placing Indonesian Navy combat forces in certain waters to overcome crises in the form of sea control.

Meanwhile, the pattern for the implementation of safeguarding Indonesian waters is carried out using the following operating pattern:

a. Presence operations at sea. It is the presence of a number of Navy forces in collaboration with other components of Defense and Security, in the form of a preventive and reactive deployment of force, for strategic deterrence and naval diplomacy, in order to protect national interests at and or by sea.

b. Maritime Security Operations. Is an operation carried out to prevent and overcome every form of maritime security disturbance by the forces of the Navy and non-Indonesian Navy in order to enforce law at sea and to carry out the form of assistance activities for Domestic Security operations in order to protect national interests at and or by sea.

A ship that moves from one point to another during its endurance has a variable radar capability and speed. For the calculation of ship coverage area and cruising range, it is described and formulated in Figure 2.1 as follows: (Marine Security Operations Manual, Asops Kasal, 2004).

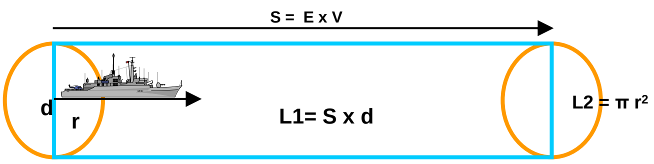


Figure 2. KRI's Coverage Area (Source: Iskandar, 2015)

$$S = E \times V \quad \text{.......................................} \quad (2.1)$$

$$L_1 = S \times d \quad \text{.......................................} \quad (2.2)$$

$$L_2 = \pi r^2 \quad \text{.......................................} \quad (2.3)$$

Information :

S = Range per Endurance (miles)

E = Endurance (hours)

V = speed of the ship (miles / hour)

L1 = Area of rectangle (mil2)

L2 = area of circle (mil2)

d = Radar range (miles)

r = Radius of radar coverage circle (miles)

KRI coverage area is the area of the rectangle (L1) plus the area of the circle (L2)

Coverage Area = (L1 + L2) x Probability of radar detection

Coverage Area = (L1 + L2) x 0.9 (mil2) .... (2.4)

Patrol boat max cruising distance = Cruising distance per day x Endurance

S = E x V (mil) .... (2.5)

Information :

S = the maximum cruising range of the patrol boat

E = Endurance, is the number of days the ship is able to sail without re-provision.

The presence of KRI in the area of operation was also inseparable from the support from the base. The Indonesian Navy bases consist of: main bases, aju bases, operations bases, intermediate bases and floating bases. According to the Indonesian Navy Base Standardization Administration Manual (PUM-703) states that the Indonesian Navy Base as an integral part of the Integrated Fleet Weapon System (SSAT) is the spearhead in supporting the success of the tasks of the Indonesian Navy operational units both in peacetime and during war. . In a logistical sense, the base functions as a support point for the provision, repair and protection of the fleet, while in the sense that the base strategy functions to ensure that the presence of the fleet along vital sea lines of communication is maintained continuously.

2.4 Planning and Logistics Costs

Hadi Firmanto (2006), Logistics planning is a process of strategy in managing a procurement, transfer and storage, final inventory through organizations and channels of civil and military companies / agencies, so that current and future profits can be maximized through cost effectiveness. Logistics management provides many ways to increase efficiency and productivity with a significant contribution to lowering unit costs.

The goal of logistics cost planning is to achieve the target at the lowest cost, with a mission to plan and coordinate all important activities in the implementation of operations. Logistics is a command function which means from the planning stage to the implementation of each situation and development

Logistical positions and movements must be authorized by the Commander. So a Commander must know the level of his logistical capability to support the concept of his operation. And vice versa

Logisticians must be prepared to make suggestions to leaders so that operations do not exceed their logistical capabilities.

The logistics costs for KRI and Indonesian Navy aircrafts are broadly divided into two, namely liquid logistics costs and personnel logistics. Included in the liquid logistics costs are the costs of fuel, lubricating oil and fresh water, while personnel logistics costs include the cost of meals during operation, screen and non-screen allowances as well as leader's allowances, flight allowances, pocket money and maintenance costs for operating ships / Harkapops. . (Kasal, Indonesian Navy Strength Development 2005-2024, Jakarta, 2005).

2.5 Multiple Criteria Decision Making (MCDM)

According to Ciptomulyono (2010), multiple criteria decision making is a method of selecting an alternative process to obtain optimal solutions from several alternative decisions by taking into account more than one criterion or object in conflicting situations. For this reason, the MCDM method provides an alternative to take advantage of objective and subjective considerations as a basis for decision making. Hwang and Yoon (1981) divided the scientific taxonomy of multicriteria decision making into 2 different approaches, namely: Multiple Objective Decision Making (MODM) and Multiple Adjective Decision Making (MADM).

The MODM approach deals with the completion of an optimization model that has multiple objectives and conflicts with each other. The existence of an "optimal" solution for this multiple objective will differentiate it from the classic single objective optimal approach such as linear programming. While the MADM approach is a multicriteria solution technique for selection or selection problems, it does not require a classical mathematical model approach. The decision variable is considered as a finite discrete variable. This approach is only intended as a decision aid so that they can study and understand the problems faced, determine priorities, values, objectively through the exploration of the decision components so that it will make it easier for decision makers later to identify which is the best choice they like (Ciptomulyono U, 2010).

2.6 Competitive Profile Matrix (CPM)

Researchers have proposed several strategic techniques that are useful for analyzing industrial competition scenarios. Coman & Ronen (2009) states that the SWOT (Strengths-Weaknesses-Opportunities-Threats) analysis is one of the most useful tools for defining a company's strategic actions by analyzing the company's internal capabilities and the external environment to identify appropriate opportunities and threats. However, the problem with SWOT analysis is that it does not prioritize or consider the internal or external factors identified (Hill & Westbrook, 1997) whereas the CPM method includes weights of all identified CSFs to analyze competitive advantage. Porter (2000) identifies another popular tool known as the five forces model for analyzing a firm's industrial attractiveness.

On the basis of analyzing these factors, Porter argues that organizations can develop generic competitive strategies of differentiation or cost leadership, capable of delivering superior performance through proper configuration and coordination of value chain activities. This model not only offers a valuable starting point for strategic analysis, it also has several limitations.

According to Porter (2000), this model helps companies assess the profitability potential of a particular industry but Rumelt (1991) argues that profitability does not depend on overall industry factors; Company-specific factors such as unique endowments, individual competencies, and strategy are more important to business profitability. Porter's model also shows that the five forces apply equally to all firms in an industry but in reality the strengths of these forces can vary from business to business in terms of brand name size or strength (Stonehouse & Snowdon, 2007, p. 258).

The Competitive Profile Matrix is a simple but powerful tool for providing information on the competitive scenario of an industry and helping managers develop the right strategy for the company. Managers need competitive information to understand the industry and its competitors and to identify areas where competitors are weak and to evaluate the impact of strategic actions on competitors (David, 2011). Using this model enables them to outperform competitors by the design and implementation of an effective strategic plan. Academics have to go a long way with this model in this area. They can push this model from a theoretical framework to the practical arena and encourage industrial firms to use it in the competitive analysis of their own firms and their competitors. Students in a variety of scientific disciplines will benefit from a corporate assessment and the competitive environment of their industry.

2.7 Transshipment Model

The transshipment model (Candra, 2013) is an extension of the transportation problem. The transshipment model is a transportation model that allows the delivery of goods (commodities) indirectly, where goods from one source can be at another source or other destination before reaching their final destination, so a source can simultaneously act as a destination and vice versa a destination can also play a role. as a source. This model has the additional feature of allowing delivery to occur between three types of nodes, namely origin or source nodes, transshipment or intermediary nodes, destination nodes. This allows the delivery of commodities from all sources through intermediate nodes before reaching their final destination. In this model, each source or destination is seen as potential points for demand and supply. Therefore, to ensure that each potential point is able to accommodate the total product in addition to the product that already exists at these points, it is necessary to add to the points the quantity of demand and supply of each is large B. The quantity B is usually referred to as a buffer, a sizeable value. Mathematically, the transshipment problem can be modeled as follows:

$$B \geq \sum_{i=1}^{m} ai + \sum_{j=1}^{n} ti \dots\dots\dots\dots\dots\dots\dots\dots. (2.6)$$

Where:

ai = Capacity (supply) of goods at the place of origin i

ti = Request for destination j

2.8 Goal Programming

Goal Programming was first introduced by Charmes and Cooper (Sunarta, 2015), which is a mathematical approach that seeks the optimal value of a set of variables in situations involving conflicting goals (goals). The goal programming model seeks to minimize the deviation between the various objectives or targets that have been determined as targets, meaning that the value of the left side of the constraint equation is as close to the value of the right side as possible.

Ignizio (in Ciptomulyono, 2011) makes a formulation for mathematically conventional optimization with a single objective, linear programming becomes a goal in the goal programming framework by adding a new variable called the negative deviation variable (n) and reducing the positive deviation variable (p) on the linear programming constrain model.

3. RESEARCH METHODOLOGY

3.1 Research Methods

The method used in this research is to use a qualitative approach and a quantitative approach. With a qualitative approach, this research is expected to be able to achieve the achievement of the target function objectives of the border area security operations in the waters of the Natuna Sea which are faced with boundaries / constraints. Meanwhile, through a quantitative approach in this research, it is hoped that the value weight will be obtained in a series of determining the objectives of a border area security operation in the waters of the Natuna Sea.

3.2 Research Flowchart

This chapter describes the stages of research methods arranged in a research flow chart. The research flow diagram is arranged in order to make it easier for researchers to carry out all research activities that will be carried out so that the research process runs systematically, structured and directed. The research methodology consists of the stages of the research process or the steps that the researcher must take in carrying out the research in accordance with Figure 3.1. This study has the following research methodology:

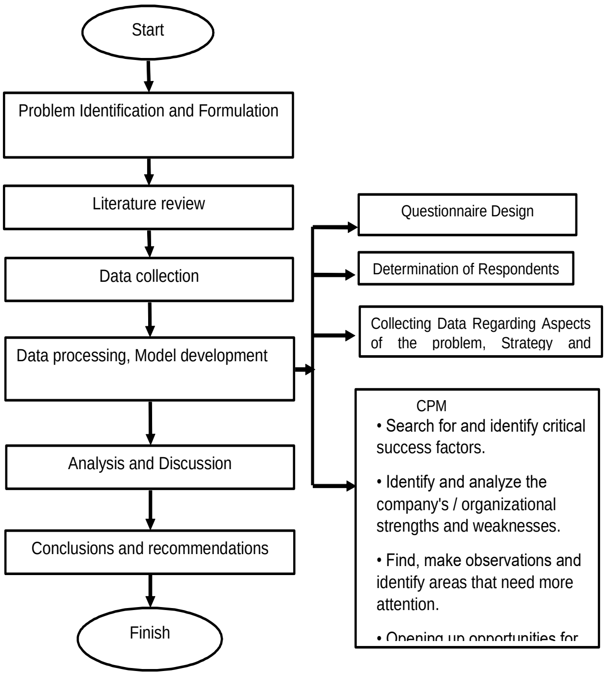


Figure 3. Research Flowchart

4. DISCUSSION

The decision-making model to be developed is the Competitive Prifile Matrix (CPM) model. At this stage, the determination of criteria was carried out preceded by conducting consultations with experts in the operational staff of Koarmada I, related to the implementation of security operations in border areas in the waters of the Natuna Sea. Then consultations were carried out by means of discussions either carried out with an expert or discussion with several experts in the operational field related to the implementation of security operations in border areas in the waters of the Natuna Sea.

The criteria developed are related to the factors that influence the decision to carry out a maritime border security operation that will be considered to support the implementation of border area confinement operations in the Natuna Sea waters. Taking into account the opinions of various sources both from experts and existing literature, this study developed 2 (two) criteria, namely: (1) KRI coverage area, (2) KRI operating costs. KRI Coverage Area Criteria, namely the extent of the area that can be covered by the elements / KRI that are in the area / sector of operation according to their radar capabilities. The sub-criteria are listed in table 1 as follows:

Table 1. Sub Criteria for Coverage Area

Code	Sub criteria	Description
K1	Sewaco capability (Sensor Weapon and Commnad)	Is the KRI capability which includes: sensor capability (radar, sonar), armament capability, against various threats (air, surface, subsurface) in the operations sector
K2	*Endurance* KRI	Is the sailing resistance of each KRI according to the capacity of fuel, fresh water, freshroom, and weather resistance.
K3	KRI speed	Is the time used by KRI to cover a certain distance.
K4	Mileage	Is the distance that can be reached to a stop by KRI with a certain amount of fuel.

Operation Cost Criteria, namely the costs used to support KRI operations. The sub-criteria are listed in table 2 as follows:

Table 2. Sub Criteria for Operating Costs

Code	Sub criteria	Description
K5	Liquid logistics costs	This is the cost of fuel, lubricating oil and fresh water required by KRI.
K6	Personnel logistics costs	These are the cost of meals during surgery, capital costs, tactical costs and prophylactic costs.
K7	Harkapops Fee.	Is the cost of maintaining the ship that carries out the operation

The optimization model in this research is the transshipment model, the goal programming model and the weighted goal programming model. Where the algorithms of the three models are integrated silmutaneously so as to produce an optimal solution related to the operation of securing border areas in the waters of the Natuna Sea. The transshipment model in this research is the KRI which will be assigned to the border area security operations sectors in the Natuna Sea waters, departing from the main base of Koarmada I, Jakarta as the point of origin / source, then moving to aju bases as a transshipment point / intermediary. then occupy to the operating sector as the destination / operating sector.

The goal programming model is used to determine the achievement and deviation from the objective function. While the weghted goal programming model is used to determine the level of importance of the objective function, where the weight value is obtained from the CPM model. Meanwhile, the decision variable in this model is the placement of the KRI from the main base to the Aju base, then the assignment of the KRI to the operations sector. The form of the decision variable (decision variable) is an integer and 0-1 (zero-one). Where:

Kijk = 1, meaning that KRI i is assigned to the initial base j and assigned to the k operation sector

Kijk = 0, meaning that KRI i is not assigned to the initial base j and is not assigned to the k operation sector. The decision variable can be seen in table 3.

Table 3. Variables of KRI Placement and Assignment Decisions

KRI (i)	Initial Base			Operating Sector			
	a	b	c	I	II	III	IV
1	k1,a	k1,b	k1,c	k1a,I	k1,a,II	k1,a,III	k1,a,IV
.							.
.							.
.							.
N	ki,j	.	.	.	.	.	ki,j,k

Matrix description:

- k1, a, I = 1st KRI assigned to base starting a and to sector I operations
- ki, j, k = the i-th KRI is assigned to the j-initial base and to the k-th operation sector

The data needed are primary data and secondary data. Primary data were obtained directly from parties related to border area security operations in Natuna Sea waters by filling out questionnaires and face-to-face interviews. Judgment value of the direct interrelation between criteria or aspects of related parties is used to determine the relationship between criteria. In addition, judgment pairwise comparisons are also needed on the criteria or aspects and alternatives of border security operations in the Natuna Sea. Meanwhile, secondary data is data obtained through literature studies both from documents and reference books related to border security operations in Natuna Sea Waters.

The data that has been collected will be processed using methods that have been studied by researchers, namely the CPM, Transshipment, Goal Programming and Weighted Goal Programming methods. These methods will be used to determine the optimization of border area security operations in the Natuna Sea which will be carried out by Koarmada I. The data processing includes:

a. Calculating the priority weight value of the criteria, Ops Pamwiltas alternatives by means of pairwise comparison based on the CPM method.
b. Assigning KRI by means of the transshipment method.
c. Calculating the achievement and deviation from the target / objective function with the Goal Programming method.
d. Aligning the value of the weighted goal / goal with the achievement of the weighted goal / goal using the Weighted Goal Programming method.

Where the whole algorithm will be processed silmutaneously, together with the help of optimization software Lingo 11, while for weighting on CPM using superdecission software.

After the required data is collected and processed, interpretation and analysis are then carried out on the results of data processing on the model that has been developed. Interpretation is carried out to answer the problems as formulated and their relation to meeting the research objectives.

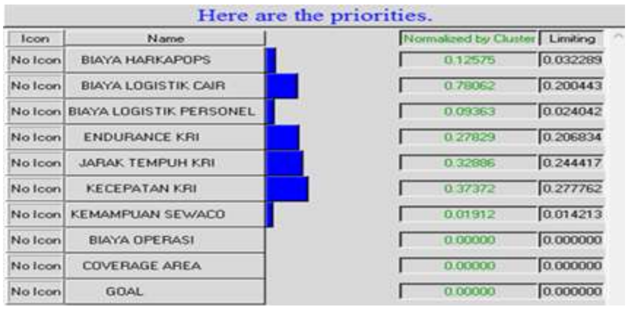
The next step after the model output is obtained is to carry out data analysis. In this study, there are 2 (two) data analyzes, namely: scenario analysis and sensitivity analysis. The scenario analysis referred to in this study is to make changes or change the decision variables in the model related to the composition of KRI. This aims to determine any changes in the value of the objective function. Meanwhile, the sensitivity analysis in this research is carried out by changing the weight of the criteria, if the weight is changed to the criteria, a different solution will be obtained. Sensitivity analysis is needed to provide an evaluation of the stability of the solution obtained from the model. This analysis is carried out by providing variations in changes in various existing parameters and their effects on changes in the results of the model. In this study, the sensitivity analysis was carried out by changing the weights of the criteria or subcriteria. If we change one of the criteria or sub-criteria weights, especially those that have a large weight or are very influential on the final model solution, then we will get a different model solution. However, if what we change is the weights of the criteria or subcriteria that are of small value, changes to the weights of these criteria do not necessarily result in changes to the resulting best solution. If this can be carried out well, it can be concluded that the model that has been created is working well. In addition to conducting a sensitivity analysis by changing the weight of the criteria, sensitivity analysis can also be carried out by making changes to the composition of the KRI assigned, changes to the number of KRIs assigned and changes to the constraint function. Changes in the constraint function represent changes in existing resources or changes in policies taken in the decision-making process.

5. CONCLUSIONS

5.1 Model Algorithm Results

5.1.1. Results of the CPM Model (Competitive Profile Matrix)

Using the Super Decision software produces the following relative weights:


Here are the priorities.

Icon	Name	Normalized by Cluster	Limiting
No Icon	BIAYA HARKAPOPS	0.12575	0.032289
No Icon	BIAYA LOGISTIK CAIR	0.78062	0.200443
No Icon	BIAYA LOGISTIK PERSONEL	0.09363	0.024042
No Icon	ENDURANCE KRI	0.27829	0.206834
No Icon	JARAK TEMPUH KRI	0.32886	0.244417
No Icon	KECEPATAN KRI	0.37372	0.277762
No Icon	KEMAMPUAN SEWACO	0.01912	0.014213
No Icon	BIAYA OPERASI	0.00000	0.000000
No Icon	COVERAGE AREA	0.00000	0.000000
No Icon	GOAL	0.00000	0.000000

Figure 4. Super Decision Software Processed Results from the CPM Model.

Table 4. Weight of Sub Criteria and Criteria for Coverage Area

No	Sub Kriteria dari Kriteria *Coverage Area*	Bobot
1	*Endurance* KRI	0,206834
2	Jarak tempuh KRI	0,244417
3	Kecepatan KRI	0,277762
4	Kemampuan Sewaco	0,014213
	Total Bobot *Coverage area*	0,743226

Table 5. Weights of Sub Criteria and Criteria for Operating Costs

No	Sub Kriteria dari Kriteria Biaya operasi	Bobot
1	Biaya harkapops	0,032289
2	Biaya logistik cair	0,200443
3	Biaya logistik personel	0,024042
	Total Bobot Biaya operasi	0,256774

By using Lingo 11 software, optimization results were obtained for the five KRIs in the implementation of security operations in the border areas waters, namely: the deployment of forces (placement and assignment of KRI) including the length of operation, effectiveness of KRI's coverage area in the operating sector, efficiency of KRI's operating costs. These results can be seen in the following table :

Table 6. Variables for Placement and Assignment Decisions of KRI

No	KRI Class (i)	Initial Base			Operating Sector				Operation Time (Daysi)
		I	II	II	P	Q	R	S	
1	A	0	0	1	0	0	0	1	3,2
2	B	1	0	0	0	1	0	0	2,2
3	C	0	1	0	0	0	1	0	1,6
4	D	1	0	0	1	0	0	0	2,7
5	E	1	0	0	1	0	0	0	0,9

Table 7. Coverage Area Effectiveness Results

No	Operational Sector	Type of KRI Assigned	Sector Area (mil^2)	Covergae area (mil^2)	
				Covered	Uncovered
1	P	D,E	1367	171924	-
2	Q	B	1731	99124	-
3	R	C	2789	71415	-
4	S	A	2042	108450	-

5.2 Model Analysis

Model analasis is performed on the optimization model, consisting of scenarios of analysis and sensitivity analysis.

5.2.1 Analysis Scenarios

First Analysis Scenario In the first analasis scenario, the optimization model is used to model the needs of KRI in the joint marine operations in the waters of Natuna, obtained the following optimization results:

Table 8. Coverage Area Effectiveness Results in First Analysis Scenario

No	Operational Sector	Type of KRI Assigned	Sector Area (mil^2)	Covergae area (mil^2)	
				Covered	Uncovered
1	P	A2,B1,D1,D2,D3,D4,D5,D6,E3,E4,E5,E6	1367	944030	-
2	Q	B2,E1	1731	171560	-
3	R	E2	2789	69341	-
4	S	A1,	2042	108450	-
Total			7929	1293381	

Second Analysis Scenario In the second analasis scenario, the optimization model is used to model kri's needs as a veil element for one Marine BTP, obtained by optimization as follows:

Table 9. Coverage Area Effectiveness Results in The Second Analysis Scenario

No	Operational Sector	Type of KRI Assigned	Sector Area (mil^2)	Covergae area (mil^2)	
				Covered	Uncovered
1	Q	A2,A3,B1,B2,B3,C1,C2,D1,D2	1731	171560	-
2	R	A1	2789	69341	-
	Total		7929	1293381.	

5.3 Conclusion

From a series of data processing and analysis carried out in this research / thesis, the following conclusions can be drawn:

a. Optimization of border area security operations in the waters of the Natuna Sea can be modeled with a combination of the Competitive Profile Matrix (CPM), Transshipment, Goal Programming and Weighted Goal Programming methods to produce a compromise solution in implementing operations to secure maritime border areas in the Natuna Sea waters.

b. The decision-making method in the form of the Competitive Profile Matrix (CPM) model produces the relative weight of the objective function of the border area security operation in the Natuna Sea, namely maximizing the coverage area and minimizing operating costs.

c. The optimization method is in the form of the Transshipment model, the Goal Programming model and the Weighted Goal Programming model, where the three models are run silmutaneously, together using the Lingo 11 software produces an optimization solution in the form of a decision variable in the form of a zero-one matrix assigning 5 (five) KRIs from main base to base aju and to the operating sector, length of operation in the operating sector, achievement or deviation from the objective function in the border area security operation in the Natuna Sea waters. Where it is obtained the average coverage area achieved is 450,913 miles, which means it has exceeded the target coverage area of the operating sector area of 7929 miles2, and the average operating cost efficiency is 40% of the set budget.

ACKNOWLEDGEMENTS

The authors greatly acknowledge the support from Indonesian Naval Insitute of Technologyand Indonesian Navy Institution for providing necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

REFERENCE

AL Headquarters, (2004), Manual of Opskamla, Asops Kasal, Jakarta.

Boynton, A. C., & Zmud, R. W. (1984). An assessment of critical success factors. *Sloan Management Review (pre-1986)*, *25*(4), 17-27.

Campbell, D. J., Stonehouse, G., and Houston, B. (2002). *Business strategy: an introduction* (2nd Ed.), Oxford, UK: Butterworth-Heinemann

Capps III, C. J., & Glissmeyer, M. D. (2012). Extending The Competitive Profile Matrix

Using Internal Factor Evaluation And External Factor Evaluation Matrix Concepts. *Journal of Applied Business Research (JABR)*, *28*(5), 1059-1062.

Chang, H. H., & Huang, W. C. (2006). Application of a quantification SWOT analytical method. *Mathematical and Computer Modeling*, *43*(1), 158-169.

Coman, A., & Ronen, B. (2009). Focused SWOT: diagnosing critical strengths and weaknesses. *International Journal of Production Research*, *47*(20), 5677-5689.

Coman, A., B. Ronen. 2009. Focused SWOT: Diagnosing Critical Strenghts and Weakness. International Journal of Production Research Vo. 47 No. 20 : 5677-5689

Ciptomulyono, U., 2010, *The Paradigm of Multicriteria Decision Making in the Perspective of Project Development and Industry with Environmental Concerns*, Sepuluh Nopember Institute of Technology Surabaya

David, Fred R., Strategic Manajemen, Manajemen Strategis, Konsep, Edisi Kesepuluh, Penerbit Salemba Empat, Jakarta, 2006

David, F. R. (2011). *Strategic management: Concepts and cases (*13th ed.). Upper Saddle River, NJ: Prentice Hall.

Hill, T., & Westbrook, R. (1997). SWOT analysis: it's time for a product recall. Long range planning, 30(1), 46-52.

Porter, Michael E., 2002, Strategi Bersaing Teknis Menganalisis Industri dan Pesaing, Penerbit Erlangga, Jakarta

Hozairi (2008), Development of Genetic Algorithms for Optimizing the Placement of the Indonesian Navy Ship Fleet in Eastern Indonesia. Final Project, Department of Informatics, Islamic University of Madura.

Hozairi, 2011, Application of Expert Systems for the Development of Strategies for Safeguarding Indonesian Maritime Border Areas. Final Project, Department of Marine Control and Systems Engineering, Faculty of Marine Technology, Sepuluh Nopember Institute of Technology, Surabaya.

Hwang, C.L., and K. Yoon, 1981, Multiple Attribute Decision Making Methods and Applications. Springer-Verlag, Berlin.

Iskandar, 2015, Optimization of the Assignment and Placement of Patrol Elements in Eastern Indonesia. Final Project, Systems Analysis and Operations Research Study Program, STTAL, Surabaya.

Marsetio, (2014), *Sea Power Indonesia, Universitas Pertahanan,* Jakarta*.*

Ming,Wann and Yang, Kuei (2007) *Using ANP Priorities with Goal Programming in Resource Allocation in Transportation*, International Journal Mathematical and Computer Modelling 46 (2007) 985-1000.

Muhammad, Candra (2013) *Optimalisasi Model Transshipment di PT. PRIMATEXCO Menggunakan Program Solver,* UNNES Journal of Mathematics 2 (1) (2013).

Okol, (2008), Fleet Placement Optimization Model (Case Study of Indonesian Navy Patrol Boats in Eastern Indonesia). Final Project, Marine Transportation Study Program, Faculty of Marine Technology, Sepuluh Nopember Institute of Technology, Surabaya

MODELING MARINE OPERATIONS BASED ON INTELLIGENCE THREAT PREDICTION IN INDONESIAN NAVAL 2ND FLEET COMMAND USING MCDM

Fa'iq Mumtaz M[1], Budi Santoso W[2], Okol Sri Suharyo[3]

[1,3]Indonesian Naval Technology Collage
Bumimoro-Morokrembangan, Surabaya 60178, Indonesia
[2]November 10th Institute ofTechnology
Keputih-Sukolilo, Surabaya 60111, Indonesia
e-mail: morvita.oi2001@gmail.com

ABSTRACT

Indonesia, which is an archipelago country, needs strong maritime sector security. Indonesian Navy in Law No. 34 of 2004 has been given the mandate to safeguard the sovereignty of the Republic of Indonesia. Indonesian Naval 2nd Fleet Command as the executing command and operational supervisor every year carries out the OMSP, which is carried out under the command of naval battle group (Guspurla) and marine security group (Guskamla). The importance of intelligent information regarding the estimated threat / contingency that will occur is very influential on decision makers in an operational planning and in the context of taking action against the contingency/threat. With the contingencies that have been given by the intelligence sector staff, it is necessary to have an appropriate marine operation modeling. In multi-operation operations, it is necessary to have a supporting attribute, namely a headquarters warship (C2). The purpose of this study is to formulate an operation modeling using the selection of a headquarter warship which is preceded by the prior determination of contingency priorities. This study uses MCDM which consists of MCDA and MCDO which uses the integration of the Delphi method, AHP, Fuzzy Weighting, Goal programming and integer linear programming. Based on the processing of Delphi and AHP in determining contingencies, there are 6 (six) contingency priorities in the order: National jurisdiction marine security got a value of 0,23792; the spread of the pandemic was 0,22492; VVIP security was 0,20416; security of vital objects was 0,15410 and violence at sea was 0,12923 while marine pollution was 0,04967. While in the selection of a headquarters warship that functions to coordinate warships in carrying out sector patrols using FWH and IGP, 1st warship was selected to be the headquarters warship (C2) with a value of 6,006; with the second priority 4thwarship, which was 6,652; 5th warship was 7,198; 2nd warship was 7,890 and 3rt warship of 8,763. While in the modeling, it is found that in a year there are 4 operations under 2nd Guskamla where the level of area is security obtained from the KRI (warship) assignment for ALFA operations is 152 with 4.963.600 Kl of fuel, KILO is to consume 8.104.200 Kl of fuel, MIKE is 59,13 with 765.079 of fuel and by consuming 425.906 Kl of fuel on INDIA operations get a level of safety area of 44,91.

Keywords: *MCDM, Contigency,headquarters warship.*

1. INTRODUCTION

The Navy is an integral part of the TNI having a role as a major component of state defense and security in the maritime dimension, carrying out its duties based on state policy and political decisions in order to uphold state sovereignty, maintain the territorial integrity of the Unitary State of the Republic of Indonesia (NKRI) based on Pancasila and the 1945 Constitution (Marsetio , 2013).In accordance with Article 9 of Law Number 34 Year 2004 concerning the TNI, the duties of the Indonesian Navy are as follows: 1) Carry out the duties of the Navy Marine Corps in the defense sector; 2) Upholding the law and maintaining security in the marine area of national jurisdiction in accordance with the provisions of national law, international law that has been ratified; 3) Carrying out the diplomatic duties of the Navy in order to support the foreign policy stipulated by the government; 4) Carry out TNI duties in the development and development of the strength of the marine dimension; 5) Implementing the empowerment of marine defense areas.

A marine operation planning needs intelligence support as an early warning system that produces intelligence information obtained through a processing process from information obtained in order to anticipate possible threats that will arise in order to determine steps with calculated risks.Intelligence as information that has been processed is a product which is subsequently conveyed to the users to be used as material for the preparation of plans and policies to be pursued and which allow for decision making materials.In other words, intelligence is needed to make correct decisions in three aspects, namely planning, wisdom and how to act.

Currently the Indonesian Navy in carrying out maritime territorial cover in all parts of Indonesia is divided into 3 commands, namely the Indonesian Naval Fleet Command (Koarmada) where the demands of Koarmada's duties are to carry out daily operations and marine combat operations for sea control and power projection to land via the sea in order to enforce the sovereignty and law at sea. The wide working area of 2nd Naval Fleet is faced with a variety of threats that arise as well as the limited number and capability of patrol boats and limits on operational support, on the other hand the rapid changes in the strategic environment will add to the increasingly complex problems of enforcement and security at sea.

Based on the above problems, this study offers a modeling of a marine operation in maintaining national maritime security based on threat prediction based on intelligent forecasting in Naval Fleet.

Like most real-world decision making problems, the selection of a predection of threats and C2 and modelling maritime operation systems requires a multiple criteria decision analysis (MCDA). Ho (2007) classified MCDAs into two technical categories, multiple objective decision making (MODM) and multiple attribute decision making (MADM). MODM is mathematical programming that has multiple objective functions and constraints. When an MCDA involves a number of independent or competing objectives, a multi-criteria mathematical programming approach is useful because it forces the simultaneous resolution of various objectives. Linier programming (LP) is an example of MODM.

MADM selects the best alternative among the various attributes that are to be considered. One of the most popular MADM techniques includes AHP. AHP structurally combines tangible and intangible criteria with alternatives in decision making. AHP logically integrates the judgment, experience, and intuition ofdecision makers. Because of its usability and flexibility, AHP has been widely applied to complex and unstructured decision making problems such as resource allocation, alternative selection, manufacturing, and military decision making. Recently, the analytic network process has been developed to handle decision problems that are not hierarchically structured (Saaty, 2008). Further, the fuzzy AHP is introduced to facilitate decisions under fuzzy situations (Kong & Liu, 2005).

A number of studies have integrated MADM and MODM. These studies have included a combined AHP-mathematical programming approach, On selection of a headquarters warship, some researchers applied combined approaches such as a hybrid AHP-integer programming approach to screen weapon systems projects (Greiner, Fowler, Shunk, Carlyle, & McNutt, 2003), an AHP approach based on linguistic variable weights (Cheng & Lin, 2002) an approach that integrated AHP with a technique for ordering performance by comparing alternatives to an ideal solution under a fuzzy environment (Dagdeviren, Yavuz, & Kılın, 2009), and an A hybrid approach of goal programming for weapon systems selection (Jaewook Le, Suk-Ho Kang, & Jay Rosenberger, 2009).

This research aims to make planning of a marine operation for Indonesian Naval 2nd Fleet Command in facing security threats in national waters, which includes obtaining priority for predicting threats that will arise in the future, Obtain the best alternative in order to select a base warship in a multi-operation operation and get the Guskamla operation model in 2nd Naval Fleet in order to maximize the coverage area with existing resources.

2. ANALYTICAL METHODS

2.1. Analytic hierarchy process

AHP, introduced by Saaty (1980), designs general decision problems based on a multilevel hierarchy of goals, criteria, subcriteria, and alternatives. AHP is characterized by three basic principles: hierarchical structure, the relative priority of decision criteria; and consistent judgment. It uses a pairwise comparison technique to derive the relative importance (or weight) of each criterion that reflects reasonable human judgment on elements in the same category. A pairwise comparison allows conversion of linguistic judgmentsinto numerical scales. When the importance of one element to another can be expressed as a scale of 1–9, scale 1 means the two elements are of equal importance, and scale 9 means one is extremely more important than the other. Pairwise comparison helps decision makers simplify a complex problem by focusing their interest on the comparison of just two criteria and improves their consistency across the decision process (Badri, 2001). Judgment by pairwise comparison produces a reciprocal matrix A, represented as follows:

$$A = \begin{pmatrix} a_{11} & a_{12} \cdots & a_{1n} \\ a_{21} & \ddots & \vdots \\ \vdots & & \\ a_{n1} & \cdots & a_{nn} \end{pmatrix}$$

Each entry of A represents the relative importance of decision elements.For example, aij is the relative importance in decision elementi against decision element j, and vice versa. It satisfies $a_{ij} = 1/a_{ji}$. The actual relative weights of decision elements can be obtained by computing the normalized eigen vector of A that satisfies the following equation:

$$A \,.\, w = \lambda \,.\, w_1$$

where k is the eigen value associated with eigen vector. Saaty (1980) recommended using the eigen vector, $w_{max} = [w_1, w_2, \ldots, w_n]$ T correspondin to the maximum eigen value, k_{max}, to represent the relative weights of each of the n criteria. This process should be performed at all levels of the criteria to obtain all the relative weights of the decision elements. During the process of deducing the weights, a consistency test can be performed to verify the reasonability of the decision makers' pairwise comparison. The measure of consistency is obtained by a consistency index (CI) and a consistency ratio (CR), which are definedas follows:

$$CI = \frac{(\lambda max - n)}{(n - 1)}$$

$$CR = \frac{CI}{RI(n)}$$

where n is the number of decision elements, and the random consistency index (RI) is an experimental value provided by Saaty (1990) as shown in Table 1.

Table 1. RandomConsistency Index

Tabel Index Random Konsistensi

RCI values corresponding to the order of the matrix

No. of criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RCI	0	0	0,58	0,9	1,12	1,24	1,32	1,41	1,45	1,49	1,51	1,48	1,56	1,57	1,59

It can be seen that the RI increases in proportion to the order of matrix A. k_{max} equals to n if the judgments by comparison are perfectly consistent. If the CR is less than 0.1, the judgment is consistent; if the CR is greater than 0.2, the judgment is not consistent. If the value of the CR is between 0.1 and 0.2, the judgment is acceptable (Saaty, 1990).

2.2 Fuzzy Weighting

Fuzzy set theory was first developed by Zadeh, while the concept of fuzzy numbers was introduced by Dubois and Prade which aims to present and make the fuzzy theory concept more applicable (Liang & Wang, 1994).The main objective of the FWT method is to eliminate subjective judgments from the preferences of the experts by quantifying qualitative data or data that is uncertain into data that is quantitative and definite.The data processing step using the Fuzzy Weighting algorithm is to compile a qualitative/preference assessment table of the experts on the main aspects of the research object, compile a qualitative assessment table for the experts on the criteria and sub-criteria of the main aspects of the research object. Determine the mean value of the fuzzy number (at), by adding the values that appear at each level of the linguistic scale and then dividing the sum by the number of aspects or criteria whose valuesfall into the level of the linguistic assessment. The mathematical notation is as the following formula:

$$at = \frac{\sum_{i=1}^{k} \sum_{j} T_{ij}}{\sum_{i=1}^{k} n_{ij}}$$

After that determine the lower limit value (ct) and the upper limit value (bt) of fuzzy numbers, where the lower limit value (ct = b (i - 1)) is equal to the middle value of the level below, while for the upper limit value (bt = b (i - 1)) is equal to the middle value of the above level. Then determine the aggregate weight of each qualitative criterion, because in this study a form of linguistic assessment that already has a triangular fuzzy number definition is used, the aggregation process is to look for the aggregate value of each lower limit value (c), the middle value. (a) and the ceiling value (b), which can be modeled as follows:

$$ct = \frac{\sum_{j=1}^{n} c_{tj}}{n}$$

$$at = \frac{\sum_{j=1}^{n} a_{tj}}{n}$$

$$bt = \frac{\sum_{j=1}^{n} b_{tj}}{n}$$

The next step is to look for the defuzzification criteria, where the defuzzification method used is the centroid method. The formula for the defuzzification criteria using the centroid method is as follows:

$$Nt = \frac{\left[\!\left[\int_{c_t}^{a_t} \frac{(x-c_t)}{(a_t-c_t)} x\,dx + \int_{a_t}^{b_t} \frac{(x-b_t)}{(a_t-b_t)} x\,dx \right]\!\right]}{\left[\!\left[\int_{c_t}^{a_t} \frac{(x-c_t)}{(a_t-c_t)} dx + \int_{a_t}^{b_t} \frac{(x-b_t)}{(a_t-b_t)} dx \right]\!\right]}$$

Defuzzyfication can also be determined using the Aritmetic mean and the geometric mean. The results of previous studies indicate that the defuzzyfication using Geomean is close to the centroid results. Meanwhile, the aritmetic mean still has a low level of confidence.

The last stage is processing the defuzzification value into the final weight value of each criterion, by dividing the weight value of each defuzzification criterion by the total number of weight values of all defuzzification criteria.

$$\text{NB t} = \frac{Nt}{\sum Nt\,(1-n)}$$

2.3. Integer Linear Programming

Linear Programing is a planning technique that uses a mathematical model with the aim of finding the best product combinations in constructing a limited allocation of resources in order to achieve optimally used goals.

In building the formulation model of an optimization problem, the characteristics of Integer Linear Programing (ILP) are used (Suharyo, 2014), namely:

a. Decision variables are variables that describe the complete decisions to be made, which are denoted by X1, X2, X3, ..., Xn.

b. The objective function is a function of the decision variable that will be maximized or minimized. Expressed using the decision variables

X1 and X2, to express the value of this objective function denoted Z.

c. Constraints are constraints faced, or limits that affect the decision variables. The coefficient of the decision variable on the constraint is called the technological coefficient, while the number on the right side of each delimiter is called the right side of the delimiter.

The sign delimiter is a delimiter which explains that the decision variable is assumed to have only non-negative value or that the decision variable can be positive or negative (not limited in sign).

In general, (Ryan, 2014) the Integer Linear Programming problem model can be formulated in the following example:

Maks : $Z = C_j X_j$.

Constraints: $C_{ij} X_j \leq / = / \geq B_i$, $j = 1,2,3, \ldots n$

$X_j \geq 0$, $j = 1,2,3, \ldots n$

X_j dengan $j = 1,2,3, \ldots, p$ $(p \leq n)$

2.4 Coverage Area

TNI AL warship that moves from one point to another during its endurance has a variable radar capability and speed. For the calculation of the patrol boat coverage and cruising range is described and formulated in the following figure

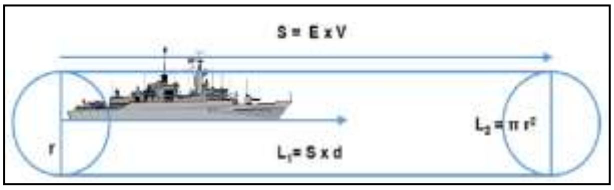


Figure 1. Illustration of a warship carrying out a patrol

$S = V \times E$ .... (4.5)

$L1 = S \times d$ .... (4.6)

$L2 = \pi r^2$

Where :

S = Cruising distance per day (mil)

V = Speed (mil/hours)

E = Endurance (hours)

L1 = Rectangular area (mil^2)

L2 = Circle area (mil^2)

d = Radar range (mil)

r = The radius of the radar range circle (mil)

The patrol boat's coverage area is the area of a rectangle (L1) plus the area of the circle (L2).

Coverage Area = (L1+L2) x Prob radar detection

= (L1+L2) x (0,9)

2.5 Flow Chart

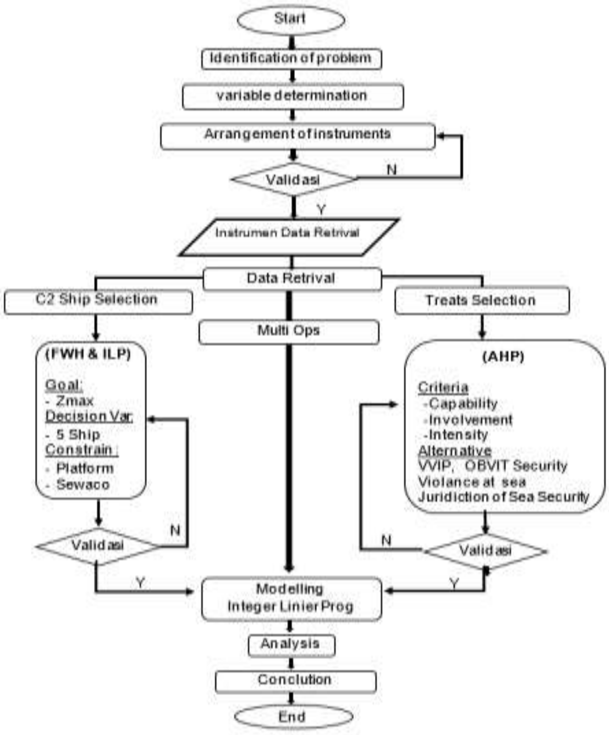


Figure 2. Flow Chart

3. RESULT AND DISCCUSION

3.1 Selection Of Threat Priority.

3.1.1. The Criteria And Alternatives Are Determined Using The Delphi Method.

At this stage, the identification of assessment criteria is carried out for weighting the level of importance of intelligent forecasting in supporting the implementation of operations. Based on Indonesian Law No. 34 of 2004 about the Indonesian National Army and interviews with several Intelligence experts in 2nd Fleet.

Table2. Withdrawal of the Delphi Opinion Round 1

No	Aspect	Interviewees					Average	Std. Dev	Modus	Q1	Q2	Q3	IR	Evaluation	
		X1	X2	X3	X4	X5								Std. Dev	IR
	Criteria														
1	Capability	8	6	7	8	9	8	0,707106781	8	8	8	8	0	Kon	Kon
2	Impact of Ipoleksosbudhankam	9	8	8	7	7	7,8	0,836660027	8	7	8	8	1	Kon	Kon
3	Budget Availability	2	4	5	5	0	3,2	2,167948339	5	2	4	5	3	Div	Div
4	Readiness	7	8	8	0	2	5	3,741657387	8	2	7	8	6	Div	Div
5	Involvement	8	7	6	8	7	7,2	0,836660027	8	7	7	8	1	Kon	Kon
6	The intensity of the incident	8	8	8	7	7	7,6	0,547722558	8	7	8	8	1	Kon	Kon
7	Accesibility	7	4	5	0	5	4,2	2,588435821	5	4	5	5	1	Div	Kon
	Sub Kriteria														
1	Marine Pollution	6	6	5	5	6	5,6	0,547722558	6	5	6	6	1	Kon	Kon
2	Pandemic Spread	8	7	7	8	6	7,2	0,836660027	8	7	7	8	1	Kon	Kon
3	VVIP security	8	6	6	7	8	7	1	8	6	7	8	2	Kon	Kon
4	SAR aviation and shipping	6	7	7	4	0	4,8	2,949576241	7	4	6	7	3	Div	Div
5	Natural Disaster,	4	3	0	7	7	4,2	2,949576241	7	3	4	7	4	Div	Div
6	Security of Border Areas	0	7	5	7	8	5,4	3,209361307	7	5	7	7	2	Div	Kon
7	Obvitnas Security	7	8	7	8	7	7,4	0,547722558	7	7	7	8	1	Kon	Kon
8	Violence at Sea	6	7	8	7	7	7	0,707106781	7	7	7	7	0	Kon	Kon
9	National Marine Security Jurisdiction	9	8	7	7	8	7,8	0,836660027	8	7	8	8	1	Kon	Kon

Most of the informants have filled in the value of the questionnaire data but there are still sources who still have not provided real value so it is necessary to hold a second round as well as to validate the speakers on the results of the first round questionnaire scores.

Table 3. Withdrawal of the Delphi Opinion Round 2

No	Aspect	Interviewees					Average	Std. Dev	Modus	Q1	Q2	Q3	IR	Evaluation	
		X1	X2	X3	X4	X5								Std. Dev	IR
	Criteria														
1	Capability	8	7	7	8	8	7,6	0,547722558	8	7	8	8	1	Kon	Kon
2	Impact of Ipoleksosbudhankam	8	8	9	7	7	7,8	0,836660027	8	7	8	8	1	Kon	Kon
3	Budget Availability	3	5	7	5	2	4,4	1,949358869	5	3	5	5	2	Div	Kon
4	Readiness	7	6	7	4	4	5,6	1,516575089	7	4	6	7	3	Div	Div
5	Involvement	7	8	7	8	7	7,4	0,547722558	7	7	7	8	1	Kon	Kon
6	The intensity of the incident	8	8	7	9	8	8	0,707106781	8	8	8	8	0	Kon	Kon
7	Accesibility	8	6	5	3	6	5,6	1,816590212	6	5	6	6	1	Div	Kon
	Sub Kriteria														
1	Marine Pollution	6	7	6	5	7	6,2	0,836660027	6	6	6	7	1	Kon	Kon
2	Pandemic Spread	8	8	7	8	7	7,6	0,547722558	8	7	8	8	1	Kon	Kon
3	VVIP security	7	6	6	7	7	6,6	0,547722558	7	6	7	7	1	Kon	Kon
4	SAR aviation and shipping	8	7	7	4	5	6,2	1,643167673	7	5	7	7	2	Div	Kon
5	Natural Disaster, Tsunami	4	7	5	7	3	5,2	1,788854382	7	4	5	7	3	Div	Div
6	Security of Border Areas	5	7	4	5	8	5,8	1,643167673	5	5	5	7	2	Div	Kon
7	Obvitnas Security	8	7	7	7	8	7,4	0,547722558	7	7	7	8	1	Kon	Kon
8	Violence at Sea	7	7	8	8	6	7,2	0,836660027	7	7	7	8	1	Kon	Kon
9	National Marine Security Jurisdiction	8	8	9	7	7	7,8	0,836660027	8	7	8	8	1	Kon	Kon

Based on the results of processing, it has obtained a selection of criteria, contingent alternatives that are important and potential to be developed. Based on the average, the criteria are 1) Number/intensity of events; 2) Impact of Ipoleksosbudhankam; 3) Capability; and 4) Engagement. As for the contingency itself, they are 1) National jurisdiction marine security; 2 The spread of the pandemic; 3 Obvitnas safeguard; 4) Violence at sea; 5) VVIP security and 6) Marine pollution.

3.1.2 AHP Data Processing

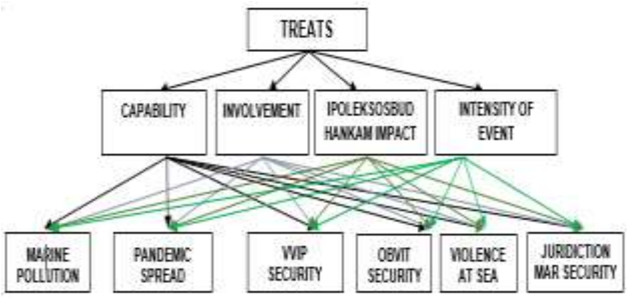


Figure 3.The hierarchy of treat decision making

The data that has been obtained from distributing questionnaires in the form of pairwise comparison between the criteria for each alternative. The assessments of the informants will be combined using the formula for the geometric mean. The calculated geometry is then entered into the pairwise comparison matrix in software super decisions.

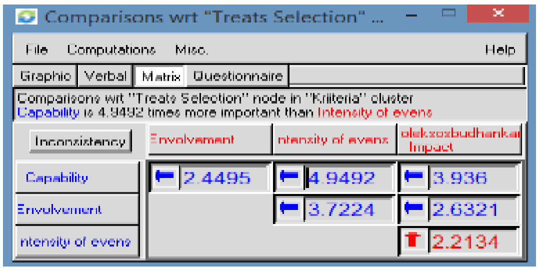


Figure 4. Geomean in comparison matrix

The processing results produce an Inconsistency Index (CI) of 0,0268. This value is still below 0.1 which means that the answers given by the speakers in the questionnaire are consistent.

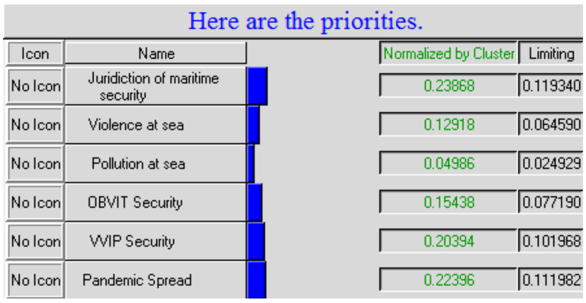


Figure 5. Threat priority

After normalization is carried out at the final weighting magnitude, the national jurisdiction kamla contingency weight gets a value of 0,23792; violence at sea is 0,12923; marine pollution is 0,04967; vital object security is 0,15410 and VVIP security is 0,20416 while pandemic spread of 0,22492. So that in the operation modeling that will be made based on the threat of national security and jurisdiction.

3.2 Determination of Headquarters Warship (C2)

The problem is designed as a hierarchical structure of four levels: First the goal of the decision problem, followed by the criteria, subcriteria, and alternative levels. As shown in Fig. 6, to select an optimal alternative, we considered five candidate C2 warship as decision variables (x1, x2, . . ., x5) and evaluated them based on four criteria and 16 subcriteria.

Each subcriterion, identified and structured in the previous stage, has its own characteristic data about the candidate C2 warship (table 5). The criteria and characteristic data were identified by the research team on the basis of confidential materials on C2 warship. Because of the confidentiality issue, part of the data was arbitrary but meaningfully generated.

We also have target values, or goals, for each subcriterion that should be achieved in the decision making process. Expert and determine the target values in the form of requirements for operational capability that describe the capabilities demanded for successful operational performance.

3.2.1 Hybrid ILP Model

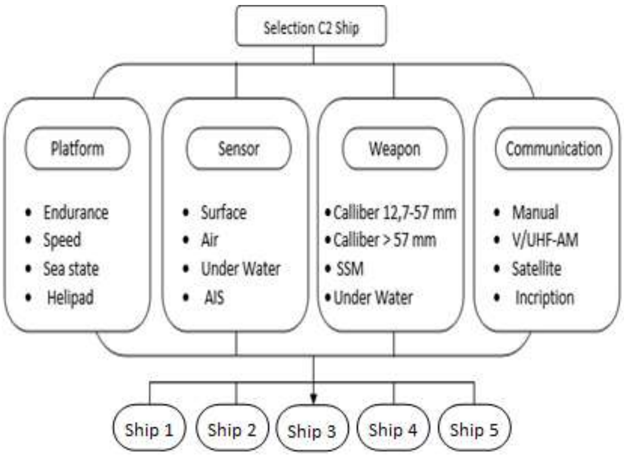


Figure 6. Hierarchical structure for C2 warship selection.

Table 4. Fuzzy Weight-deriving process for criteria.

Criteria	Sub Criteria	Agregat Value			Defuzzy	Weight	Round
		ct	at	bt			
Platform	Endurance	5,975	7,875	9,43155	7,62765	0,07038	0,070
	Speed	4	6,55833	8,32738	6,02265	0,05557	0,056
	Sea state	5,6	7,41667	9,26488	7,27354	0,06712	0,067
	helipad	6,93333	8,78571	9,8125	8,42364	0,07773	0,078
Sensor	Surface	6,55833	8,32738	9,64583	8,07633	0,07452	0,075
	Air	6,475	8,32738	9,64583	8,04197	0,07421	0,074
	Under Warter	1,75	5,18333	6,95833	3,98154	0,03674	0,037
	AIS	7,41667	9,26488	10	8,82435	0,08143	0,081
Weapon	12,7-57 mm	3,75	5,975	7,86905	5,60743	0,05174	0,052
	> 57 mm	4,1	6,91667	8,35417	6,18768	0,0571	0,057
	SSM	2,5	5,6	7,41667	4,70016	0,04337	0,043
	Under Water	1,75	5,18333	6,95833	3,98154	0,03674	0,037
Com	Manual	1	4,83333	6,475	3,15134	0,02908	0,029
	V/UHF-AM	7,41667	9,26488	10	8,82435	0,08143	0,081
	Sattelite	7,41667	9,26488	10	8,82435	0,08143	0,081
	Inkripsi	7,41667	9,26488	10	8,82435	0,08143	0,081
Total					108,373	1	1

Table 5. Characteristic data on alternative C2 warship systems

Sub Criteria	Value	Ship 1	Ship 2	Ship 3	Ship 4	Ship 5
Endurance	5	9	7	10	6	7
Speed	12	14	12	14	14	15
Sea state	3	4	4	5	3	3
Helipad	1	1	0	1	0	0
Surface	48	98	98	48	48	48
Air	60	105	100	60	60	60
Under Water	1	1	1	0	0	0
AIS	1	1	1	1	1	1
Caliber 12,7-57mm	2	2	2	4	2	2
Caliber > 57mm	1	1	1	1	1	1
SSM	1	1	1	1	1	1
Under Water	1	2	3	1	2	2
Manual	4	5	5	8	6	5
V/UHF – AM	3	8	6	6	4	4
Satellite	1	1	1	1	1	1
Enkripsi	2	2	2	2	2	2

A weighted integer GP model can be formulated with a decision variable of xj (0 or 1) to indicate whether warship j is selected. Because we have 16 goals to satisfy, 16 goal constraints are also present.

The constraints on the platform are expressed as follows:

$$9X_1+7X_2+10X_3+6X_4+7X_5-d_1^{+}+d_1^{-} = 5 \quad ...(1)$$

$$14X_1+12X_2+14X_3+14X_4+15X_5-d_2^{+}+d_2^{-} = 12 \quad ...(2)$$

$$4X_1+4X_2+5X_3+3X_4+3X_5-d_3^{+}+d_3^{-} = 3 \quad ....(3)$$

$$X_1+X_3-d_4^{+}+d_4^{-} = 1 \quad ...(4)$$

The constraints on sensor capabilities are:

$$96X_1+96X_2+48X_3+48X_4+48X_5-d_5^{+}+d_5^{-} = 48 \quad ...(5)$$

$$105X_1+100X_2+60X_3+60X_4+60X_5-d_6^{+}+d_6^{-} = 60 \quad ...(6)$$

$$X_1+X_2-d_7^{+}+d_7^{-} = 1 \quad ...(7)$$

$$X_1+X_2+X_3+X_4+X_5-d_8^{+}+d_8^{-} = 1 \quad ...(8)$$

A set of the constraints on weapon are:

$2X_1+2X_2+4X_3+2X_4+2X_5–d_9^{+}+d_9^{-} \;=\; 2$ ...(9)

$X_1+X_2+X_3+X_4+X_5–d_{10}^{+}+d_{10}^{-} \;=\; 1$ ...(10)

$X_1+X_2+X_3+X_4+X_5–d_{11}^{+}+d_{11}^{-} \;=\; 1$ ...(11)

$2X_1+3X_2+1X_3+2X_4+2X_5–d_{12}^{+}+d_{12}^{-} \;=\; 1$ ...(12)

The constraints on communication capabilities are:

$5X_1+5X_2+8X_3+6X_4+5X_5+d_{13}^{+} - d_{13}^{-} \;=\; 4$ .....(13)

$8X_1+6X_2+6X_3+4X_4+4X_5+d_{14}^{+}-d_{14}^{-} \;=\; 4$ ....(14)

$X_1+X_2+X_3+X_4+X_5–d_{15}^{+}+d_{15}^{-} \;=\; 1$ .....(15)

$2X_1+2X_2+2X_3+2X_4+2X_5–d_{16}^{+}+d_{16}^{-} \;=\; 2$ .....(16)

where decision variables are C2 warchip alternatives.

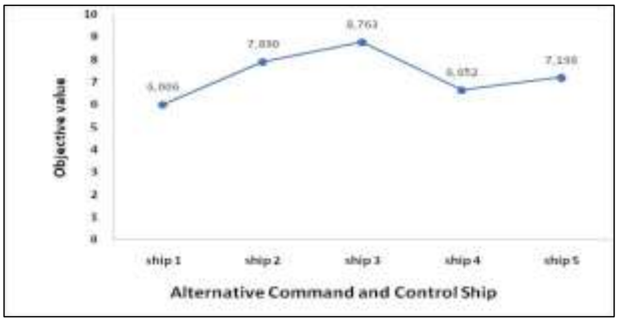
$$Xj = \begin{cases} 1 \text{ if the jth alternative is selected;} & ;\ j = 1; 2; \ldots; 5: \\ 0 \text{ otherwise;} & \end{cases}$$

The model also includes the following hard constraint:

$$\sum_{J=1}^{5} Xj = 1$$

The objective function is to minimize the total weighted deviations from the goals that satisfy the above constraints. It can be expressed as follows:

$$Z_{min}=0{,}070d_1^{-}+0{,}056d_2^{-}+0{,}056d_3^{-}+0{,}078d_4^{-}+0{,}075d_5^{-}+ 0{,}074d_6^{-}+0{,}037d_7^{-}+0{,}081d_8^{-}+0{,}052d_9^{-}+0{,}057d_{10}^{-} +0{,}043d_{11}^{-}+0{,}037d_{12}^{-}+0{,}029d_{13}^{+}+0{,}081d_{14}^{+}+ 0{,}081d_{15}^{-}+0{,}081d_{16}^{-}$$



Graph 1. The results of the selection of headquarters warships

The objective function of the LP problem is a combination of the heterogeneous units of measure. Thus, the constraints should be normalized before solving the problem so that the deviation variables in the objective function are adjusted to the same unit of measure. We used excel solver to solve the LP model. Because the purpose of the problem is to select the C2 warship, the optimal alternative in our case study was warship 1.

3.3 Marine Operations Modeling With ILP

3.3.1 Decision Variables

The decision on this matter was that several warships were assigned to sectors of the operation. The form of the decision variable is integer and 0-1 (zero-one). In this modeling, the assignment of 27 warships will be the decision variable where 4 of them become C2 warships in turn. The warship will be assigned to areas 1 to 8.

$$X_{ij} \begin{cases} \text{Matrix valuable = 0, meaning Warship i NO SELECTED assignments in sector j} \\ \text{Matrix valuable = 1, meaning Warship i SELECTED assignments in sector j} \end{cases}$$

Table 6. Warship capability data

Warship	Speed (Knot)	Endurc (day)	Sensor (Nm)	Distance (Nm/day)	Coverage (Nm2/day)	Pola operasi		Fuel/Etmal		Person
						Ops	Harbour	speed eco	Harbour	
1	12	7	96	288	31.394	6	3	12.620	2.300	106
2	12	7	96	288	31.394	6	3	12.620	2.300	106
3	12	7	96	288	31.394	6	3	12.620	2.300	106
4 (C2)	14	9	96	336	35.542	6	3	16.800	3.000	93
5	12	6	48	288	14.069	6	3	5.880	800	68
6	12	6	48	288	14.069	6	3	5.880	800	68
7	12	6	48	288	14.069	6	3	5.880	800	68
8	12	6	48	288	14.069	6	3	8.900	1.200	68
9	13	5	48	312	15.106	6	3	3.888	960	59
10	13	5	48	312	15.106	6	3	3.888	960	59
11	13	5	48	312	15.106	6	3	3.888	960	59
12	14	5	48	336	16.143	5	3	7.008	960	57
13	14	5	48	336	16.143	5	3	7.008	960	57
14	14	5	48	336	16.143	5	3	12.200	720	59
15	14	5	48	336	16.143	5	3	12.200	720	59
16	14	4	48	336	16.143	4	3	16.968	768	36
17	13	5	48	312	15.106	5	3	10.920	720	51
18	13	5	48	312	15.106	5	3	10.515	210	50
19	13	5	48	312	15.106	5	3	9.560	700	50
20	14	5	24	336	7.665	5	3	8.244	756	32
21	14	5	24	336	7.665	5	3	7.669	756	33
22	14	5	24	336	7.665	5	3	7.669	756	33
23	10	3	24	240	5.591	3	3	6.720	720	33
24	10	3	24	240	5.591	3	3	6.720	720	33

Table 7. sektor, wide area and person support datas

Ops	ALFA	KILO					MIKE	INDIA
SECTOR	A1	A2	A3	A4	A5	A6	A7	A8
SQUARE	32750	136.000	145.250	152.310	125.610	125.150	23.624	20.866
PERSON	170	180					80	80
TIME	60	60					30	30

3.3.2 Objective Function

The goal of this modeling is to minimize the use of fuel by the operating elements.

3.3.3 Determination of Constraints

In this mathematical model of solving there are several constraints, namely as follows:

a. The first constraints: the amount of operational support is still based on the quota from Indonesian Nation Armed Forces headquarters in the form of the number of personnel in each operation.

- Operation ALFA which consists of 3 sectors is given a quota of 170 personnel.
- KILO operations in securing 5 sectors of the Main naval base sea area are given a quota of 180 personnel.
- Operation MIKE in carrying out joint patrols with Malaysia and Philippines is given a quota of 60 personnel.
- INDIA operations in carrying out joint patrols with the Philippines are given a quota of 60 personnel.

b. Second constraints: the assignment of warship corresponds to each warship Home Base.

- The 20th and 21st warships were only involved in ALFA operations and patrols in sector A6
- Warships 24th Only involved in ALFA operations and patrol sector A3
- Warships 22nd and 23rd Only involved in ALFA operations and patrol sector A2
- Warships 19th Only involved in ALFA operations and patrol sector A4
- Warships 17th and 18th Only involved in ALFA operations and patrol sector A5 and A7.
- Warship C2 is only assigned to ops Alfa or A3 and must be in an operation.
- Warships 14th and 15th can operate in all operating sectors.
- The remaining warships only get ALFA and KILO operations

c. Third constraints: warship used in surgery is not used in the following three months to carry out maintenance and repairs.

d. The fourth constraints: The coverage area of warship/operations must be larger than the area of the sector in the operational period.

3.3.4 Optimization Result Data Analysis

Solving this model produces a zero-one (0-1) assignment table.X_{ij} = 1 means that the i-th warship is assigned to sector j and X_{ij} = 0 means that the i-th warship is not assigned to sector j.

Table 8.The Processing Results Of The Model

Ops	Sektor	SHIP PATROL			
		TW 1	TW2	TW2	TW4
ALFA	A1	SHIP C2, 6	SHIP C2, 7	SHIP 2, 13	SHIP 1, 12
Person		161	161	163	63
Coverage (Nm2)		1.984.435	2.976.653	2.791.701	1.861.134
Fuel (KL)		983.200	1.474.800	1.252.800	1.252.800
KILO	A2	SHIP 9	-	-	SHIP 5
	A3	SHIP 11	-	SHIP C2	SHIP C2
	A4	-	SHIP 3	SHIP 8	-
	A5	-	SHIP 5	-	SHIP 17
	A6	SHIP 10	-	-	-
Person		177	174	161	177
Coverage (Nm2)		1.963.104	3.430.979	2.700.449	1.949.529
Fuel (KL)		524.160	1.203.000	1.668.000	2.071.350
MIKE	A7	SHIP 21	SHIP 20	SHIP 17	SHIP 15
Person		33	32	51	59
Coverage (Nm2)		229.846	229.853	453.061	484.170
Fuel (KL)		152.299	163.080	212.850	236.850
INDIA	A8	SHIP 18	NO OPS	NO OPS	SHIP 14
Person		55	NO OPS	NO OPS	59
Coverage (Nm2)		453.066	NO OPS	NO OPS	484.170
Fuel (KL)		197.156	NO OPS	NO OPS	228.750

The maximum total coverage area that can be secured by patrol boats in all areas of Indonesian Naval 2nd Fleet Command for 1 year in maritime security operations under 2nd Guskamla with existing resources is 21.992.150 NM^2 where with minimum fuel use is 15.077.335 Kl but still covering the entire work area in Indonesian Naval 2nd Fleet Command. (687.320 NM^2)

Security Level = (Area of Coverage Area that is secured divided by Total Area of Indonesian Naval 2nd Fleet Command)

(**Area Security Level = 31.997)**

The higher the Area Security Level obtained from the warship assignment, the higher the coverage area that is secured in presence operations at sea by Patrol Boats with the composition of the warship assignment above.

4. CONCLUSIONS

a. The results of intelligence analysis of various possible contingencies have been analyzed from several criteria and sub-criteria carried out with separate FGD and processed using the Delphi method then prioritized using AHP where the results of determining threat priority using AHP are as follows: National jurisdiction marine security got a value of 0,23792; the spread of the pandemic was 0,22492; VVIP security was 0,20416; security of vital objects was 0,15410 and violence at sea was 0,12923 while marine pollution was 0,04967. The selection of the national jurisdiction maritime security contingency in the future forecast will maximize the operation of 2nd Guskamla.

b. From the results of the processing of fuzzy weighting and linear goal programming, it was found that 1st warshipwas selected to be the headquarters warship (C2) with a value of 6,006; with the second priority 4th warship, which was 6,652; 5thwarshipwas 7,198; 2ndwarshipwas 7,890 and 3rt warship of 8,763. This Hq warship must be in operation under 2nd Guskamla. In determining the operating sector for headquarters warships in a separate discussion, a questionnaire determines that the headquarters warships (C2) are operating in sector A1 or A3.

c. Operations modeling under 2nd Guskamla used 27 patrolling forces and combat patrols where 4 warships of type S were used as Hq warships. With the presence of 7 patrol boats that have been dispersed to each Main naval base which automatically makes the home base warship to carry out operations according to the closest sector, the warship headquartered in Surabaya can carry out operations in all sectors with the following results:

1) Modeling in 1st quarter resulted in the ALFA operation carried out by 2 warships, namely warship C2 and 6thwarship with a coverage area of 1.984.435 Nm2 and use of 983.200 Kl of fuel while in KILO operation carried out 3 warships, namely 9th, 10th and 11stwarshipswith coverage of 1.963.104 Nm^2 and fuel consumption of 524.160 Kl and MIKE operation using 1 warship, namely 21st warshipwith a coverage of 229.846 Nm^2 and fuel consumption of 152.299 Kl. As well as INDIA operations using 18thwarshipwith a coverage of 453.066 Nm^2 and fuel consumption of 197.156 Kl.

2) Modeling in 2nd quarter resulted in the ALFA operation carried out by 2 warships, namely the C2 warship and 7th warshipswith a coverage area of 2.976.653 Nm^2 and the use of fuel 1.474.800 Kl while the KILO operation carried out 2 warships, namely 3rd and 5th warships with a coverage of 3.430.979 Nm^2 and fuel consumption of 1.203.000 Kl and MIKE operation using 1 warship, namely 20th warship with a coverage of 229.853 Nm^2 and fuel consumption of 163.080 Kl. and the INDIA operation was not scheduled.

3) Modeling in 3th quarter resulted in the ALFA operation carried out by 2 warships, namely 2nd and 13rd warship with a coverage area of 2.791.701 Nm^2 and the use of fuel 1.252.800 Kl while in the KILO operation 2 warships were carried out, namely C2 and 8th warships with a coverage of 2.700.449 Nm^2 and fuel consumption of 1.668.000Kl and MIKE operation using 1 warship, namely 17th warship with coverage of 453.061 Nm^2 and fuel consumption of 212.850 Kl. and the INDIA operation was not scheduled.

4) Modeling in 4th quarter resulted in the ALFA operation carried out by 2 warships, namely 1st and 12nd warship with a coverage

area of 1.861.134 Nm2 and fuel consumption of 1.252.800 Kl while in KILO operation 3 warships were carried out, namely C2, 5th and 17th warships with coverage of 1.948.529 Nm2 and fuel consumption of 1.252.800 Kl and MIKE operation using 1 warship, namely 15th warship with a coverage of 484.170 Nm^2 and fuel consumption of 236.850 Kl. As well as the INDIA operation using 14th warships with a coverage of 484.170 Nm^2 and fuel consumption of 228.750 Kl.

5) The level of area security obtained from the warship assignment to ALFA operations is 152; KILO is 14,68; MIKE is 59,13 and INDIA operations are 44,91

ACKNOWLEDGEMENTS

The authors greatly acknowledge the support from Indonesian Naval Insitute of Technologyand Indonesian Navy Institution for providing necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

REFERENCE

Badri, M. A. 2001. A Combined AHP–GP model for quality control systems.International *Journal of Production Economics, 72(1), 27–40.*

Bush, George W 2005. The National Strategy for Maritime Security, Maritime security, resource management, https://georgewbush-whitehouse.archives.gov/homeland/maritimesecurity.html, downloaded 3rd August 2020

Cheng, C. H., & Lin, Y. 2002. Evaluating the best main battle tank using fuzzy decision theory with linguistic criteria evaluation. European *Journal of Operational Research, 142, 174–186.*

Cheng, C. H., Yang, K. L., & Hwang, C. L. 1999. Evaluating attack helicopters by AHP based on linguistic variable weight. European *Journal of Operational Research, 116, 423–435.*

Dagdeviren, M., Yavuz, S., & Kılın, N. 2009. Weapon selection using the AHP and TOPSIS methods under fuzzy environment. Expert Systems with Applications, 36 (4), 8143–8151.

Fox, W. P. 2016. Applications and Modelling Using Multi-Attribute Decision Making to Rank Terrorist Threats, *Journal of Socialomics* 5: 162.

Greiner, M. A., et al. 2003. A hybrid approach using the analytic hierarchy process and integer programming to screen weapon systems projects. *IEEE Transaction on Engineering Management, 50(2), 192–203.*

Marsetio. (2013). Indonesian naval strategy in securing the maritime boundary of the Republic of Indonesia: Historical-Strategy studies. *Citra Lekha history journal, XVII*(1), 1-18.

Ho, W. 2007. Combining analytic hierarchy process and goal programming forlogistics distribution network design. *IEEE International Conference on Systems, Man and Cybernetics, 714–719.*

Ho, W. 2008. Integrated analytic hierarchy process and its applications — Aliterature review. *European Journal of Operational Research, 186, 211–228.*

Kong, F., & Liu, H. 2005. Applying fuzzy analytic hierarchy process to evaluatesuccess factors of e-commerce. International,*Journal of Information and SystemsScience, Computing and Information, 1(3–4), 406–412.*

L, Jaewook 2010, AHybrid Approach Of Goal programming For Weapon Systems Selection. International,*Journal of Computers & Industrial Engineering, 58, 521–527*

Liang, G. S., & Wang, M. J. J. (1994). Personnel selection using fuzzy MCDM algorithm. *European Journal of Operational Research, 78(1), 22-33.*

Ren-Shuai Chen & Joseph Z. Shyu, (2006), Selecting a weapon system using zero-one goal programming and analytic network process, *Journal of Information and Optimization Sciences, 27:2, 379-399.*

Saaty, T. L. (1990). *Multicriteria decision making: The analytic hierarchy process*. Pittsburgh, PA: RWS Publications.

Saaty, Thomas L.2008 "*Decision Making With The Analityc Hierarchy Process*." *Int. J. Services Sciences,* Vol. 1, No. 1.

Sugiyono. 2017. *Quantitative Research Methods, Qualitative and R & D.* Bandung: CV. Alfabeta.

Suharyo, O. S. 2014. Fleet Placement Optimization Model: A Case Study of Indonesian Navy Patrol Boats in Eastern Indonesia. *AAL Journal.*

Trivedi. A. 2017, A Hybrid Multi-Objective Decision Model For Emergency Shelter Location-Relocation Projects Using Fuzzy Analytic Hierarchy Process And Goal programming Approach.International Journal of Project Management Volume 35, Issue 5, Pages 827-840

Indonesian Naval Technology College, STTAL
Postgraduate International Conference, Vol. 4
ICMST 2020 September, 24th 2020

ACCURACY OF OPERATING PATTERNS IN LANAL TAREMPA IN THE FACE OF REGIONAL VIOLATION RATES WITH DOUBLE HOLT WINTERS EXPONENTIAL SMOTHING AND BAYESIAN NETWORK COMBINATION MODELS

Hadi Syafruddin[1], Ahmadi[2], Yudha Sukma[3]

[1,2,3]*Indonesian Naval Technology Collage*
Bumimoro-Morokrembangan, Surabaya 60178, Indonesia
e-mail: adhitahadi@gmail.com

ABSTRACT

The dynamics in the development of the security situation are so rapid that there are many political policies that change the security situation of a Country. So that everyone competes to create a technique so that the designed method can be applied especially in the field of security. Indonesia is one of the island states that has an area of sea 2/3 of the land so the source of natural wealth is very abundant, this causes many conflicts of interest with neighboring countries. The number of violations of the Lanal Tarempa region in the Natuna Sea as an example. In the calculation between the degree of violation over time and the application of proper operating patterns it takes a method with a forecasting calculation system (Forcasting) in this case using the Time Series Double Holt Winters Exponential Smothing by combining Holt's (Double Exponential Smoothing) model as a closed system model with the Bayesian Network model as an open system model. This proposed model has the ability to follow a significant pattern of actual data movement. The number of illegal fishing violations based on the data of the last 4 (four) years. The accuracy of an analysis if in the processing of forecasting data results in a small α (Alpha) and β (Beta) value as well as mape, MSE and MAE correction values.

KEYWORDS: *Security Situation, Breach, Tarempa Naval Base, Operation Pattern, Forecasting and Bayesian Network Model.*

1. INTRODUCTIONS

Indonesia as the world's largest maritime country and archipelago has a specific character that is not owned by other countries where 2/3 of Indonesia is an ocean territory. With the greatest water conditions, the threat of maritime and sovereignty is greater. The implications of indonesia's geographical location and constellation, the border area becomes a potential conflict, including the sea border between Indonesia and other countries making cooperation sometimes disrupted. The Natuna Sea is a big concern right now. Conflicts of interest often occur there, especially when it comes to taking natural resources in secret by neighboring countries. This led the Indonesian government to make strict policies such as the capture of foreign fishing vessels, the sinking of foreign fishing vessels, the return of spoils and fines to the State for illegal fishing in the Natuna Sea. Illegal fishing is a violation

of the territory which includes a violation of the sovereignty of the Republic of Indonesia so that it becomes the main duty of the TNI, especially the TNI AL in order to support the National Assembly. In accordance with Law No.3 of 2002 article 10 states that the TNI as a defense tool of the Unitary State of the Republic of Indonesia (NKRI) is tasked with carrying out the defense policy of the country at sea implied in the sentence of carrying out operations other than war, so that the duty of the Navy in law enforcement at sea has three roles known as "Trinity Role of the Navy". The task is carried out to ensure the integrity and sovereignty of the Indonesian state over all waters of national jurisdiction while ensuring Indonesia's national interests in and or by sea but will not run if it is not supported by an adequate base. Sea defense control is tasked to KRI as the leading sector but still requires the concept of supporting facilities and meeting kri needs as based on The Decree of Kasal Number Skep/372/III/2007 on Standardization of Naval Base. Base as one of the components of the Integrated Fleet Weapons System (SSAT). Based on the facilities and capabilities of a base, the base consists of the Main Base of the Navy (LANTAMAL) and the Naval Base (LANAL) consisting of type B and C. One of the bases located in the Natuna Sea is Lanal Ranai and Lanal Tarempa where the second position of Lanal is very strategic and directly facing the border of another Country. Lanal Tarempa's own position is in the Southwest of Lanal Ranai. With this strategic position makes Lanal Tarempa often violations of territory such as illegal fishing by other countries, this becomes an issue where the limitations of patrol elements from Lanal Tarempa such as KAL – 28 and Patkamla who are only able to carry out patrols near the nearest islands have not been able to cover the entire area of Lanal Tarempa so it is necessary to implement a proper operating pattern system with limited operations in the face of any violations in its territory. Violations often committed by other Countries are very uncertain, this causes the current pattern of limited patrol operations to be less maximal so there needs to be an allegation or forecast of violations occurring based on previous years. To be able to predict the need for accurate data is also the right forecasting method. Among the existing forecasting methods holt winters method is that the accuracy is better than other methods. The Holt Winters Method uses comparison of actual data with prediction data in time series so that the results are more accurate. Holt Winters Exponential Smoothing model is also still relatively close system because this method is based only on historical data. In fact, there are several external factors that affect the pattern of operation, such as existing alut sista factors, limited personnel capabilities, and others that should be solved by open system methods. To supplement the forecasting of illegal fishing violations in the Lanal Tarempa region on an open system basis, the Bayesian Network method was used.

The Bayesian Network method can perform probabilistic decision-making (inference) by using other known variable values. Neapolitan also states that the Bayesian Network method can represent a causal relationship between variables found in the Bayesian Network structure. Therefore, Bayesian Network is an appropriate method to develop the idea of an element of uncertainty with a limited amount of data as well. Based on that background, the problem that will be discussed in this study is how to build an open system model combined with a close system method that can be used to determine the exact pattern of operation by predicting data violations of the territory in this case illegal fishing by foreign fishermen taking into account not only historical data but also some factors that allegedly affect the pattern of operations in the Lanal Tarempa region. The results of this study are expected to obtain a model for accuracy in determining the pattern of operation in each level of violation by predicting the number of future violations by applying the Bayesian Network (open system) method approach combined with the time series (close system) forecasting method.

2. MATERIALS / METHODOLOGY

2.1. Research Approach

2.1.1. Operations Research

The approach or method used in this study is to use the rules of surgical research. Operation Research (OR) is a method of problem solving that prioritizes the thinking of the friend to know the various degrees of development of the factors that influence the problem (et.al, 1999). The main purpose of this study is to develop a model that can be used to obtain the right pattern of operation by predicting illegal fishing violations in the Lanal

Tarempa Natuna region. Therefore, the object used in this study is data on the number of illegal fishing violations over the past four years. Statistical Software used to perform data auto correlation calculation and data pattern determination. Minitab 16 software is used to help process data that is also thought to contain missing value. For GeNie 2.0 software is used to develop Bayesian network models based on the initial data that has been obtained and also test the model that has been developed. At the data processing stage, all data obtained is processed using software, such as Minitab 16, and GeNie 2.0. To build the model, 75 percent of the overall data was used and the remaining 25 percent was used to test the model, so out of a total of 48 existing data as much as 36 data was used to build the model and the remaining 12 data was used to test the model.

2.1.2. Qualitative

In addition to using the Rules of Operation Research (OR) also use a qualitative approach where the data obtained is primary and secondary data as well as from the existing literature. In addition to using the Rules of Operation Research (OR) also use a qualitative approach where the data obtained is primary and secondary data as well as from the existing literature.

2.2 Use of Methods

2.2.1. Holt Winters Exponential Smoothing

This method uses time-run data forecasting that follows a linear trend where the first step to perform is to determine or initialize the values of alpha and beta parameters. Common forms used to calculate forecasts are:

a. Exponential Smoothing Equation: $Ft = \alpha Yt + (1 - \alpha)(Ft{-}1 + T)\ t{-}1$

b. Trend Estimation Equation: $Tt = \beta\ (Ft - Ft{-}1) + (1 - \beta)\ Tt{-}1$

c. Equations Used to make forecasting in the coming p period are

$$: Yt{+}p = Ft + \ Tpt$$

Where:

= exponential smoothing value

a = smoothing constant for data (0 < a < 1)

b = smoothing constant for trend estimation (0 < b < 1)

Y = actual value in period t

T = estimated trend p = number of forward periods to be foreseen

2.2.2. Bayesian Networks

Graphically, the construction of the Bayesian Network structure consists of nodes and arrows. The variable will later be represented by a node and have a probability value. The arrow shows the relationship between the variables that affect or are affected. For example, we will observe the level of wetness in the grass. The variables used in the model are grass wetness level (A), rainfall level (B), sprinkler water splash (C). If rainfall levels and splashes of water from sprinklers are high, then the grass will get wetter. In accordance with the rules of the probability chain, the equation is obtained:

$$(x) = \prod_{i=1}^{n} (xi|x1, \ldots, xi\text{-}1)$$

where for each Xi, there will be Πi {X1, ..., Xi-1}, which indicates that Xi and {X1, ..., Xi-1} with information are conditionally independent. For the case of the level of grass wetness, it can be written in the equation:

$$p(A|B, C) = p(A)$$

which means that the event of grass getting wet occurs after rain or sprinklers that water the grass. Therefore, the construction of structures for the level of wetness of grass such as:

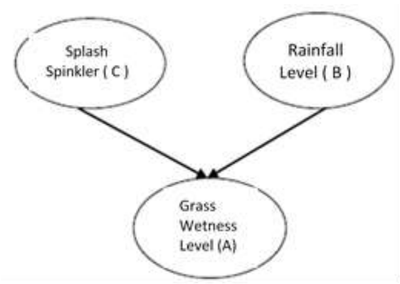


Figure 2.1 Relationship Causal.

In addition, the Bayesian Network is built with a statistical approach called the bayes theorem. In this theorem is used conditional probability which is the chance of an event A if it is known event B has occurred before. Conditional probability is notified with P (A| B). The calculation for conditional probability is contained in the equation below:

$$P(A|B) = \frac{P(A \cap B)}{P(B)} \quad \text{dan} \quad P(A|B) = \frac{P(A \cap B)\ .\ P(A)}{P(B)}$$

In addition, there is also a joint probability which is the chance of occurrence of events A and B that are notified with (P AnB). Calculation for joint probability is found in the equation:

$P(A \cap B) = P\ (A|B)\ xP\ (B\ )\ atau\ P(A \cap B) = P\ (B|A)\ xP(A)$

In determining the parameter value can use the frequency of events and the probability of events. So that later can be known the probability value of each parameter.

3. RESULT AND DISCUSSION

3.1. Conceptual Model

It is a conceptual model of research or an overview of the research to be done. The conceptual model consists of four parts: pre-processing, input, method, and output. The pre-processing section describes information about data without missing value and data that allegedly contains missing value and tools used in the processing of missing value data. The input section describes the information about where the data used in this study was obtained. In the method section describes the information about what methods are used in data processing. Then, the final part is the output section that describes the information about the results of the data processing that has been done.

Figure 3.1 Model Concept

3.2 Development of Model Close System

In this study, the closed system model was

built by applying the idea of Holt's method. To build the model, the data used was 75 percent of the overall data and the remaining 25 percent was used to test the model. As for the total data overall is 48 data, so 36 data will be used to build the model and the remaining 12 data will be used to test the model. Thus, the data used to build the model is data from January 2016 to December 2018, while data from January 2019 to December 2019 is used to test the model.

3.3 Causal Relationships

Bayesian Network's method is to describe the la causal relationship between the operating model and the factors that affect it.

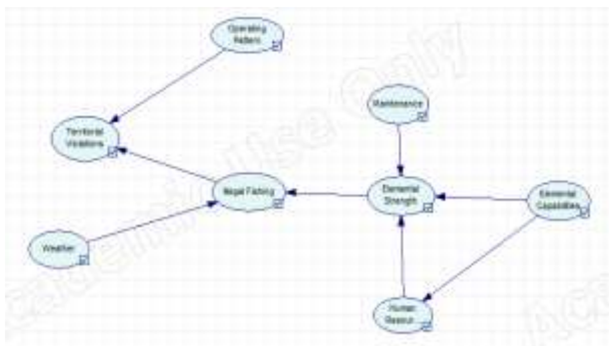


Figure 3.2 Causal Relationships

3.4 Calculation of Probability of Each – Individual Factors

The next step in creating the Bayesian Network model is to determine the probability of events for each node (factor) and the relationship between those nodes. In this study, the probability of an event was calculated based on the frequency at which the state or combination of states of each node was selected.

3.5 Testing Model Open System

Once all the probabilities of events on each node have been calculated, the Bayesian Network model can be said to be complete and can be tested against that model. This test serves to measure the accuracy or level of conformity of movement patterns of the built models. The data used for model testing is 15 data or 25% of the overall data. Bayesian Network model testing is performed by setting evidence on each of the outermost nodes (factor nodes that affect 1, node factors affecting 2, and so on), based on the state in each month.

3.6 Development of Model Combines between Open and Closed System

The combination model was built by combining holt's model with the Bayesian Network model. Basically, the level of conformity of Holt's model is higher than the level of conformity of the Bayesian Network model, so the combination of these two methods is expected to improve the accuracy of forecasting the right operating patterns. The development of this combination model follows equations in Holt's model that begin by looking for an estimate of the level value and trend value until it is later obtained from the forecasting results. From the test results of the model, a significant degree of pattern conformity is obtained. Where the pattern's conformity level is essentially the same as the conformity level of Holt's own model, but from MAPE, MAD, and MSD error calculations, holt's and Bayesian Network's combination models have a smaller error value compared to Holt's models. Thus, the use of this combination model can apparently improve the accuracy of forecasting.

3.7 Model Close System Testing

In this study, the closed system model was built by applying the idea of Holt's method. To build the model, the data used was 75 percent of the overall data and the remaining 25 percent was used to test the model. Thus, the data used to build the model is illegal fishing data from January 2016 to December 2018, while the prediction data from January 2020 to December 2020 is used to test the model.

NO	Months	Holt's Winters Predictions		Result
		Forcast Violations	Forecasting	
1.	Jan '20	27.5361	Decreased	Appropriate
2.	Feb '20	27.2798	Decreased	Appropriate
3.	Mar '20	27.0234	Decreased	Not Appropriate
4.	Apr '20	26.7671	Decreased	Appropriate
5.	Mei '20	26.5107	Decreased	Appropriate
6.	Jun '20	26.2544	Decreased	Appropriate
7.	Jul '20	25.9980	Decreased	Not Appropriate
8.	Aug '20	25.7417	Decreased	Appropriate
9.	Sep '20	25.4853	Decreased	Appropriate
10.	Oct. '20	25.2289	Decreased	Appropriate
11.	Nov. '20	24.9726	Decreased	Appropriate
12.	Des '20	24.7162	Decreased	Appropriate
MAPE				9.36572
MAD				2.36804
MSD				8.76783
Pattern Level				83.34 %

Table 3.1 Holt's Model Test results

3.8 Model Open System Testing

Once all the probabilities of events on each node have been calculated, the Bayesian Network model can be said to be complete and can be tested against that model. This test serves to measure the accuracy or level of conformity of movement patterns of the built models. The data used for model testing is data from January 2019 to December 2019. The factors or nodes on the Bayesian Network model are built with Use Software GeNie 2.0.

Figure 3.3 Bayesian Network Model Testing.

Table 3.2 Bayesian Test Results

Months	Bayesian Network Predictions			Result
	High	Low	Predictions	
Jan '20	0.7	0.3	Increased	Appropriate
Feb '20	0.7	0.3	Increased	Appropriate
Mar '20	0.43	0.57	Decreased	Appropriate
Apr '20	0.43	0.57	Decreased	Not Appropriate
Mei '20	0.43	0.57	Decreased	Appropriate
Jun '20	0.43	0.57	Decreased	Appropriate
Jul '20	0.43	0.57	Decreased	Appropriate
Aug '20	0.68	0.32	Increased	Not Appropriate
Sep '20	0.68	0.32	Increased	Appropriate
Oct. '20	0.68	0.32	Increased	Not Appropriate
Nov '20	0.68	0.32	Increased	Appropriate
Des '20	0.7	0.3	Increased	Appropriate
Pattern Level				75%

From the test results of the model in Table 3.2, it can be seen that the Bayesian Network model that has been built has a pattern conformity level with the actual data movement pattern of 75%. This figure is still smaller than the degree of pattern conformity produced by Holt's method, so with the combination between these two methods it is expected to improve the accuracy of forecasting the appropriate operating patterns. In this combination model, the α(Alpha) value is 0.383731 and the trend beta value is 0.109555. While the MAPE value becomes 8.57443, the MAD value becomes 2.19136, and the MSD value becomes 9.3245. With the conformity rate being 79.2%. These values are obtained using the help of software minitab 16. In the builder data and test data, the forecasting results are obtained from the addition or reduction between the estimated level value and the multiplication of probability and the estimated trend value. The process of addition or subtraction as well as probability depends on the forecasting results of the Bayesian Network model.

4. CONCLUTIONS

In the development of the proposed model in establishing the right pattern of operation by forecasting the amount of data violation (Illegal Fishing) not only considering historical data but also some factors that influence the pattern of such operations is carried out by combining holt's model with the Bayesian Network model. This proposed model has better accuracy compared to the original model (closed system). This proposed model also has the ability to follow the conformity of actual data movement patterns significantly. The value is calculated based on the total frequency of conformity between the proposed model movement pattern and the actual data movement pattern of the number of violations (Illegal Fishing).

By combining Holt's model with the Bayesian Network model. This proposed model has a MAPE value of 8.57%, a MAD value of 2.19%, and an MSD value of 9.32. This proposed model also has the ability to follow the conformity of the actual data movement pattern by 79.2%. The value is calculated based on the total frequency of conformity between the proposed model movement pattern and the actual data movement pattern of the number of violations (Illegal Fishing).

ACKNOWLEDGEMENT

Thank you for your help in the creation of this research and guidance from guidance lecturers and

support from fellow students. This research is not yet entirely true there is still much to improve and is expected to continue by the next researchers.

REFERENCE

Hanke, J. E. dan Wichern, D. W., 2005, *Business Forecasting 8Th Ed*, Pearson Prentice Hall, New Jersey.

Lukman, A. (2017). Bayesian Network Algorithm for Simulation of Election Winner Perediction. Journal of Informatics Engineering, Stimed, 314-330.

Maharani. (2017). Bayesian Network Construction with K2 Algorithm in Weather Prediction Case. Eeccis Vol. 7, No. 1, 30-67.

Pramitaningrum, E. dan Masruroh, N. A., 2013, Development of Waste Monitoring Model in Yogyakarta City Using Bayesian Network Method, *Proceeding of International Conference on Industrial Engineering and Service Science*, Surabaya.

Rahmat, H. F. (2008). Forecasting Rainfall With Bayesian Networks (Case Study: Rainfall In Indramayu Area). Journal of Natural Resources Management Ip

Wu, Y.P., Hu, Q.P., Poh, K.L., Ng, S.H., and Xie, M., 2005, Bayesian Networks Modeling for Software Inspection Effectiveness, *Proceedings of the 11th International Symposium Pacific Rim Dependable Computing (PRDC 2005)*.

DETERMINATION OF STATE IN SOUTHEAST ASIA AS PREDICTORS OF THREATS TO INDONESIA, USING PROFILE MATCHING, DELPHI AND BORDA METHODS

Pius Herdasa Krisna Murti [1], Budisantoso W[2], Avando Bastari[3]

[1,2,3]*Indonesian Naval Technology College, STTAL,*
Bumi Moro, Moro Krembangan Surabaya - 60178, Indonesia

ABSTRACT

A condition free from anxiety and the ability to predict threats, is a situation desired by all citizens. Not yet optimal in countermeasures and predicting the direction of the threat. The need for innovation in the method of determination according to the current state. Research based on the Decision Support System (DSS) trying will provide a solution in determining the predictor of the threat state. Using the Profile Matching method researchers try to map the profiles of countries located in the region. Providing problem solving by modifying the Profile Matching method is to start with delphi method in obtaining the determining criteria of research and weighting it with Borda technique. The criteria and weighting as the constituent criteria of the threat predictor country's strength profile, followed by the role so that the names of the threat predictor countries in Southeast Asia are obtained. The determination of the predictor state will facilitate in countermeasures or deal with it as well as provide actual information of where the threat comes from and the disertor criteria where the country can be weakened by Indonesia.

Keywords: *Threat, Southeast Asia Region, Profile Matching, Delphi, Borda.*

1. INTRODUCTION

The Profile of the country is a power that a country has in displaying its power, which can support the survival of the nation. Indonesia as an island nation has waters that are directly adjacent to other countries. There are 10 neighboring countries whose waters are directly adjacent to the Archipelago. They are Malaysia, Singapore, Thailand, India, Philippines, Vietnam, Papua New Guine, Australia, the Republic of Palau and East Timor. As well as Indonesia's position as a link between the two Oceans namely the Pacific Ocean and the Indian Ocean. According to Stubbs, (1886) history shows that the danger of threatening a nation's independence is from the momentary domination of a neighboring country as well as its formidable military power, efficient economy, and ambitious to expand its borders and influence to another country, a danger directly proportional to the level of strength, followed by the "inevitability" of ambition.

The growing regional cooperation in the Southeast Asia region brings a range of new issues that directly influence all the mechanisms that ASEAN must run. One of the issues that will be discussed in this paper is related to security issues, namely the prediction of threats from the perspective of the profile of countries in the Southeast Asian region against Indonesia. The obscurity of the borders of a country in a region, has an impact on a country's perception of the behavior of another country. Perceptions that are not always considered a positive value, it is not uncommon for perceptions to arise is a form of alertness, where the behavior of a country can threaten the existence of another country's existence. The rise of arms build-up in Southeast Asian countries, for whatever reason, will give birth to a security dillema for fellow Southeast Asian countries. This is natural given the shift in posture and regional defense alliances of Southeast Asia at the beginning of the post-Cold War, the security community such as the ASEAN Regional Forum (ARF), this is a form of security uncertainty so that arms build-up by each country is seen as urgent. Asean countries' cooperation with countries outside ASEAN such as SEATO, FPDA will also have its own impact on relations between countries in southeast Asia. It does not close the possibility that foreign interference in the life of a nation is how the country will continue to strive to gain and assert influence, taking advantage of changing conditions in the international environment. According to Toynbee, (1934) "the balance of power refers to the actual state in which power is distributed between several countries with an estimate of equality" . Morgenthau, (1978)"when every country or bloc becomes, or threatens to become very powerful, other countries must recognize this as a threat to their security and respond by taking equal action, individually and together, to increase their power.

A threat can be interpreted as the potential to harm the asset owned, the asset can be information, a process, a system as well as an organization. Identifying and determining possible threats from a country's profile is a major challenge and is the subject of numerous studies. From several studies discussing threats, the discussion focuses on the analysis of weaknesses that a country has that is then associated with the strengths and advantages of other countries. In this study, researchers considered the need for anticipation of potential threats coming from the Southeast Asian region based on the profile of excellence. This will contribute in order to ensure the realization of the objectives of the Republic of Indonesia. One of them is the determination of countries that have the potential to be a threat to Indonesia. In support of the anticipation efforts, researchers tried to give thought to a study on the profile of countries in Southeast Asia that could potentially threaten Indonesia. Indonesia's display of excellence profile will be a comparison to the profiles of the countries studied. From the excellence profile of these countries, a method of determination is required based on the competency profile of a country. The use of Profile Matching Method is considered capable of supporting this research. The study of the country profile criteria is also indispensable therefore researchers use delphi method in determining the criteria of the country profile builder and validating the weighting of the profile building criteria with the Borda method. Hopefully, what is done will provide a strong analysis in favor of a decision in determining the predictors of threat countries in the Southeast Asia region.

Research Objectives are:

a. Get a discription of the facts about the country that is a potential threat in southeast Asia to Indonesia.

b. Shows the main criteria (Core Factor) and secondary factor criteria of the profile of a country capable of presenting as a potential threat.

c. Showing the country's priorities that are a threat to Indonesia.

2. MATERIALS AND METHOD

2.1 Literatur Review

Researchers have conducted a review of previous studies conducted from either similar or different objects, subjects, and approach methods used. The research opportunities that can be done are to show the predictors of real threat countries not only in the maritime sector and not only military threats but also non-military using profile matching methods, as well as the use of profiles owned by an object can be a criterion in borda method research. The use of internet facilities in the retrieval of a remote consensus from experts or speakers still opens up opportunities in research that will be supported by delphi method will be effective in determining criteria.

2.2 Profile Definition

The word profile is derived from the Italian name profilo and profilare which means outline. The meaning of the profile in the english dictionary is a side view of people's faces, paintings or drawings of people from the side, biographical sketches, cross-sections (land, mountains, and so on), graphics or overviews that provide facts about special things.

According to Victoria Neufeld (1996) profiles are graphs, diagrams, or writings describing a situation that refers to a person's data or something.

Various understandings of profiles and opinions from experts, can be taken understanding that the profile is an outline of where it looks. When viewed in terms of profile statistics is a set of data that describes something in the form of a table or graph.

2.3 Threat

According to The Research of Professor I. Pasha Mahmood of the National University of Singapore Business and Cocurating Transformation Map on ASEAN that the current threats that need to be observed are:

a. Geopolitical stability and regional relations.
b. Governance challenges for businesses.
c. New business model.
d. Changing demographics. Inclusive growth and sustainable development.
e. Regional digital economy.
f. Economic integration (MEA).

While according to John M. Collins, in evaluating the threat there are three influential considerations: by assessing its capabilities, intensions and vulnerabilities.

2.4 Threat Analysis Concept

Threat analysis is a formal process for identifying, documenting and reducing system security threats, which can be shared in three main phases: threat modeling, asset mapping, and building mitigation plans. The proposed methodology includes formalization of all these aspects with a new approach to system characterization.

2.5 OCTAVE (Operationally Critical Threat, Asset, and Vulnerability Evaluation) Concept

This OCTAVE Allegro method is an operational method of Critical Threat, Asset, and Vulnerability Evaluation, created to conduct information system security risk assessments in context with operational and strategic drivers they rely on to fulfill missions (Mikewati & Welly, 2012).

2.6 Prediction Concept

Prediction is a systematically estimating process of something that is most likely to happen in the future based on past and present information, so that the error (the difference between something that happens and the forecast result) can be minimized. Predictions do not have to give a definitive answer to the events that will occur, but rather try to find answers as close as possible that will occur (Herdianto, 2013).

2.7 Decision Support System (DSS)

The Decision Support System (DSS) is an interactive computer-based system, which helps decision makers to use data and various models to solve unstructured problems (Turban et al, 2005). According to Kusrini (2007) defining the decision support system is an interactive information system that provides information, modeling and data manipulation. The system is used to assist decision-making in semistructured situations and unstructured situations, where no one knows exactly how decisions should be made.

2.8 Profile Matching Method

Profile Matching is a decision-making mechanism assuming that there is an ideal variable predictor level that should be met by the subjects studied, instead of the minimum level that must be met or skipped (Kusrini, 2007)

In the Profile Matching process that becomes an outline is the process of comparison between the competency of the subject into the competency of the objective so that it can be known the difference of competency or called gap. The smaller the gap, the greater the weight that means having a greater chance of the Subject occupying the predictor's goal.

a. Weighting

At this stage starting with gap mapping by looking for differences inrespondent's value with standard value will then be determined the weight of each value – each aspect of the criteria by using GAP weights

Table 1. GAP Weight

No	Difference (GAP)	Value Weight	Description
1.	0	5	No difference (Profile Index as needed)
2.	1	4,5	Country Profile Index excess 1 value
3.	-1	4	Country Profile Index lacks 1 value
4.	2	3,5	2-value surplus country profile index
5.	-2	3	Country Profile Index lacks 2 values
6.	3	2,5	Country Profile Index excess 3 values
7.	-3	2	Country Profile Index lacks 3 values
8.	4	1,5	Country Profile Index excess 4 values
9.	-4	1	Country Profile Index lacks 4 values

b. Core and Secondary Factor Grouping

After determining the weight of the gap value of the required criteria, the next step is that each criterion is grouped into two groups namely Core Factor and Secondary Factor.

1) Core Factor is the aspect (country profile) that stands out or is most needed. To calculate Core Factor used formulas:

$$\mathbf{NCF} = \frac{\sum \mathbf{NC}}{\sum \mathbf{IC}} \text{.......}\mathbf{(1)}$$

Description:

NCF = Core Factor average

NC = Total number of Core Factor values

IC = Number of Core Factor items

2) Secondary Factor (Supporting Factor) is items other than aspects that are included in the Core Factor. To calculate Secondary Factor used formula:

$$\mathbf{NSF} = \frac{\sum \mathbf{NS}}{\sum \mathbf{IC}} \text{................}\mathbf{(2)}$$

Description:

NSF = *Secondary Factor average*

NS = *Total number of Secondary Factor values*

IC = Number of Secondary Factor items

c. Calculation of Total Value

From the calculation of Core Factor and Secondary Factor of each aspect (country profile), then calculated the total value of each aspect (country profile) that is estimated to affect each Profile Index – each country. To calculate the total value of each aspect of the criteria, a formula is used:

N =(X) %NCF+(X) %NSF....... (3)

Description:

N = Total Value of each Criterion

NCF = *Core Factor average*

NSF = *Secondary Factor average*

(x)% = Percentage value inputted by Borda method

d. Rangking

The final result of the Profile Matching process is a ranking that refers to the calculation result indicated by the formula:

Ranking=70%NCF+30%NSF.......... (4)

Description:

NCF = Core Factor Value

NSF = Secondary Factor Value

2.9 Delphi Method

Delphi's approach has three different groups: decision makers, staff, and respondents. The decision-maker will be responsible for the results of the Delphi study. A working group of five to nine members consisting of staff and decision makers, tasked with developing and analyzing all questionnaires, data collection evaluations and revisions of questionnaires required.The staff group is led by coordinators who must have experience in design and understand Delphi's methods as well as get to know the problem area. The job of the coordinating staff is to control the staff in mailing questionnaires, divide and process results as well as scheduling meetings. Respondents are experts in the problem and anyone who agrees to answer the questionnaire.

2.10 Borda Method

The Borda method used by its inventor Jean Charles de Borda in the 18th century was one of the methods used to determine the best alternatives of the chosen few alternatives. Each alternative decision-making option will be judged by its weight based on its ranking. The greatest weight is the best alternative to decision-makers. Borda is a voting method used in group decision making for single winner or multiple winner selection. Borda determines the winner by awarding a certain number of points to each candidate. The winner will then be determined by the number of points the candidate collects (Cheng and Deek, 2009).

2.11 Research Procedure

At this stage all data will be managed using Delphi and Borda methods hope to obtain empirical results from the criteria that are material in advanced analysis. The activities that will be interconnected in this stage are

a. Literature studies are conducted to gather information by reading books or in digital form intended to study the theories related to the method to be used namely profile matching method. In addition to studying profile matching methods, literature studies are also conducted to study the issues that will be raised in this study from interviews or observations directly.

b. Determining criteria, data sources and samples at this stage began to determine what criteria are required based on data and samples sourced from the results of interviews and observations directly.

c. Creation, Filling and Examination of Questionnaires From research data obtained from the results of interviews with speakers. The next step is to start making the questionnaire and then check the questionnaire and the questionnaire is filled out by the respondent. This activity researchers will use delphi and borda methods.

d. In this stage the results of questionnaires that have been filled out by panelists or respondents will be analyzed, data analysis is done using profile matching method to determine the selected predictor. Once the analysis phase is complete, a conclusion will be generated containing the role that will be further insetized.

e.

3. RESULT AND DISCUSSION

3.1 Criteria Determination

The criteria and sub criteria to be examined are as follows:

Table 2. Criteria and Sub criteria for building a Country Profile

Criteria	Sub Criteria
Economic Resources	Size
	International Laverage
	Technology
	Connectivity
Military Capability	Defence spending
	Armed Forces
	Weapon and Platform
	Signature Capabilities
	Asian Military Posture
Resilience	Institutional Stability
	Resource Security
	Geoeconomic Security
	Geopolitical Security
	Nuclear Deterrence
Resilience Future Resources	Economic Resources 2030
	Defence Resources 2030
	Broad Resources 2030
	Demographic Resources 2030
Diplomatic Influence	Diplomatic Network
	Multirateral Power
	Foreign Policy
Economic Relationships	Regional Trade Relations
	Regional Investment Ties
	Economic Diplomacy
Defence Networks	Regional Alliance Network
	Regional Non allied Partners
	Global Arms Tranfers
Cultural Influence	Cultural Projection
	Information Flows
	People Exchanges

Source: Asia Power Index,Lowy Institute 2019

Table 3. Southeast Asian State Ranking Index

Criteria	Sub Criteria	Alternatives state / State Rank								
		N1	**N2**	**N3**	**N4**	**N5**	**N6**	**N7**	**N8**	**N9**
Economic Resources	Size	12	16	9	13	25	17	15	22	21
	International Laverage	11	5	10	13	15	23	14	25	19
	Technology	10	6	13	14	12	24	16	23	25
	Connectivity	10	4	9	14	22	19	12	23	21
Military Capability	Defence spending	14	10	12	17	22	15	13	25	23
	Armed Forces	19	11	16	18	25	13	10	23	22
	Weapon and Platform	14	9	16	22	20	17	12	25	23
	Signature Capabilities	15	4	16	21	18	17	12	24	23
	Asian Military Posture	13	9	11	20	23	16	8	25	23
Resilience	Institutional Stability	9	1	11	22	4	24	13	16	19
	Resource Security	3	24	13	19	9	14	17	5	15
	Geoeconomic Security	10	18	7	14	21	19	15	22	20
	Geopolitical Security	22	14	17	13	20	15	24	18	19
	Nuclear Deterrence	7	7	7	7	7	7	7	7	7
Resilience Future Resources	Economic Resources 2030	10	12	11	13	20	17	15	22	21
	Defence Resources 2030	15	14	13	16	23	12	10	25	21
	Broad Resources 2030	13	7	15	21	23	17	10	22	24
	Demographic Resources 2030	8	24	14	6	25	12	10	20	17
Diplomatic Influence	Diplomatic Network	9	15	11	13	21	16	10	19	20
	Multirateral Power	11	14	5	15	12	22	10	16	17
	Foreign Policy	10	2	15	16	23	21	13	24	20
Economic Relationships	Regional Trade Relations	9	7	4	14	23	18	10	21	19
	Regional Investment Ties	9	7	8	14	23	17	12	21	18
	Economic Diplomacy	5	3	10	13	12	15	9	15	15
Defence Networks	Regional Alliance Network	11	11	8	7	11	11	11	11	11
	Regional Non allied Partners	3	1	12	13	19	22	14	23	17
	Global Arms Tranfers	15	8	13	19	16	20	17	22	22
Cultural Influence	Cultural Projection	8	7	9	15	16	23	14	25	20
	Information Flows	7	12	11	15	23	19	8	24	22
	People Exchanges	3	8	4	10	23	15	9	19	17

Source: Asia Power Index,Lowy Institute 2019

Determination of Criteria using Delphi method with results

Table 4. Country Profile Building Criteria Determination Results

Criterias
Military Capabilities
Economic Resources
Resilience
Defense Network
Diplomatic Influence
Economic Relations
Resilience Future Resources
Cultural Influences

Source: Processed Data Researchers

Determination of Core Factors and Secondary Factors

Table 5. Core Factor and secondary Factor Grouping Results

Criterias	Core Factor (CF)	Secondary Factor(SF)
Military Capabilities	CF	
Economic Resources	CF	
Resilience	CF	
Defense Network		SF
Diplomatic Influence		SF
Economic Relations		SF
Resilience Future Resources	CF	
Cultural Influences		SF

Source: Processed Data Researchers

3.2 Criteria Weighting

Weighting Criteria of the process on the Borda method

Table 6. Criteria Role Results

Alternatives/Criteria	Ranking Selection by Responsden							
	A	B	C	D	E	F	G	H
Military Capabilities	1	2	1	2	1	3	2	1
Economic Resources	2	1	2	1	2	2	1	2
Resilience	4	5	3	4	3	4	5	3
Resilience Future Resources	3	3	4	5	4	5	3	6
Defense Network	6	4	6	7	5	1	4	5
Diplomatic Influence	7	7	7	6	6	7	8	8
Economic Relations	5	6	5	3	7	8	6	4
Cultural Influences	8	8	8	8	8	6	7	7
Amount	**36**	**36**	**36**	**36**	**36**	**36**	**36**	**36**

Source: Processed Data Researchers

Table 7. Core Factors Criteria Weighting Results

Core Factors	Percentage
Military Capabilities	13%
Economic Resources	13%
Resilience	31%
Resilience Future Resources	44%

Source: Processed Data Researchers

Tabel 8. Secondary Factors Criteria Weighting Results

Secondary Factors	Percentage
Defense Network	18%
Diplomatic Influence	20%
Economic Relations	30%
Cultural Influences	32%

Source: Processed Data Researchers

3.3 Profile Matching Calculation

In the early stages of calculating Profile Matching, all of the initial data of table 3.2 that is ranking must be converted with values that later make it easier to compare with the standard values of the results of the panelist

Table 9. Conversion Value Results

Criteria	Sub Criteria	Alternatives state / Conversion Value								
		N1	**N2**	**N3**	**N4**	**N5**	**N6**	**N7**	**N8**	**N9**
Economic Resources	Size	4	4	5	4	3	4	4	3	3
	International Laverage	4	5	5	4	4	3	4	3	4
	Technology	5	5	4	4	4	3	4	3	3
	Connectivity	5	5	5	4	3	4	4	3	3
Military Capability	Defence spending	4	5	4	4	3	4	4	3	3
	Armed Forces	4	4	4	4	3	4	5	3	3
	Weapon and Platform	4	5	4	3	4	4	4	3	3
	Signature Capabilities	4	5	4	3	4	4	4	3	3
	Asian Military Posture	4	5	4	4	3	4	5	3	3
Resilience	Institutional Stability	5	5	4	3	5	3	4	4	4
	Resource Security	5	3	4	4	5	4	4	5	4
	Geoeconomic Security	5	4	5	4	3	4	4	3	4
	Geopolitical Security	3	4	4	4	4	4	3	4	4
	Nuclear Deterrence	5	5	5	5	5	5	5	5	5
Resilience Future Resources	Economic Resources 2030	5	4	4	4	4	4	4	3	3
	Defence Resources 2030	4	4	4	4	3	4	5	3	3
	Broad Resources 2030	4	5	4	3	3	4	5	3	3
	Demographic Resources 2030	5	3	4	5	3	4	5	4	4
Diplomatic Influence	Diplomatic Network	5	4	4	4	3	4	5	4	4
	Multirateral Power	4	4	5	4	4	3	5	4	4
	Foreign Policy	5	5	4	4	3	3	4	3	4
Economic Relationships	Regional Trade Relations	5	5	5	4	3	4	5	3	4
	Regional Investment Ties	5	5	5	4	3	4	4	3	4
	Economic Diplomacy	5	5	5	4	4	4	5	4	4
Defence Networks	Regional Alliance Network	4	4	5	5	4	4	4	4	4
	Regional Non allied Partners	5	5	4	4	4	3	4	3	4
	Global Arms Tranfers	4	5	4	4	4	4	4	3	3
Cultural Influence	Cultural Projection	5	5	5	4	4	3	4	3	4
	Information Flows	5	4	4	4	3	4	5	3	3
	People Exchanges	5	5	5	5	3	4	5	4	4

Source: Processed Data Researchers

a. Weighting

This stage is to calculate the gap difference which is **GAP** = Converted Profile - Profile Standard Value, so that the data is obtained as follows:

Table 10. Results of Calculating Difference in Values (GAP)

Criteria	Sub Criteria	Standard Value	Alternatives state / GAP Value								
			N1	**N2**	**N3**	**N4**	**N5**	**N6**	**N7**	**N8**	**N9**
Economic Resources	**Size**	5	-1	0	-1	-2	-1	-1	-2	-2	-5
	International Laverage	4	1	1	0	0	-1	0	-1	0	-4
	Technology	5	0	-1	-1	-1	-2	-1	-2	-2	-5
	Connectivity	4	1	1	0	-1	0	0	-1	-1	-4
Military Capability	**Defence spending**	5	0	-1	-1	-2	-1	-1	-2	-2	-5
	Armed Forces	5	-1	-1	-1	-2	-1	0	-2	-2	-5
	Weapon and Platform	5	0	-1	-2	-1	-1	-1	-2	-2	-5
	Signature Capabilities	5	0	-1	-2	-1	-1	-1	-2	-2	-5
	Asian Military Posture	5	0	-1	-1	-2	-1	0	-2	-2	-5

Resilience	**Institutional Stability**	**4**	**1**	**0**	**-1**	**1**	**-1**	**0**	**0**	**0**	**-4**
	Resource Security	**5**	**-2**	**-1**	**-1**	**0**	**-1**	**-1**	**0**	**-1**	**-5**
	Geoeconomic Security	**5**	**-1**	**0**	**-1**	**-2**	**-1**	**-1**	**-2**	**-1**	**-5**
	Geopolitical Security	**5**	**-1**	**-1**	**-1**	**-1**	**-1**	**-2**	**-1**	**-1**	**-5**
	Nuclear Deterrence	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**-3**
Resilience Future Resources	**Economic Resources 2030**	**5**	**-1**	**-1**	**-1**	**-1**	**-1**	**-1**	**-2**	**-2**	**-5**
	Defence Resources 2030	**5**	**-1**	**-1**	**-1**	**-2**	**-1**	**0**	**-2**	**-2**	**-5**
	Broad Resources 2030	**3**	**2**	**1**	**0**	**0**	**1**	**2**	**0**	**0**	**-3**
	Demographic Resources 2030	**4**	**-1**	**0**	**1**	**-1**	**0**	**1**	**0**	**0**	**-4**
Diplomatic Influence	**Diplomatic Network**	**4**	**0**	**0**	**0**	**-1**	**0**	**1**	**0**	**0**	**-4**
	Multirateral Power	**4**	**0**	**1**	**0**	**0**	**-1**	**1**	**0**	**0**	**-4**
	Foreign Policy	**4**	**1**	**0**	**0**	**-1**	**-1**	**0**	**-1**	**0**	**-4**
Economic Relationships	**Regional Trade Relations**	**4**	**1**	**1**	**0**	**-1**	**0**	**1**	**-1**	**0**	**-4**
	Regional Investment Ties	**4**	**1**	**1**	**0**	**-1**	**0**	**0**	**-1**	**0**	**-4**
	Economic Diplomacy	**5**	**0**	**0**	**-1**	**-1**	**-1**	**0**	**-1**	**-1**	**-5**
Defence Networks	**Regional Alliance Network**	**4**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**-4**
	Regional Non allied Partners	**4**	**1**	**0**	**0**	**0**	**-1**	**0**	**-1**	**0**	**-4**
	Global Arms Tranfers	**4**	**1**	**0**	**0**	**0**	**0**	**0**	**-1**	**-1**	**-4**
Cultural Influence	**Cultural Projection**	**4**	**1**	**1**	**0**	**0**	**-1**	**0**	**-1**	**0**	**-4**
	Information Flows	**5**	**-1**	**-1**	**-1**	**-2**	**-1**	**0**	**-2**	**-2**	**-5**
	People Exchanges	**4**	**1**	**1**	**1**	**-1**	**0**	**1**	**0**	**0**	**-4**

Source: Processed Data Researchers

From the calculation of GAP Difference is then weighted with weights on the competency requirements of index table 1.

Table 11. GAP Value Weighting Results

Criteria	**Sub Criteria**	**Alternatives state / GAP Weight Value**								
		N1	**N2**	**N3**	**N4**	**N5**	**N6**	**N7**	**N8**	**N9**
Economic Resources	**Size**	**4**	**4**	**5**	**4**	**3**	**4**	**4**	**3**	**3**
	International Laverage	**5**	**4,5**	**4,5**	**5**	**5**	**4**	**5**	**4**	**5**
	Technology	**5**	**5**	**4**	**4**	**4**	**3**	**4**	**3**	**3**
	Connectivity	**4,5**	**4,5**	**4,5**	**5**	**4**	**5**	**5**	**4**	**4**
Military Capability	**Defence spending**	**4**	**5**	**4**	**4**	**3**	**4**	**4**	**3**	**3**
	Armed Forces	**4**	**4**	**4**	**4**	**3**	**4**	**5**	**3**	**3**
	Weapon and Platform	**4**	**5**	**4**	**3**	**4**	**4**	**4**	**3**	**3**
	Signature Capabilities	**4**	**5**	**4**	**3**	**4**	**4**	**4**	**3**	**3**
	Asian Military Posture	**4**	**5**	**4**	**4**	**3**	**4**	**5**	**3**	**3**
Resilience	**Institutional Stability**	**4,5**	**4,5**	**5**	**4**	**4,5**	**4**	**5**	**5**	**5**
	Resource Security	**5**	**3**	**4**	**4**	**5**	**4**	**4**	**5**	**4**
	Geoeconomic Security	**5**	**4**	**5**	**4**	**3**	**4**	**4**	**3**	**4**
	Geopolitical Security	**3**	**4**	**4**	**4**	**4**	**4**	**3**	**4**	**4**
	Nuclear Deterrence	**3,5**	**3,5**	**3,5**	**3,5**	**3,5**	**3,5**	**3,5**	**3,5**	**3,5**
Resilience Future Resources	**Economic Resources 2030**	**5**	**4**	**4**	**4**	**4**	**4**	**4**	**3**	**3**
	Defence Resources 2030	**4**	**4**	**4**	**4**	**3**	**4**	**5**	**3**	**3**
	Broad Resources 2030	**4,5**	**3,5**	**4,5**	**5**	**5**	**4,5**	**3,5**	**5**	**5**
	Demographic Resources 2030	**4,5**	**4**	**5**	**4,5**	**4**	**5**	**4,5**	**5**	**5**
Diplomatic Influence	**Diplomatic Network**	**4,5**	**5**	**5**	**5**	**4**	**5**	**4,5**	**5**	**5**
	Multirateral Power	**5**	**5**	**4,5**	**5**	**5**	**4**	**4,5**	**5**	**5**

	Foreign Policy	**4,5**	**4,5**	**5**	**5**	**4**	**4**	**5**	**4**	**5**
Economic Relationships	**Regional Trade Relations**	**4,5**	**4,5**	**4,5**	**5**	**4**	**5**	**4,5**	**4**	**5**
	Regional Investment Ties	**4,5**	**4,5**	**4,5**	**5**	**4**	**5**	**5**	**4**	**5**
	Economic Diplomacy	**5**	**5**	**5**	**4**	**4**	**4**	**5**	**4**	**4**
Defence Networks	**Regional Alliance Network**	**5**	**5**	**4,5**	**4,5**	**5**	**5**	**5**	**5**	**5**
	Regional Non allied Partners	**4,5**	**4,5**	**5**	**5**	**5**	**4**	**5**	**4**	**5**
	Global Arms Tranfers	**5**	**4,5**	**5**	**5**	**5**	**5**	**5**	**4**	**4**
Cultural Influence	**Cultural Projection**	**4,5**	**4,5**	**4,5**	**5**	**5**	**4**	**5**	**4**	**5**
	Information Flows	**5**	**4**	**4**	**4**	**3**	**4**	**5**	**3**	**3**
	People Exchanges	**4,5**	**4,5**	**4,5**	**4,5**	**4**	**5**	**4,5**	**5**	**5**

Source: Processed Data Researchers

b. Calculation of Core Factors and Secondary Factors

In table 5 there is already a grouping of criteias into Core Factors and Secondary Factors, the next step is to calculate the value according to the criteria and the Country Alternatives to be selected using formulas (1) and (2).

Table 12. Core Factor (NCF) Value Calculation Results

PROFILE FACTORS	No	Criteria		Sub Criteria	Alternatives state / GAP Weight Value								
					N1	**N2**	**N3**	**N4**	**N5**	**N6**	**N7**	**N8**	**N9**
CORE FACTORS	**1.**	**Economic Resources**		**Size**	**4**	**4**	**5**	**4**	**3**	**4**	**4**	**3**	**3**
				International Laverage	**5**	**4,5**	**4,5**	**5**	**5**	**4**	**5**	**4**	**5**
				Technology	**5**	**5**	**4**	**4**	**4**	**3**	**4**	**3**	**3**
				Connectivity	**4,5**	**4,5**	**4,5**	**5**	**4**	**5**	**5**	**4**	**4**
		Item (IC)	**4**	**NCF**	**4,6**	**4,5**	**4,5**	**4,5**	**4,0**	**4,0**	**4,5**	**3,5**	**3,8**
	2.	**Military Capability**		**Defence spending**	**4**	**5**	**4**	**4**	**3**	**4**	**4**	**3**	**3**
				Armed Forces	**4**	**4**	**4**	**4**	**3**	**4**	**5**	**3**	**3**
				Weapon and Platform	**4**	**5**	**4**	**3**	**4**	**4**	**4**	**3**	**3**
				Signature Capabilities	**4**	**5**	**4**	**3**	**4**	**4**	**4**	**3**	**3**
				Asian Military Posture	**4**	**5**	**4**	**4**	**3**	**4**	**5**	**3**	**3**
		Item (IC)	**5**	**NCF**	**4,0**	**4,8**	**4,0**	**3,6**	**3,4**	**4,0**	**4,4**	**3,0**	**3,0**
	3.	**Resilience**		**Institutional Stability**	**4,5**	**4,5**	**5**	**4**	**4,5**	**4**	**5**	**5**	**5**
				Resource Security	**5**	**3**	**4**	**4**	**5**	**4**	**4**	**5**	**4**
				Geoeconomic Security	**5**	**4**	**5**	**4**	**3**	**4**	**4**	**3**	**4**
				Geopolitical Security	**3**	**4**	**4**	**4**	**4**	**4**	**3**	**4**	**4**
				Nuclear Deterrence	**3,5**	**3,5**	**3,5**	**3,5**	**3,5**	**3,5**	**3,5**	**3,5**	**3,5**
		Item (IC)	**5**	**NCF**	**4,2**	**3,8**	**4,3**	**3,9**	**4,0**	**3,9**	**3,9**	**4,1**	**4,1**
	4.	**Resilience Future Resources**		**Economic Resources 2030**	**5**	**4**	**4**	**4**	**4**	**4**	**4**	**3**	**3**
				Defence Resources 2030	**4**	**4**	**4**	**4**	**3**	**4**	**5**	**3**	**3**
				Broad Resources 2030	**4,5**	**3,5**	**4,5**	**5**	**5**	**4,5**	**3,5**	**5**	**5**
				Demographic Resources 2030	**4,5**	**4**	**5**	**4,5**	**4**	**5**	**4,5**	**5**	**5**
		Item (IC)	**4**	**NCF**	**4,5**	**3,9**	**4,4**	**4,4**	**4,0**	**4,4**	**4,3**	**4,0**	**4,0**

Source: Processed Data Researchers

Table 13. Secondary Factors (NSF) Calculation Results

PROFILE FACTORS	No	Criteria	Sub Criteria	Alternatives state / GAP Weight Value								
				N1	N2	N3	N4	N5	N6	N7	N8	N9
SECONDARY FACTORS	1.	Diplomatic Influence	Diplomatic Network	4,5	5	5	5	4	5	4,5	5	5
			Multirateral Power	5	5	4,5	5	5	4	4,5	5	5
			Foreign Policy	4,5	4,5	5	5	4	4	5	4	5
		Item (IC) 3	NSF	4,7	4,8	4,8	5,0	4,3	4,3	4,7	4,7	5,0
	2.	Economic Relationships	Regional Trade Relations	4,5	4,5	4,5	5	4	5	4,5	4	5
			Regional Investment Ties	4,5	4,5	4,5	5	4	5	5	4	5
			Economic Diplomacy	5	5	5	4	4	4	5	4	4
		Item (IC) 3	NSF	4,7	4,7	4,7	4,7	4,0	4,7	4,8	4,0	4,7
	3.	Defence Networks	Regional Alliance Network	5	5	4,5	4,5	5	5	5	5	5
			Regional Non allied Partners	4,5	4,5	5	5	5	4	5	4	5
			Global Arms Tranfers	5	4,5	5	5	5	5	5	4	4
		Item (IC) 3	NSF	4,8	4,7	4,8	4,8	5,0	4,7	5,0	4,3	4,7
	4.	Cultural Influence	Cultural Projection	4,5	4,5	4,5	5	5	4	5	4	5
			Information Flows	5	4	4	4	3	4	5	3	3
			People Exchanges	4,5	4,5	4,5	4,5	4	5	4,5	5	5
		Item (IC) 3	NSF	4,7	4,3	4,3	4,5	4,0	4,3	4,8	4,0	4,3

Source: Processed Data Researchers

c. Calculation of Total Value

From the calculation of Core Factor and Secondary Factor of each aspect (country profile), then calculated the total value of each aspect that is estimated to affect each Country ' s Profile Index.
By using Formula (3) generated The total criteria value of each country, namely as follow

Table 14. Core Factors Total Value (NCF) Calculation Results from Alternatives

Alternatives State	Criteria				Total Value (NCF)
	Core Factors Values (NCF)				
	Economic Resources (13%)	Military Capability (13%)	Resilience (31%)	Resilience Future Resources (44%)	
N1	4,63	4,0	4,2	4,5	4,360
N2	4,50	4,8	3,8	3,9	4,051
N3	4,50	4,0	4,3	4,4	4,320
N4	4,50	3,6	3,9	4,4	4,146
N5	4,00	3,4	4,0	4,0	3,923
N6	4,00	4,0	3,9	4,4	4,133
N7	4,50	4,4	3,9	4,3	4,194
N8	3,50	3,0	4,1	4,0	3,838
N9	3,75	3,0	4,1	4,0	3,870

Source: Processed Data Researchers

Table 15. Secondary Factors Total Value (NSF) Calculation Results from Alternatives

Alternatives State	Criteria				Total Value (NSF)
	Secondary Factors Values (NSF)				
	Diplomatic Influence (18%)	Economic Relationships (20%)	Defence Networks (30%)	Cultural Influence (32%)	
N1	4,7	4,7	4,8	4,7	4,717
N2	4,8	4,7	4,7	4,3	4,589
N3	4,8	4,7	4,8	4,3	4,639
N4	5,0	4,7	4,8	4,5	4,722
N5	4,3	4,0	5,0	4,0	4,358
N6	4,3	4,7	4,7	4,3	4,501
N7	4,7	4,8	5,0	4,8	4,854
N8	4,7	4,0	4,3	4,0	4,217
N9	5,0	4,7	4,7	4,3	4,619

Source: Processed Data Researchers

d. Ranking

The last stage is the role of all countries based on Core Factors and Secondary Factors, using the formula (4).

Tabel 16. Result of Total Value

Alternatives State	Profile Matching Total Value	Ranking
N1	4,4667	1
N2	4,2128	6
N3	4,4156	2
N4	4,3185	4
N5	4,0534	8
N6	4,2431	5
N7	4,3920	3
N8	3,9516	9
N9	4,0944	7

Source: Processed Data Researchers

Tabel 17. Result of Profile Matching

PROFILE MATCHING RESULT

Predictor Rank	Predictor State
1	N1
2	N3
3	N7
4	N4
5	N6
6	N2
7	N9
8	N5
9	N8

Source: Processed Data Researchers

3.3 Discussion

In this study, researchers applied the Delphi method as the first step in the search for criteria up to the determination of criteria. The results of delphi method application using questionnaire on Google Form are set out in Table 3 where the preliminary criteria of the 2019 Asia Power Index source issued by the Lowy Institute. In the table there are 9 countries as alternatives that will be in the value. Consensus on delphi method produces criteria that correspond to the opinions of panelists or resource persons, through 2 rounds. From the opinions of these panelists in accordance with the concept of threat discussed in the previous chapter by Professor I. Pasha Mahmood. Furthermore, still with delphi method the criteria are grouped into factors that make up the country's strength profile namely Core Factor and Secondary Factor. The panelists' consensus result is found in Table 4 where there are 8 criteria and with each sub criterion of the participants. The process in this criteria implements one of the steps in OCTAVE which is the preparation of profile assets. From the composed asset profile is expected to provide an overview of the threat posed by the predictor countries, so as to provide a definitive picture of what sectors could potentially be a threat and how to deal with it.

While the process on the Borda method is to determine the weight of the criterias of the core factor and secondary factor constituents who are the builders of the State Power Profile. Results from borda questionnaire on Google form and data processing by investigators generated table 5. This process will support the processing of Profile Matching at the Core factor and Secondary Factor value calculation stage. Core Factor has 4 criteria – each weight is 13%, 13%, 31% , 41% while in Secondary Factor also has 4 criteria of 18%, 20%, 30%, 32%. This weight calculation becomes input as a criterion that needs to be considered, because this weight is the constituent of the integrity of 100% a State Strength Profile. From the threat analysis it becomes an opportunity for Indonesia to anticipate the phenomenon that will emerge.

The Profile Matching method used in this study has resulted in a measured decision of the criteria - the criteria of the building of the country's Power Profile to select the country predictor of the threat to indonesia. Where the measured result is to designate n1 countries as a priority of threat that should be of full concern to Indonesia. As for the factors detailed in the criteria and sub-criteria, it can make a key point in weakening or becoming a development strategy facing the countries - the predictor of the threat.

4. CONCLUSION

The results of this study have provided an overview of countries that have the potential as a threat to Indonesia. This is seen from the role table used as the data source to be processed. From this study can be concluded that the criteria presented in this study are able to be the constituent factors of a country's Strength Profile. This is demonstrated in the process of selection of Criteria and grouping of Main Factors (Core factor) and Secondary Factor (Secondary Factor) using delphi method. Then the weighting which is a form of validation of one of the processes in the Profile Matching Method is able to provide appropriate support

The State that are the priority of the threat are shown from the processing results in the Profile

Matching method, namely country N1. With indicators calculated so that the country ranks the main country in southeast Asia as a predictor of threat to Indonesia. From the calculation using profile matching method, Delphi and Borda are recognized as able to map state in Southeast Asia in accordance with the purpose of this research namely the determination of state in Southeast Asia as predictors of threats to Indonesia.

ACKNOWLEDGEMENT

This research is a tangible manifestation of the problem-solving process often faced by neighboring countries. The hope of this research to be used in determining the country of threat to Indonesia. The subjects of the study by the researchers were poured in variables capable of representing alternative state of choice, as well as with the aim of not causing negative perceptions in the nation. Thank you to the agencies who have provided support and opportunities to researchers to provide support for thought. Thanks to officials and advisers so that this thesis can be composed. Surely thanks to God who gave life.

REFERENCE

Antonietta Stango, Neil R. Prasad, Dimitry M. Kyriazanos. (2009). A threat Analysis Methodology for Security Evaluation and Enhancement Planning. researchgate.net.

Bley, H. L. (2019). *Lowy Institute Asia Power Index 2019.* Sydney: Lowy Institute.

CSIS. (2019). *Perception And Readiness of Indonesia towards The Belt and Road Initiative.* Jakarta: CSIS Indonesia.

Dalkey, N. (1967). *Delphi.* Santa Monica, CA: The RAND Corporation.

Dalkey, N. H. (1962). *An Experimental Application of Delphi Method to the Use of Experts.* Santa Monica, CA: The RAND Corporation.

Davis, F. D. (1986). *"Technology Acceptance Model for Empirically Testing New End-User Information System Theory and Results.".*

Drs. Suharso, Dra. Ana Retnoningsih. (2011). English-Indonesian Dictionary,Lux Edition. Semarang: Widya Karya.

Efraim Turban, Jay E.Aroson, Ting Peng Liang. (@005). *Decisioan Suport System and Intelligent System.* Pearson Education.

George Kassimeris andJohn Buckley . (2010). *The Ashgate research companion to modern warfare.* Surrey, England : Ashgate Publishing Limited.

Harold A.Listone, Murrrau Turoff, Olaf Helmer. (2002). *The Delphi Method,Techniques and Applications.*

Heryaman, O. (2001). Military Posture of Asian Countries. How to Supremacy and Posture of Indonesia's Defense Force.

I Nengah P.A., Abdul Hakim. (2016). Analysis of Indonesia's Maritime Security Opportunities and Threats as a Strategic Environmental Development Impact. ASRO Journal STTAL.

Irfan,Surbakti. (2002). Decision Support System. Surabaya.

ITU. (2019). *Global Cybersecurity Index 2019.* ITUPublisher.

Kusrini. (2007). Concept and Application of Decision Support System. Yogyakarta: Andi Offset. Yogyakarta.

Linstone, H. a. (2002). *The Delphi Method Techniques and Application.*

Portner, C. d. (2006). Using The Technology Acceptance Model to Explain How Attitudes Determine Internet Usage: The Role of Perceived Access, Barriers and Demographics. *Journal of Business Research* , Vol. 59, p.999-1007 .

Prasetyono, E. (1994, November - December). Increased Military Strength of Pasisic Asian Countries and Their Implications for Regional Security". CSIS Analysis No. 6 Years XXIII .

Rahmat, A. N. (2013). Five Power Defence Arrangements In View of Constructivism. Journal of Interdependence Th1, Vol 1.

Schwab, P.-N. (2018). *4 stages of competitor analysis to carry out successful market research.*

Ullman, D. G. (2001). Robust Decision Making For Engineering Design.

Yousuf, M. (2007). *The Delphi Technique, Essay in Education.*

OPTIMIZATION OF KRI ASSIGNMENTS IN PUSHIDROSAL TO SUPPORT THE INDONESIAN SEA MAP SURVEY

Supriyono, Okol Sri Suharyo, Anton Nugroho

Indonesian Naval Technology College, STTAL
Bumimoro-Moro Krembangan, Surabaya, 60178, Indonesia

ABSTRACT

Scheduling is an assignment activity that deals with a number of constraints. A number of events can occur in a time period and place / location so that the objective function is as close as possible to be fulfilled. In the decision-making hierarchy, scheduling is the last step before the start of an operation. The scheduling of KRI assignments at Pushidrosal is an interesting topic to discuss and find solutions to using mathematical methods. The scheduling process for the KRI Pushidrosal assignment is carried out to produce an annual ship movement schedule. This process not only requires fast follow-up, but also requires systematic and thorough steps. Where assignment scheduling is a quite complex combinatorial problem. Meanwhile, the current assignment schedule is considered inadequate because the calculations are carried out in a conventional manner. The ship assignment scheduling process in this study uses Integer Programming modeling to obtain an alternative operation scheduling. Scheduling observed was 7 ships in carrying out N number of operations for 52 weeks (1 year). This research begins with determining the scheduling decision variables and the constraints faced. Hard constrain limitations include: ship maintenance schedule, time and duration of each survey operation, the class of ships assigned to carry out operations and the number of vessels executing each operation. Meanwhile, soft constrain is the length of the operating vessel in a row. The mathematical formulation of the Integer Programming model consists of three indicators, one decision variable, two measuring parameters and five constraint functions. Furthermore, the determination of the best alternative scheduling is done using Microsoft Excel's Solver computation program.

Keywords: *Assignment, Integer Programming, Solver.*

1. INTRODUCTION

1.1 Background

The Indonesian Navy's Hydrographic and Oceanographic Center (Pushidrosal) is the main command for guidance and operations. In the field of development, Pushidrosal is in charge of compiling and planning programs for the development of elements of the Indonesian Warship (KRI), hydro-oceanographic surveys and supporting facilities and infrastructure in Pushidrosal's ranks. Meanwhile, in the operational field, Pushidrosal is tasked with compiling plans and carrying out survey programs and making Indonesian marine maps for the entire Indonesian marine archipelago. The survey is both a marine map for the benefit of public shipping and strategic tactical, namely making military maps and humanitarian aid and disasters in all Indonesian waters. The elements of KRI Pushidrosal can be operated both during war and peacetime in order to support shipping safety and can be implemented individually or in formation.

The Indonesian Navy's Hydrographic and Oceanographic Center (Pushidrosal) is the main command for guidance and operations. In the field of development, Pushidrosal is in charge of compiling and planning programs for the development of elements of the Indonesian Warship (KRI), hydro-oceanographic surveys and supporting facilities and infrastructure in Pushidrosal's ranks. Meanwhile, in the operational field, Pushidrosal is tasked with compiling plans and carrying out survey programs and making Indonesian marine maps for the entire Indonesian marine archipelago. The survey is both a marine map for the benefit of public shipping and strategic tactical, namely making military maps and humanitarian aid and disasters in all Indonesian waters. The elements of KRI Pushidrosal can be

operated both during war and peacetime in order to support shipping safety and can be implemented individually or in formation.

Pushidrosal's annual operation plan was drawn up with the TNI Headquarters and the Indonesian Navy Headquarters. Ship operational planning is adjusted between the number of personnel, materials, and the area that will be the objective of the survey data collection and ship class. So that the ship to be driven is in accordance with the needs of the task to be carried out, both in terms of ship class and number. Based on the annual operation plan, Pushidrosal, in this case the Operation Staff (Sops) Pushidrosal, makes a KRI assignment schedule in one year (52 weeks) to support operational tasks. This schedule is made to meet the planned supply (posting) of operations so that it reflects what vessels are carrying out operations and vessels carrying out maintenance.

So that all planned operational activities do not experience ship readiness problems, both in terms of ship class and quantity required, an operation schedule and maintenance schedule need to be drawn up and drawn up before the operation is carried out. So that in making the assignment schedule and ship preparation needed to carry out operational activities, Sops Pushidrosal calculates the needs for the class of ships and the number to be operated and always takes into account the ship maintenance schedule. In this case the Sops coordinates with the Pushidrosal Ship Maintenance Service as the ship maintenance schedule maker. The warship assignment schedule is made by taking into account the ship maintenance schedule so that the ship is in prime condition and ready to operate, so that all operational tasks run effectively and efficiently.

Currently, scheduling operation assignments still causes program crashes which result in violations of operating rules and restrictions. Among them resulted in delays in ship maintenance schedules. As well as a violation of the time constraint for maximum operation. There is a ship that gets a new order to carry out further tasks when the ship has finished carrying out operations, even though it has exceeded the maximum time limit for carrying out the operation.

So that the schedule for the assignment of warships is made by considering the limited factors of infrastructure that are faced with each task and the rules for implementing warship operations. These limitations and regulations include: ship class according to task requirements, ship maintenance according to schedule, start and duration of carrying out predetermined tasks, one ship only carries out one task at the same time and the maximum time for carrying out the ship's tasks in succession. is 3 months (12 weeks).

This research has various references, including: (Solekan, 2016) conducted research on the KRI assignment schedule at Pushidrosal using the Binary Integer Programming (BIP) method approach with the aim of minimizing penalties for violating soft constraints (consecutive length of operating vessels) which are completed computing using LINGO 11.0. (Šeda, 2007) uses the Mixed Integer Programming (MIP) method, by presenting a mathematical model for flow shop scheduling changes and the proposed job shop scheduling problem. (Hidayat, 2018) research that aims to find the best alternative in order to optimize the ship assignment plan schedule in order to produce a JOG / JOP by developing an optimization model and applying the Integer Linear-Zero One Programming method.

KRI scheduling model is a quite complex combinatorial problem with many variables so it is difficult to process manually. Therefore, the authors are interested in conducting research to create an Integer Programming model with a solution using the

Microsoft Exel Solver computation program from the KRI assignment schedule at Pushidrosal to get the best alternative scheduling solution. So as to get the best scheduling by increasing the benefits of the infrastructure owned by Pushidrosal, TNI AL or other agencies.

2. LITERATURE REVIEW

2.1 Battleships

Warships are ships that are used for military or armed forces. Generally divided into aircraft carriers, combatants, patrol boats, transport ships, submarines and support ships.

At this time Pushidrosal operates various types of KRI and survey units for marine mapping surveys, including: Hydro Oseonography Assistance class (KRI Spica and KRI Rigel), Kondor class / Mine Sweeper (KRI Romang and KRI Rempang), Hecla class (KRI Twin Gods). Warship grouping is intended to focus on the priority scale of ships according to needs with support according to the functions and capabilities of each ship (TNI-AL, 2005). In this research, Pushidrosal has 5 KRI elements and 8 marine mapping survey units.

Scheduling problem solving must answer at least two forms of questions, namely which resources will be allocated to work on the operation and when each operation starts to finish. Scheduling is one of the important aspects in operations management because good scheduling will enable the organization to use its assets or resources more efficiently and have a positive effect on achieving its goals (effectively). In other words, resource utilization will be better when early the organization can know when and how much capacity is still idle.

With the same resources it causes the organizational capacity to be "bigger" with more output. From these potential benefits, the organization will be able to have a competitive advantage by doing good scheduling. Even this one concept of scheduling can contribute to achieving better, faster, cheaper, and reliable service at the same time. A good schedule should be simple, easy to understand and can be implemented by management or whoever uses it. Scheduling rules should be strong enough but have realistic goals, so that they are flexible enough to solve unpredictable problems and allow for re-planning.

This research belongs to the activity level of Middle-range planning scheduling, which is in the span of 1 - 2 years. The scheduling approach used in this study is the forward scheduling approach, where a job is scheduled from the moment it arrives, or when it is ready or when it is zero (time zero) and moves forward towards the due date in weeks. Where an operation is scheduled when the ship is ready to carry out operations for a certain duration and by using all available resources to the maximum without violating the rules that have been made.

2.2 Integer Programming (IP)

Integer Programming (IP) is Linear Programming (LP) with integer (round) type variables. The IP model was chosen for more difficult problems than the LP model. This is due to the large number of integer value combinations that must be tested, and each combination requires a normal LP or NLP solution. The main idea in IP is to clearly define the problem using the amount of information available. And the following steps are to translate the problem into a mathematical model.

Optimal scheduling can be obtained by using the IP scheduling technique and using the Heuristic Priority Dispatching approach. Priority Dispatching method rules are used to fulfill which task will be done first. Classification of assignment priorities based on dynamic information. Different priority is given to each ship on a task. The highest priority is given to the ship that has the greatest success rate in an operational task, and so on.

3. Research Methods

This research uses a case study of the KRI Pushidrosal assignment schedule. The research approach uses a quantitative approach by developing mathematical models and theories related to empirical observations. The approach of this research is to create an Integer Programming (IP) model to find the best alternative in order to obtain a more optimal scheduling.

3.1 Variable Exploration

At this stage, identification of influencing variables is carried out by observing problems related to the model. The ship assignment model variables are as follows:

Indicator.

i = Ship carrying out operational tasks (1 …… 5).

j = Operational task performed (1 …… n).

k = Schedule period / length of time in weeks (1 …… 52)

Decision Variables.

= 1, If the i-th ship is scheduled to carry out the j-th operation assignment in the k-week.

= 0, otherwise.

Parameter.

Cijk = 1 …… 5, priority of the i-th ship to carry out the j-th operation in the k-week.

= 1000, if not prioritized and if collided with the ship maintenance schedule in the k-week.

= The number of ships in the jth operation assignment.

3.2 Model Formulation

Integer Programming (IP) is an approach used in solving linear programming problems but requires additional limitations, namely that some or all decisions are integers. The IP model of the ship assignment scheduling problem consists of an objective function and a constraint function. The objective function is a function that is used to formulate goals to be achieved, both the goals of maximizing and minimizing. Meanwhile, the constraint function is a limiting function related to the limited resources available and existing rules.

a. First step

This research method aims to optimize the assignment of 5 ships to each assignment with an IP optimization model which can be formulated as follows:

1) Decision Variable

The variable of the optimization decision in this study is the assignment of one or several ships to each operational task. The form of the decision variable is Binary 0-1 (zero-one). Result 0 means ship i was not assigned to task j and result 1 means ship i was assigned to task j.

2) Purpose Function

Minimizing Z to get the highest ship priority in carrying out an operational task.

Minimum:

$$Z = \sum_{i=1}^{13} \sum_{j=1}^{n} \sum_{k=1}^{52} c_{ijk} X_{ijk}$$

3) System Boundary Function (Constrain)

In planning the operation, there are several obstacles that must be faced, both hard and soft constrains. These obstacles include:

a) Class of ships carrying out operations. The class constraints of the ship carrying out the operation mean that the ship that carries out each operation has a certain class of capability or characteristics tailored to the needs of the operational task. In this study using the Priority Dispatching method.

b) Schedule constraints on ship maintenance. Every ship must carry out maintenance according to the ship maintenance schedule that has been planned by Disharkap¸, namely the week in which maintenance starts and the length of time for implementation.

c) Operational task schedule constraints. Each operational task has been determined or planned from the TNI Headquarters and the Indonesian Navy Headquarters, namely what week the operation will start and the length of time it will be carried out.

d) Constraints on clashing operating schedules. Each ship only carries out one operational task at a time, in other words, the ship does not carry out more than one operation at the same time.

e) Constraints on the number of vessels needed in one operation. In carrying out a training operation task sometimes requires more than one ship according to training needs.

f) Time constraints for the maximum operation of the ship in succession. Each ship in carrying out operations must not exceed 3 months or 12 consecutive weeks in an effort to maximize the achievement of the task.

b. Second Step

Data from the mathematical formulation of the first step is then carried out computational calculations from the Microsoft Excel Solver computer program. The computer program aims to quickly obtain optimal results from the data obtained from the first step. And then implementing a computer program in the case example in completing the KRI assignment scheduling at Pushidrosal

4. RESEARCH RESULTS

The IP model of the ship assignment schedule problem consists of an objective function and a constraint function. The objective function is a function that is used to formulate the objectives to be achieved, namely to minimize the priority of ships carrying out operational tasks. Meanwhile, the constraint function is a limiting function that is needed with respect to the limited resources available, for example the number of ships, available time, vessel capacity, task load and is adjusted to the maintenance plan that will and must be carried out.

4.1 Schedule of ship maintenance

In making a maintenance schedule, each ship that is planned to carry out the repair / maintenance process in that week is given a large number, for example 1000.While ships that do not carry out repairs/ maintenance in that week are given number 1.

4.2 Operation plan schedule

In making the operational plan schedule, each operational task plan from the beginning to the end of the task in that week is given the number 1. While ships that do not carry out operations in that week are given the number 0.

4.3 Priority of Ships carrying out Operational Tasks

Giving priority to the task force means that the ship has a class of capability or characteristics that are tailored to the needs of the operational task. In making priorities for ships that are planned to carry out operational tasks, each ship in each task that has been planned for that week is assigned a number according to priority. The main priority is given number 1 and so on until the last priority number 10 according to the number of ships. Or given the number 1000 if the ship is not prioritized in that task.

Priority ships that have been made are faced with ship repair schedule constraints and other constraints as well as assignment rules.:

4.4 Final Results

The final result of the processing of activity scheduling for each KRI for one year (52 weeks).

4.5 Model Validation

Validation is carried out between the conceptual models made by the researcher on the current ship assignment scheduling in Pushidrosal. Currently, the ship assignment schedule occurs that the assignment schedule still violates the existing constraints, first on the hard constrain (violating the ship maintenance schedule) and violating the soft constrain (the maximum length of time the ship carries out operations in succession). Meanwhile, the scheduling of the ship assignment from the results of running modeling made by the researcher can be used as an alternative to actualization. The model created has advantages compared to the existing scheduling, namely the ship assignment scheduling does not violate hard or soft constraints.

4.6 Sensitivity Analysis

The scheduling of the KRI assignment in Pushidrosal uses 7 KRI elements (4 ships operating and 3 ships with conservation status), to carry out 33 operational tasks and a maintenance schedule for 52 weeks. A different pattern will occur if the operating vessels are reduced. The results after changes are made to the operating schedule and compared with the operating schedule with the total number of ships. In addition, an analysis of changes / reduction in the elements of the KRI is being analyzed. How many vessels can be operated so that the results obtained are still optimal without breaking hard and soft constraints.

Scenario 1: the ship is reduced by 1 element from the BHO class so that there are 2 ships operating, the results obtained by the ship can still carry out operations optimally.

Scenario 2: the ship is reduced by 1 element from the Condor class so that there are 2 ships operating, the results obtained by the ship are still able to carry out operations optimally.

Scenario 3: the ship is reduced by 1 element from the unit survey so that there are 8 units survey operating, the results obtained by the ship can still carry out operations optimally.

The scheduling of KRI assignments using the model created by the researcher can be carried out with optimal results or in other words, no constraints are violated when the minimum number of ships is 5 ship elements. However, if the number of ships operating is only 3 elements, then there will be obstacles that are violated.

5. CONCLUSIONS AND SUGGESTIONS

5.1 Conclusion

From a series of data processing and analysis carried out in this study, the following conclusions can be drawn:

a. Making a schedule of operational tasks at Pushidrosal by fulfilling all the constraints can be applied using IP.

b. The scheduling of KRI assignments using the IP program is better in meeting all applicable constraints, because it produces a schedule that is compromised with all related constraints and meets applicable regulations.

c. The time required for the preparation of the ship assignment schedule and the time for the creation of several ship assignment schedule scenarios that still meet the applicable regulations are more efficient than the current ship assignment scheduling.

d. This ship assignment scheduling model can be used as an alternative in making a ship schedule in Pushidrosal.

5.2 Suggestions

IP is a method used to model problems where the variables are not real numbers. Meanwhile, the decision of the IP in the form of a binary number is worth 0-1. For further development of the implementation of this scheduling are as follows:

a. The author only needs a ship assignment schedule and has not included the operating cost factor, both the logistics costs for the ship and the logistics costs for the manning personnel and the personnel transported, so that this can be continued for the next research study to include these costs because by knowing the costs involved used it can be found the most cost efficient in an operation.

b. The author also does not discuss the additional operation assignments that can affect the existing scheduling that has been made. So that it can be seen how many additional assignment limits can be imposed on Pushidrosal.

ACKNOWLEDGEMENTS

The authors greatly acknowledge the support from Naval Technology College, STTAL Surabaya Indonesia for providing the necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

REFERENCES

Andersson, H., Jon, M. D., & Fagerholt, K. (2011). Ship Routing and Schedulling With Cargo Coupling and Synchronization Constraints. Computer & Industrial Engineering, 61 (4), 1107-1116.

Baker, KR. (1974), Scheduling a full-time workforce to meet cyclic staffing requirements, Management science 20, 1561-1568.

Carlatfis et al. (2009). Containership routing with time deadlines and simultaneous deliveries and pick-ups. Journal Transportation Research, Part E 45, pp. 210-221.

Chen, T., Li, J., Jin, P., & Cai, G. (2012). Reusable Rocket Engine Preventive Maintenance Schedulling Using Genetic Algorithm. Science Direct, Relliability Engineering & System Safety.

Christiansen, M., Fagerholt, K., Nygreen, B., & Ronen, D. (2013). Ship Routing and Schedulling in he Knew Millenium. European Journal of Operational Research, 228 (3), 467-483.

Deris, S., Omatu, S., Ohta, H., & PA, S. (1999). Ship Maintenance Schedulling By Genetic Algorithm and Constraint-Based Reasoning. Science Direct, European Journal of Operational Research, 489-502.

Fetanat, A., & Shafipour. (2011). Generation Maintenance Scheduling in Power System Using Ant Colony Optimization for Continous Domain Based 0-1 Integer Programming. Expert System with Application, 38 (8), 9729-9735.

Hidayat, A. (2018). Optimization Model of Warship Assignment Scheduling to Secure the Koarmada II & Koarmada III Sea Region. Surabaya: Indonesian Naval Technology College.

Ministry of Defense. (2014). Regulation of the Minister of Defense of the Republic of Indonesia No.12 concerning the Principles of Development of National Defense Materials. Jakarta: Ministry of Defense of the Republic of Indonesia.

Keneth, R. B. (1974). Scheduling a Full-Time Workforce to Meet Cyclic Staffing Requirements. Management Science, 1561-1568.

Maras, at al. (2013). Routing of Barge Container Ship by Mixed Integer Programming Heuristics. Applied Soft Computing, 13, pp. 3515-3528.

Salmeron, J., & Dufek, M. (2014). Optimization of Continuous Maintenance Avability Scheduling. Naval Postgraduate School, Operations Research, Monterey, California.

Šeda, M. (2007). Mathematical Models of Flow Shop and Job. International Journal of Applied Mathematics and Computer Sciences, 4, 241-246.

Solekan, M. (2016). Scheduling KRI Assignments at Kolinlamil with a Binary Integer Programming Approach. Surabaya: Naval College of Technology.

T'kindt, V. & Billaut, JC. (2002). Multicriteria Scheduling: Theory. Models, and Algorithms. Springer. New York.

Wen, M., Ropke, S., Peterson, H. L., Larsen, R., & O, B. G. (2016). Full-Shipload Tramp Ship Routing and Scheduling with Variable Speeds. Computer & Operation Research, 70, 1-8.

ANALYSIS OF THE SELECTION OF THE ALKI STATES FOR HANDLING CRIMINAL ACTIONS OF VIOLATIONS BY THE MULTI CRITERIA DECISION MAKING APPROACH (CASE STUDY ALKI II)

Petrus Indra Cahyadi[1], Avando Bastari[2], As'ad Aris M[3]

[1,2,3]Indonesian Naval Technology Collage
Bumimoro-Morokrembangan, Surabaya 60178, Indonesia
e-mail: lealuna.navy50@gmail.com

ABSTRACT

The incidents of criminal offenses at sea that often occur in Indonesian waters greatly affect the credibility and authority of the Indonesian people in the eyes of the international community. Based on existing data, the number of criminal offenses at sea in Indonesian waters is the largest in the world, especially in ALKI II waters. This condition of course has a negative impact on the Indonesian government. There are several studies that take the theme of selecting locations with the Analytic Hierarchy Process (AHP) and Geographic Information System (GIS) methods. Wang (2009) states, although the AHP method is more widely used in building a decision-making system, this method has drawbacks, namely that it does not consider uncertainties and doubts in decision making. Therefore, Fenton & Wang (2006) argue that fuzzy-set theory can be used to overcome the limitations of AHP. This study assesses the location selection using Fuzzy AHP and TOPSIS to reduce decision uncertainty. This research can help determine the best Indonesian Navy base from several existing bases, especially those around ALKI II waters. This base will then serve as an aju base for KRI and personnel carrying out maritime security operations in the context of handling criminal offenses at sea. In the research area which is limited to ALKI II waters, there are 7 Indonesian Navy bases that can be used as alternatives, namely Lanal Palu, Lanal Kendari, Lanal Tolitoli, Lanal Nunukan, Lanal Sangatta, Lanal Kota Baru, Lanal Banjarmasin. From the weighting and ranking results, the Banjarmasin Navy Base was selected as the best Aju base, namely from a scale of 0-1, with a weight value of 0.8442.

Keywords : *Selection of Indonesian Navy bases, Fuzzy AHP, Topsis*

1. INTRODUCTION

The incidents of criminal offenses at sea that often occur in Indonesian waters greatly affect the credibility and authority of the Indonesian people in the eyes of the international community. Based on existing data, the number of criminal offenses at sea in Indonesian waters is the largest in the world, especially in ALKI II waters. This condition of course has a negative impact on the Indonesian government. Offenses at sea such as piracy and piracy have increased drastically in recent years and are estimated to cost the global economy more than $ 7 billion per year (Ploch 2010). This has caught the attention of the United Nations, thus providing an international statement that the main motivation for pirate attacks is the financial gain obtained either through piracy and theft of cargo or ransoms collected after the kidnapping of ships and crew (Hastings 2009). A number of approaches to combat piracy have been implemented by various parties (Rengelink 2012). For example, the October 2008 UN Security Council resolution provided a legal basis for pursuing pirates into Somali territorial waters. UN sanctions in 2008 and a statement by the US president in 2010 prohibit ransom payments to lists of individuals known to be involved in piracy. Although various efforts have been made to reduce the crime of violations at sea, observers state that these efforts have not provided evidence of success (Shortland & Vothknecht 2010). Thus, the ability to create new strategies that aim to reduce criminal offenses at sea such as piracy and piracy is needed.

So far, various efforts to overcome criminal acts of violations at sea have been carried out by the Indonesian government, both repressive and preventive. However, the efforts that have been made have not got maximum results because they have not gone through good planning and only take advantage of ships operating in these waters. A reliable intelligence capability and support is needed, both in terms of information accuracy and base readiness to be used as a starting point for the movement of ships and personnel in maritime security operations. A law enforcement operation at sea is said to be successful if the objectives can be achieved with minimal losses on one's part. There are several Indonesian Navy bases located in ALKI II waters. These bases include Lanal Palu, Lanal Kendari, Lanal Tolitoli, Lanal Nunukan, Lanal Sangatta, Lanal Kota Baru, Lanal Banjarmasin. Each of these bases has advantages and disadvantages with regard to the ability to provide support to KRI and personnel who are carrying out Marine Security Operations activities.

In this study, the authors used a method to consider the alternative selection of the Indonesian Navy Base that would serve as aju base based on qualitative and quantitative criteria. The Multi Criteria Decision Making combination model used is the weighting method with Fuzzy AHP (Analytical Hierarchy Process) and the ranking method with Technique For Others Reference by Similarity to Ideal Solution (TOPSIS).

2. ANALYTICAL METHODS

2.1. Decision Making Theory

This process is for determining and resolving organizational problems. The decision-making process in the human brain is basically choosing an alternative from many alternatives based on a number of criteria for a problem.

There are several methods in making decisions, including:

a. Decision analysis - deterministic.
b. Multi Criteria Decision Making (MCDM).
c. Analytical Hierarchy Process (AHP).
d. Analytical Network Process (ANP).

[Kadarsah Suryadi, 2000,138].

2.2 Selection of Bases

Determination of a strategic base is expected to be able to provide solutions in solving problems / obstacles faced in current conditions. In this paper, the authors use two models in determining strategic locations, namely Fuzzy AHP (Analytical Hierarchy Process) ranking method with Technique For Others Reference by Similarity to Ideal Solution (TOPSIS). This is intended so that the research conducted can obtain maximum results. Given that each model has a different function in solving the problems that will be raised in completing this paper. The Fuzzy AHP and TOPSIS methods emphasize the selection of an alternative to the Indonesian Navy Base which can be used as the most effective base.

2.2.1 Fuzzy Analytic Hierarchi Process (Fuzzy AHP)

According to Indradewi (2008), AHP fuzzy steps are:

a. Changing linguistic variables in the form of fuzzy numbers.

Questionnaire data in the form of linguistic variables are converted into fuzzy numbers. Examples of fuzzy numbers for triangular fuzzy numbers (Triangular Fuzzy Number or TFN) are shown in

Table 1. Where the linguistic variables are converted into three fuzzy levels, namely low (c); medium (b); and high (b).

Linguistic Scale	**Firm Value AHP**	**Scale *TFN fuzzy* (a, b, c)**	***Inverse***
The two elements	1	(1,1,1+Δ)	(1,1,1/1+Δ)

are equally important			
One element approximates little more than the other	3	(3-Δ,3,3+Δ)	(1/3+Δ,1/3,1/3-Δ)
One element approaches more importance than the other	5	(5-Δ,5,5+Δ)	(1/5+Δ,1/5,1/5-Δ)
One element approaches absolute more importance than the other	7	(7-Δ,7,7+Δ)	(1/7+Δ,1/7,1/7-Δ)
One element is absolutely more important than any other	9	(9-Δ,9,9)	(1/9,9,1/9-Δ)
The value between two adjacent considerations	2,4,6, 8		

b. Compile a pairwise comparison matrix between all elements / criteria in the dimensional hierarchy system based on the assessment of linguistic variables.

$$\tilde{A}=\begin{pmatrix} 1 & \tilde{a}_{12} & \cdots & \tilde{a}_{1j} \\ \tilde{a}_{21} & 1 & \cdots & \tilde{a}_{2j} \\ \vdots & \ddots & & \vdots \\ \tilde{a}_{n1} & \cdots & & 1 \end{pmatrix}=\begin{pmatrix} 1 & \tilde{a}_{12} & \cdots & \tilde{a}_{1j} \\ 1/\tilde{a}_{21} & 1 & \cdots & 1/\tilde{a}_{2j} \\ \vdots & \ddots & & \vdots \\ 1/\tilde{a}_{n1} & \cdots & & 1 \end{pmatrix} \quad (2.1)$$

$$\tilde{a}_{ij}=\begin{cases} \tilde{1},\tilde{3},\tilde{5},\tilde{7},\tilde{9} & \textit{Criteria i relatif important to j} \\ 1 & \textit{Criteria i same important to j} \\ \tilde{1}^{-1},\tilde{3}^{-1},\tilde{5}^{-1},\tilde{7}^{-1},\tilde{9}^{-1} & \textit{Criteria i less important to j} \end{cases}$$

c. Calculate the geometric mean of the respondents' ratings.

The next step is to recap the results of the assessment of all respondents and calculate the geometric mean of the lower limit value (c); middle value (a); the upper limit value (b) of all respondents. The following formula is used to calculate the geometric mean.

c = $\sqrt[n]{c1, c2, \ldots . cn}$ (2.2)

a = $\sqrt[n]{a1, a2, \ldots . an}$ (2.3)

b = $\sqrt[n]{b1, b2, \ldots . bn}$ (2.4)

d. Defuzzification

After calculating the geometric mean, the result is defuzzified to get the crisp value of the geometric mean value of fuzzy numbers to be reprocessed in AHP. One of the defuzzification techniques is Center Of Gravity (COG). The formula for defuzzification is as follows:

COG = $$\frac{\frac{1}{(a-c)}\left[\frac{1}{3}x^3-\frac{c}{2}x^2\right]_c^a+\frac{1}{(a-b)}\left[\frac{1}{3}x-\frac{b}{2}x^2\right]_c^b}{\frac{1}{(a-c)}\left[\frac{1}{3}x^2-cx^2\right]_c^a+\frac{1}{(a-b)}\left[\frac{1}{3}x^3-bx^2\right]_c^b} \quad (2.5)$$

e. Calculating the weight with AHP

The weight calculation is carried out if the results of the questionnaire prove consistent, that is, if the Consistency Ratio (CR) value is <0.1. To get CR, the Consistency index (CI) is calculated first. Here's the formula for calculating CI:

CI = $\frac{\lambda \text{maks}-n}{n-1}$ (2.6)

Where :

λmaks = maximum eigenvalues

n = size of the matrix

CI = Consistency Index*x*

The CI value is compared with the Ratio Index (RI) value according to the matrix size so that the Consistency Ratio (CR) value is obtained.

The matrix is declared consistent if the CR value is not more than 0.1.

Table 2. : *Ratio Index (RI)*

n (ukuran matriks)	1	2	3	4	5	6	7	8	9	10
RI (Ratio Index)	0	0	0,58	0,9	1,12	1,24	1,32	1,41	1,45	1,49

2.2.2 Technique For Others Reference by Similarity to Ideal Solution (TOPSIS)

The steps for the TOPSIS method are as follows:

a. Create a normalization matrix

The rij elements resulting from the normalization of the R matrix are:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \quad (2.7)$$

b. Calculate the weight of the normalized matrix

With the weight W = (w1, w2,… .., wn), then the normalized weight of the matrix V is :

$$V = \begin{pmatrix} w_1 r_{11} & w_2 r_{12} & w_x a_{1n} \\ w_1 r_{21} & & \\ \mathrm{M} & & \\ w_1 r_{m1} & w_2 r_{m2} & w_n r_{mn} \end{pmatrix}$$

c. Determine the ideal solution and the ideal solution negative. Positive ideal solution is denoted by (A +), while negative ideal solution is denoted by (A-):

$$A^{+} = \{(\max v_{ij} \mid j \in J), (\min v_{ij} \mid j \in J'),$$
$$i = 1,2,3,\dots,m\} = \{v_1^{+}, v_2^{+}, \dots, v_n^{+}\}$$
$$A^{-} = \{\min v_{ij} \mid j \in J), (\max v_{ij} \mid j \in J'),$$
$$i = 1,2,3,\dots,m\} = \{v_1^{-}, v_2^{-}, \dots, v_n^{-}\}$$

d. Calculating the separation

The alternative distance from the ideal positive solution (Si +) and the ideal negative solution (Si-) is defined as:

$$S_{i^+} = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^{+})^2}, \text{ dengan } i = 1,2,3,\dots,m \quad (2.8)$$

$$S_{i^-} = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^{-})^2}, \text{ dengan } i = 1,2,3,\dots,m \quad (2.9)$$

e. Calculates the relative proximity to an ideal solution.

$$A = \frac{S_{i^-}}{S_{i^+} - S_{i^-}}, 0 < A < 1 \text{ dan } i = 1,2,3,\dots,m \quad (2.10)$$

f. Alternative Ranking

Alternatives can be ranked based on the order of A, therefore, the best alternative is the one that is the shortest distance from the ideal positive solution and the farthest distance from the ideal negative solution. Basically TOPSIS does not have a specific input model in solving a case, TOPSIS uses an input model adapted from other methods (for example: AHP, ELECTRE, etc.).

3. RESULT AND DISCCUSION

3.1 Fuzzy AHP method.

3.1.1. Data collection.

Questionnaire data is the main input used as calculation input to determine the priority of the Indonesian Navy Base in the Koarmada II working area which will be used as an auxiliary base for carrying out operational tasks using the Fuzzy Analytical Hierarchy Process (FAHP) method. These respondents already have sufficient competency expertise from academic provisions and official experience, especially regarding the handling of criminal offenses at sea.

3.1.2 Data processing

a. Compile questionnaire data in the form of AHP pairwise comparison matrix

Table 3. Example of a pairwise comparison matrix

Perbandingan ANTAR KRITERIA			CR = 0,04
Baris / Kolom	Umum	Taktis	Teknis
Umum	1	1/5	1/8
Taktis	5	1	1/3
Teknis	8	3	1

b. Converting linguistic variables in the form of fuzzy numbers

Table 4. Example of the TFN value comparison matrix

Perbandingan ANTAR KRITERIA							CR = 0,04		
Baris / Kolom	Umum			Taktis			Teknis		
Umum		1		1/6	1/5	1/4	1/9	1/8	1/7
Taktis	4	5	6		1		1/4	1/3	1/2
Teknis	7	8	9	2	3	4		1	

c. Calculates the geometric mean of respondents' ratings

Table 5. Example of geometric mean data for all respondents

Perbandingan ANTAR KRITERIA							CR	=	0,04
Baris / Kolom	Umum			Taktis			Teknis		
Umum		1,00		1,36	1,68	2,10	1,14	1,43	1,78
Taktis	0,48	0,60	0,73		1,00		0,61	0,70	1,32
Teknis	0,56	0,70	0,88	1,15	1,43	2,49		1,00	

d. Defuzzification

Table 6. Examples of defuzzification results

Antar Kriteria			
	Umum	Taktis	Teknis
Umum	1,00	0,30	0,28
Taktis	0,21	1,00	0,26
Teknis	0,23	0,31	1,00

e. Calculating weights with AHP

Table 7. Results of Weighted Criteria and Alternatives

Peringkat	Subkriteria	Bobot
1	KOORDINASI	0,1206
2	LETAK	0,1156
3	OPSKAMLA	0,1074
4	PENYIDIKAN	0,1046
5	KERAWANAN	0,1016
6	DUKUNGAN	0,0988
7	MOBILITAS	0,0980
8	BHY NAV	0,0819
9	ALUR	0,0816
10	KOMUNIKASI	0,0464
11	KEAMANAN	0,0434
	Jumlah	1,0000

Sumber : Pengolahan data

Pangkalan	Bobot	Peringkat
Banjarmasin	0,2660	1
Nunukan	0,2056	2
Palu	0,1718	3
Kendari	0,0961	4
Sangata	0,0918	5
Kota baru	0,0911	6
Tolitoli	0,0776	7

3.2 TOPSIS Method.

a. Determine ideal solutions and negative ideal solutions:

A+	0.2981	0.2969	0.3400	0.2726	0.2604	0.2362	0.3593	0.3300	0.3409	0.3226	0.2883
A-	0.0467	0.0388	0.0416	0.0428	0.0403	0.0462	0.0565	0.0488	0.0541	0.0515	0.0453

b. Calculate the ideal alternative distance

Pangkalan	Si+	Si-
Banjarmasin	1,44387	7,82407
Kota baru	7,32869	1,81116
Nunukan	3,75735	5,54414
Palu	4,50833	4,71899
Sangata	7,42772	1,80355
Tolitoli	8,13271	0,81909
Kendari	7,20275	1,84159

c. Create Alternative rankings

Pangkalan	Bobot	Peringkat
Banjarmasin	0,8442	1
Nunukan	0,5960	2
Palu	0,5114	3
Kendari	0,2036	4
Sangata	0,1982	5
Kota baru	0,1954	6
Tolitoli	0,0915	7

4. CONCLUSIONS

4.1 Selected Indonesian Navy Bases Based on Criteria and Sub-criteria.

From the results of data processing using the Fuzzy AHP method, then it is analyzed according to the hierarchical structure to produce the following weights:

a. Based on the data collected from all respondents, the General Criteria have the highest weight rating (0.3868), the second rank is Technical Criteria (0.3183) and the third rank is Tactical criteria (0.2949). The factors of base position, mobility, ability to provide support and security from the monitoring of perpetrators of criminal offenses at sea were seen by respondents as factors that greatly influence the implementation of Opskamla. So that for the alternative selection of the Indonesian Navy Base to be used as a base, these factors must be considered.

b. Based on the data processing of the results of the questionnaire, the results of the weight of the Sub-criteria were obtained based on each of the criteria, namely the General Criteria for the sub-criteria of Location (0.2103), Mobility (0.2179), Support (0.3377) and Security (0.2341). Tactical Criteria, Hazard Level (0.3935), Groove (0.1706), Navigation Hazard (0.1858) and Communication (0.2501). Technical Criteria, Sub-criteria for Coordination Ability (0.4559), Investigation Ability (0.1876) and Opskamla Ability (0.3565). Sub-criteria Support for general criteria, sub-criteria The level of vulnerability on the tactical criteria and the sub-criteria for coordination capabilities on the technical criteria each rank 1 for the selection of the TNI AL Aju base. When viewed from the weighting results above, to accommodate the other criteria, it can be seen that the selection of a TNI AL base is expected to pay attention to the factors of location, level of vulnerability and coordination ability.

c. Based on the results of data processing, the final weight value of the sub-criteria as a whole is rank 1 coordination ability (0.1344), 2. support (0.1306), 3. vulnerability (0.1253), 4. Opskamla ability (0.1051) , 5. Security (0.0906). 6. Mobility (0.0834), 7. Location (0.0813), 8. Communication (0.0794), 9. Navigation Hazard (0.0591), 10. Investigative ability (0.0553) and 11. Flow (0.0543).

4.2 Alternative Naval Base Selected Based on Rank.

From the results of data processing using the Fuzzy AHP method, then ranking using the TOPSIS method, the following results were obtained :

a. For alternative results, the selected Indonesian Navy Base is the Banjarmasin Navy Base (0.8419), the Nunukan Navy Base (0.5891), the Palu AL TNI Base (0.5092), Kendari Navy Base (0.2003), Sangata Base (0.1964), Pangkalan TNI AL Kota Baru (0.1961) and Pangkalan TNI AL Tolitoli (0.0894). The Banjarmasin Navy Base was chosen as a base for handling criminal offenses at sea. This is because of the 11 sub-criteria used, Lanal Banjarmasin ranks 1 in 7 sub-criteria, namely mobility, support, navigation hazards, communication, coordination skills, investigative skills and opskamla abilities. So that in order to make Lanal Banjarmasin a base in handling criminal offenses at sea, the 7 sub-criteria can be made a top priority in improving its quality.

b. In the sensitivity analysis to determine the change in ranking of the alternatives if there is a change in the weight of the criteria, it is found that the critical criteria for weight change are the location criteria (at + 0.5 weight changes) and the safety criteria (at + 0.5 changes). Changes in the weight of these two criteria resulted in changes in ranks 5 and 6, namely at the Sangata Navy Base and the New City Navy Base.

The results of the interviews and identification of problems were then carried out by arranging a hierarchy. The first level is the goal to be achieved, the second level is the criteria which are the determining factors in the process of determining the base, while the next level is the sub-criteria. At the last level, an alternative to the Indonesian Navy Base will be chosen. To determine the rank of each Pangkalan TNI AL alternative, the TOPSIS method is used by using the principle that the chosen alternative must have the closest distance from the positive ideal solution and the furthest from the negative ideal solution from a geometric point of view. A positive ideal solution is defined as the sum of all the highest scores that can be achieved for each criterion, while a negative ideal solution consists of all the lowest scores achieved for each criterion.

c. There are 7 (seven) Indonesian Navy bases along ALKI II which are used as alternative Aju bases, namely Lanal Banjarmasin, Lanal Nunukan, Lanal Palu, Lanal Kendari, Lanal Sangata, Lanal Kota Baru and Lanal Tolitoli. The Banjarmasin Navy Base has the highest score based on the overall criteria with a value of 0.8842, so it is very appropriate to be used as a base for handling criminal offenses at sea. The weights generated in data processing for the seven bases have a significant difference in ranks 1 to 4. While for ranks 5 to 7 the resulting differences are relatively small.

ACKNOWLEDGEMENTS

The authors greatly acknowledge the support from Indonesian Naval Insitute of Technologyand Indonesian Navy Institution for providing necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

REFERENCE

Ada Suk Fung Ng, (2011), "A maritime security framework for fighting piracy", ISSN 1832-570X, INSTITUTE of TRANSPORT and LOGISTICS STUDIES The Australian Key Centre in Transport and Logistics Management The University of Sydney

Chalk, (2010), Piracy off the horn of Africa: scope, dimensions, causes and responses. Brown Journal of World Affairs, 16(2), 89–108.

Daman Afshan Hojat and Majlesi Monereh (2013),GIS and the Analytic Hierarchy Process methods for site selection of waste landfills: a case study in iran". (International Journal of Geology, Earth & Environmental Sciences ISSN: 2277-2081 (Online) An Online International Journal Available at http://www.cibtech.org/jgee.htm Vol.3 (3) September-December, pp.96-104/Hojat and Monereh,

Defne et al. (2011), Comparison of AHP and Fuzzy AHP for The Multicriteria Decision Making Process With Linguistic Evaluations, Journal of IstambulTicaret Universities (6), 15

Dumais, Leo, (2001), Kerjasama Asean dalam Menanggulangi Kejahatan Lintas Negara, Jakarta

Elio Marchione, Shane D Johnson and Alan Wilson (2014), Modelling Maritime Piracy: A Spatial Approach, (Journal of Artificial Societies and Social Simulation **17** (2) 9)

Farahani, R.Z., and Asgari, N. (2006). Combination of MCDM and Covering Techniques in a Hierarchical Model for Facility Location

Hastings, J. (2009). Geographies of state failure and sophistication in maritime piracy hijackings. Political Geography, 28(4), 213–223

Kadarsah Suryadi, (2000), Sistem Pendukung Keputusan suatu Wacana Struktural Idealis dan Implementasi Konsep Pengambilan Keputusan, PT. Remaja Rosdakarya, Bandung.

Kusumadewi, S. dan Purnomo, H. 2010, Aplikasi Logika Fuzzy untuk Pendukung Keputusan, Edisi 2, Penerbit Graha Ilmu, Yogyakarta, 1-29

Mabes TNI AL (2013). Data Hidro Oseanografi Lautan Indonesia. Dinas Hidro Oseanografi, Jakarta.

Mulyono, S. (1999). Operation Research. Fakultas Ekonomi, Universitas Indonesia, Jakarta.

Muhammad Shakir, Zahir Ali, Manager Naveed Alam, (2011), Developing a Model for Locating Suitable Schools Sites using Multi-criteria Decision Analysis and Geographic Information System Techniques", National Centre for Remote Sensing and Geo-Informatics (NCRG) SUPARCO HQs, Sector 28, Gulzar-i-Hijri Off University Road Pakistan,

Ozdagoglu, A. andOzdagoglu, G., 2007, Comparison of AHP and Fuzzy AHP for The Multicriteria Decision Making Process With Linguistic

Evaluations, Journal of IstambulTicaret Universities (6), 65-85.

PLOCH, L. (2010). Piracy Off the Horn of Africa. DIANE Publishing

Prahasta, Eddy, (2005), Sistem Informasi Geografis; Konsep konsep Dasar, Cetakan Kedua, CV. Informatika, Bandung.

Prahasta, Eddy, (2011), Tutorial ArcGIS Desktop untuk Bidang Geodesi & Geomatika; Cetakan Pertama, CV. Informatika, Bandung

Rengelink, (2012), Trends in Organized Crime. Springer.

Saaty, Thomas L. (1993). Pengambilan Keputusan Bagi Para Pemimpin : Proses Hirarki Analitik untuk Pengambil Keputusan dalam Situasi yang Kompleks. PT Pustaka Binaman Pressindo, Jakarta.

Shortland & Vothknecht, (2010),). Combating Maritime Terrorism off the Coast of Somalia. Deutsches Institut für Wirtschaftsforschung, Germany.

Subroto, S. dan Wahyono (1983). Konvensi PBB tentang Hukum Laut Internasional. Edisi Pertama. Suya Indah, Jakarta.

Vahidnia, M.H. dkk., 2008, Fuzzy Analytical Hierarchy Process in GIS Application, Journal ofThe International Archives of the Photogrammetry Remote Sensing and Spatial Information SciencesFaculty of Geodesy and Geomatics Eng. K.N.Toosi University of Technology (37), 593-596

DELPHI-AHP METHOD APPLICATION IN ANALYSIS AND CRITERIA DETERMINATION OF WARSHIP TYPE

Tunang Arimbo[1], Suparno[2], Ahmadi[3]

[1,2]Indonesian Naval Technology College, STTAL, Bumi Moro, Surabaya, 60178, Indonesia
[2]Industrial Engineering Department, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
e-mail : arimbotun51@gmail.com

ABSTRACT

Fleet Comando III is the Main Command of the Indonesian Navy as Operation City which is tasked with carrying out defense and security operations of the maritime dimension by carrying out security in the territorial waters of eastern Indonesia. The operation in these waters is faced with the vulnerability of frequent violations, geological conditions consisting of thousands of islands and shallow straits, extreme weather and also with limited state defense budget conditions. Therefore, it is very necessary that warship is appropriate and ready to face these challenges and obstacles so that the goals of the organization can be achieved. The purpose of this study was to analyze the criteria and determine the type of warship needed in accordance with the conditions in Fleet Comando III. This study uses an integration between the Delphi method and the AHP method. The Delphi method is used to determine criteria while the AHP method is used to evaluate qualitative data and determine the weight of each criterion / sub-criteria. Based on this research, it is concluded that from the available alternatives, the best type of warship is combatant warship with a value of 0.299 then fast warship with a value of 0.184, amphibious warship with a value of 0.154, auxiliary warship with a value of 0.131, mine warship with a value of 0.199 and finally submarines with a value of 0.144. The results of this study are expected to be input and consideration for the leadership of the Indonesian.

Keywords: *Fleet Comando III, Delphi, AHP*.

1. INTRODUCTION

In accordance with the mandate of the Republic of Indonesia Law Number 34 of 2004 concerning the TNI, the Navy has the task of carrying out the duties of the Navy in the defense sector, upholding the law and maintaining security in the marine area of national jurisdiction in accordance with the provisions of national law and international law that have been ratified, carry out the diplomatic duties of the Navy in order to support the foreign policy stipulated by the government, carry out TNI duties in the development of the strength of the marine dimension, and carry out the empowerment of the marine defense area. In carrying out the duties of the Indonesian Navy, it is supported by the existence of an organization which includes: leadership elements, leadership assistants, service elements, Central executing agency, main command for operations and guidance.

Fleet Comando III is the main Guidance and Operations Command, which is directly under the Chief of Staff Indonesian Navy in the field of training and combat readiness of his unit command and is directly under the TNI Commander in the field of operations. Koarmada III has the main task of fostering the capabilities of the elements of the Fleet's forces, fostering maritime potentials to become a state defense and security force at sea, carrying out daily marine operations and marine combat operations for sea control and projection of power to land by sea in the context of enforcing sovereignty and law at sea.

In terms of geographical conditions and marine resources, the working area of Fleet Comando III is a vast area of water with a variety of abundant wealth. The condition of the area has resulted in vulnerabilities that can threaten Indonesia's security and sovereignty, including: Illegal, Unreported and Unregulated (IUU) Fishing, illegal surveys by foreigners which are packaged in the form of marine tourism activities, drug smuggling, firearms smuggling, marine pollution and Illegal use of Indonesian archipelago sea lanes rights of passage either by civilian ships or foreign military ships as well as other illegal activities. Therefore, sea operations are needed for sea control and power projection to land by sea in the context of enforcing sovereignty and law at sea.

In carrying out marine operations involving various Main Weapon System which are components of the Integrated Fleet Weapon System which consists of Warship, Aircraft, Marines and Bases as supporters. So that the Warship as one of the components of the Integrated Fleet Weapon System is the foremost defense force to protect the maritime territory of the Republic of Indonesia. The elements of Warship in the Indonesian Navy are grouped into 7 ship units, namely excorta ship umit, submarine unit, amphibious ship unit, fast boat unit), mine ship unit, unit patrol boat and Satban auxiliary ship unit. Therefore, it is necessary to choose the type of warship in accordance with the existing conditions in Fleet Comando III, which is adapted to geographical conditions, threats, support for repair and maintenance.

In carrying out the analysis of the selection of types of Warship requires analysis of information and identification of various criteria. So that in this study the approach method used is the Delphi method to determine criteria, the Analityc Hierarchy Process (AHP) method to determine the criteria weights and determine alternative priorities.

2. MATERIAL AND METHOD

2.1 Delphi Method

The Delphi method is a process carried out in groups to survey and collect opinions from experts on a particular topic. This method is useful for structuring the group communication process so that the process will run effectively, so that the group can solve problems. This method is used when expert opinion and judgment is required but other factors such as time or distance make it difficult for panel experts to sit down together.

In the process, this method involves interaction between the researcher and a group of experts related to a particular topic, usually through the help of a questionnaire. This method is used to gain consensus on future projections using a systematic information gathering process. This method is useful when the opinions and judgments of experts and practitioners are needed in solving problems. The three main steps in this process are:

a. The first questionnaire was sent to the expert panelists to ask some of their opinions (from experience or just their judgment), some predictions and also their recommendations.

b. In the second round, a summary of the results of the first questionnaire was sent to each expert panelist to be able to re-evaluate their first assessment on the questionnaire using the specified criteria.

c. In the third round, the questionnaire was returned with information regarding the panelists' assessment results and the consensus results. The panelists were asked again to revise their opinion or explain the reasons for disagreeing with the group consensus and convergence and carried out using statistical analysis with the following approach:

1) Standard Deviation

The first measure of convergence or consensus assessment is when the answers or assessments of all informants have a standard deviation of <1.5. The Standard Deviation formula is as follows

$$s = \sqrt{\frac{\Sigma(x_i - \overline{x})^2}{n-1}} \text{ atau } \sqrt{\frac{\Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n}}{n-1}}$$

Where:

x = response to the criteria / subcriteria n

$\bar{x}$ = average respondent's answer to the criteria / sub-criteria n

2) Interquartile Range

The second measure of convergence or consensus assessment is when the answers or assessments of all informants have an Interquartile Range <2.5. The interquartile range formula is:

IR = Q3 - Q1

Where Q3 is the Upper Quartile and Q1 is the Lower Quartile.

The above quartile formula is:

$$Q_1 = \frac{x\left(\frac{n-1}{4}\right) + x\left(\frac{n+3}{4}\right)}{2}$$

$$Q_2 = x\left(\frac{2(n+1)}{4}\right)$$

$$Q_3 = \frac{x\left(\frac{3n+1}{4}\right) + x\left(\frac{3n+5}{4}\right)}{2}$$

Evaluation to express convergence or consensus on all criteria / subcriteria is, when the standard deviation <1.5 and the interquartile range <2.5. If either the standard deviation or the interquartile range is not <1.5 and <2.5, then the criteria / subcriteria are declared non-convergent or not agreed (consensus).

2.2 Analytic Hierarchy Process (AHP)

Thomas L Saaty developed the Analytic Hierarchy Process (AHP) theory in 1970. AHP is an MCDM method as a structured technique to help the community determine the priority of several criteria by making pairwise comparisons of each criterion. In contrast to other MCDM methods, AHP is a decision support system that decomposes a complex multi-factor problem into a hierarchy, where each level is formed from specific unrelated elements. The main tool of AHP is a functional hierarchy with the main input being human perception. The existence of a hierarchy makes it possible to break down complex or unstructured problems into sub-problems, then arrange them into a hierarchical form. Three basic principles of the AHP process: (Saaty, 1993).

a. Describe and describe a hierarchy called arranging hierarchically, which is to break down the problem into separate elements.

b. Differentiation of priorities and systems, which is called priority setting, which is to determine the level of elements according to their relative importance.

c. Logical consistency, which ensures that all elements are grouped logically and ranked consistently according to a logical criterion.

2.2.1 Pairwise Comparison

Pairwise comparison based on the judgment of the decision maker by assessing the importance of an element compared to other elements. This comparison value is determined by the quantitative scale proposed by Saaty (1994). This scale starts from 1 to 9. Comparisons are made until a total judgment is obtained of n x [(n-1) / 2] pieces, where n is the number of elements being compared.

Table 1. Scale of Intensity of Importance

Intensity of Importance	Definition
1	Equally important
2	Between equally and moderately important
3	Moderately important
4	Between moderately and strongly important
5	Strongly important
6	Between strongly and very strongly important
7	Very strongly important
8	Between very strongly and extremely important
9	Extremely important

2.2.2 Consistency Ratio (CR)

Consistency deviation is expressed by the equation:

$$CI = \frac{\lambda_{maks} - n}{n-1},$$

where, CI = Consistency Index
λ_{maks} = nilai eigen terbesar

AHP measures the entire consistency of the assessment using the Consistency Ratio (CR), which is formulated as follows:

$$CR = \frac{CI}{Random\ Consistency\ Index}$$

The Random Consistency Index is abbreviated as RI, which is a certain level of consistency that is needed in determining priorities for valid results. The CR value should be no more than 10%. If not, the assessments that have been made may be random and need revision.

n	1	2	3	4	5	6	7	8	9
RI	0,00	0,00	0,58	0,90	1,12	1,24	1,32	1,41	1,45

Figure 1. Random Consistency Index (RI)

3. RESULT AND DISCUSSION

3.1 Identification of Criteria and Subcriteria

This stage is carried out by means of brainstorming / interviews with the speakers. The resource persons consisted of experts from 1) Operations Staff; 2) Planning Staff and 3) Logistics Staff. The result of this stage is the identification of the initial criteria and sub-criteria in determining the type of warship which are as follows:

a. Task Operation. It is a series of operational activities carried out by units of the Indonesian Navy independently or jointly within a certain time bound to the objectives and plans to achieve strategic and tactical objectives.

Table 2. Subcriteria of Marine Operation

No	Subcriteria	Description
1.	Marine Combat Operation	Marine combat operations are carried out in the waters of the national jurisdiction of the Koarmada working area by presenting elements of the warship and air caraft in order to anticipate any form of threat to sovereignty in the national jurisdiction.
2.	Limited Security Operations	Operations to secure the borders of the sea and air territories directly bordering with neighboring countries to free and defend against any attempts by foreign parties to carry out violations of sovereignty and law in the territorial sea borders of Indonesia withneighboring countries.
3.	Security Operation Of Sea Lines	Operations to secure areas in the Indonesian Archipelago Shipping Lanes in the context of enforcing state sovereignty and implementing Sea lines rules in sea and air territory
4.	Coordinating Patrol Ausindo	It is an MOOTW with the aim of securing the border area to ensure

		the upholding of state sovereignty in the maritime border area with other countries and the outer islands and remote islands from all forms of threats and violations, preventing the exploitation of natural resources and territorial violations by parties. foreigners in the sea border area. In its implementation, it can be carried out in a coordinated manner with the Navy of neighboring countries in the form of coordinated patrols

b. Exercise. It is an activity that is repeated systematically in practice to acquire maximum proficiency and skills

Table 3. Subcriteria Of Exercise

No	Subcriteria	Description
1.	Matra Exercise	The implementation of training carried out by the Indonesian Navy which includes inter main command, unit, or special training in the marine environment in order to improve and / or maintain operational readiness
2.	Joint Exercise	Joint Training of the Indonesian Navy is a form of collaborative training carried out by involving the Indonesian Navy together with one or more other national navies
3.	Combined Exercises	The Joint Training is an exercise in the context of combat operations assisted by other operations as needed, is part of the defense operation pattern which is carried out pre-emptively, preventively or repressively by two or more forces under a joint command.

c. Base Support. The base's ability to carry out its function in providing optimal support for the smooth operation of other Integrated Fleet Weapon System components, both ships, aircraft and Marines. The form of support in question is in the form of both sea and air landing facilities, maintenance and repair facilities, provisioning facilities, personnel maintenance facilities and base development facilities.

Tabel 4. Subcriteria of Base Support

No	Subcriteria	Description
1.	Berth Facilities	The base's ability to provide a dock for warship
2.	Maintenace and Repair Facilities	The base's ability to carry out maintenance and repairs on both its sewaco and platform
3.	Provisioning Facilities	The base's ability to provide support for class I to class X supplies to warships
4.	Personnel Care Facilities	The base's ability to support personnel maintenance activities, includes: mess facilities,

		health facilities / rumkit, sports and recreation facilities, worship facilities, training facilities for all types of warships at least one task force
5.	Base Development Facilities	The base's ability to provide public facilities, transportation facilities

d. Special. Relates to special matters.

Table 5. Subcriteria of Special

No	**Subcriteria**	**Deskripsi**
1.	Detterence Effect	The value of the deterrence effect on the presence of warship when carrying out marines' operations
2.	Geographical	This criterion is related to the ability of warship in relation to the geographical conditions of the sea in fleet Comando III

3.2 Alternative Types of Warships

Alternative selection of the types of warships used in this study are the types of warships currently owned by Koarmada II, namely:

a. Combatant Ships.
b. Amphibious Ship.
c. Fast Ship.
d. Auxiliary Ship.
e. Mine Ships.
f. Submarines.

3.3 Determination of Criteria and Subcriteria

Determination of criteria and sub-criteria that affect the selection of warships is carried out using the Delphi method. This study involved three experts. Obtaining expert consensus on the criteria and sub-criteria in this study was carried out in two rounds. Because the results of the 2nd round Delphi questionnaire are not much different from the results of the 1st round Delphi questionnaire because the experts tend not to change their assessments. In Table 6, the results of the assessment of the level of importance of the criteria and sub criteria in the second round are presented.

Table 6. Results of the second round Delphi questionnaire

No	Criteria	Sub Criteria	Expert				Avg.	Std. Dev	Modus	Q1	Q2	Q3	IR	Evaulation	
			I	II	III	IV								Std.Dev	IR
1	Task Operation	Marine combat operations	5	5	4	3	4.25	0.957	5	3.8	4.5	5	1.25	Kon	Kon
		Limited Security Operations	4	5	5	3	4.25	0.957	5	3.8	4.5	5	1.25	Kon	Kon
		ALKI security operations	5	5	5	2	4.25	1.5	5	4.3	5	5	0.75	Kon	Kon
		Ausindo coordinating patrols	5	5	5	3	4.5	1	5	4.5	5	5	0.5	Kon	Kon
2	Exercise	Matra Exercise	5	5	5	4	4.75	0.5	5	4.8	5	5	0.25	Kon	Kon
		Joint Exercise	5	5	4	4	4.5	0.577	5	4	4.5	5	1	Kon	Kon
		Combined Exercise	5	5	5	4	4.75	0.5	5	4.8	5	5	0.25	Kon	Kon
3	Base Support	Berthing facilities	5	5	4	5	4.75	0.5	5	4.8	5	5	0.25	Kon	Kon
		Repairing facilities	5	5	5	5	5	0	5	5	5	5	0	Kon	Kon
		Provisioning Facilities	5	5	5	5	5	0	5	5	5	5	0	Kon	Kon
		Personnel care facilities	2	1	2	5	2.5	1.732	2	1.8	2	2.75	1	**Div**	Kon
		Base Development	2	2	0	5	2.25	2.061	2	1.5	2	2.75	1.25	**Div**	Kon
4	Special	Detterence Efect	5	4	5	4	4.5	0.577	5	4	4.5	5	1	Kon	Kon
		Geographical	5	5	5	3	4.5	1	5	4.5	5	5	0.5	Kon	Kon

Based on table 3.5 above, it can be seen that there are 4 consensus criteria and 12 sub-criteria. Only 2 sub-criteria were not consensus, namely Personnel care facilities and Base Development sub-criteria.

Because the 2 sub-criteria have a standard deviation value > 1.5. So that the result of the second round of opinion withdrawals, which results from the evaulation of standard deviation and quartile coverage, is that the consensus will be used as the basis for building the AHP hierarchical structure in determining the type of warship.

3.4 Determine Criteria and Subcriteria Weights

3.4.1 Hierarchy Structure

The complete AHP model is shown in Figure 3.2. The goal to determine the type of Warship is seen on the left and the decision alternatives are located at the right. Between the goal and the decision alternatives lie the criteria and subcriteria.

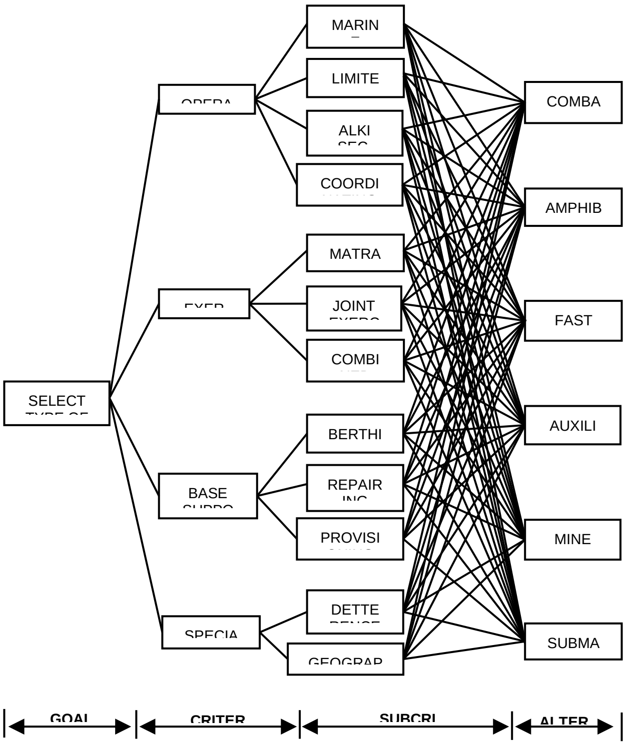


Figure 2. Hierarchy structure of determining the type of warship

3.4.2 Pairwise Comparison

Pairwise comparisons were carried out on 12 sub-criteria in each of the criteria for operation, exercise, base support and special. Pairwise comparisons were carried out with the help of the Exspert Choice V11 software. With this software allows a relatively fast calculation time. Furthermore, a pairwise comparison calculation process against the criteria and sub-criteria is shown in Figure 3 below.

Figure 3. Pairwise Comparison

3.4.3 Consistency Ratio

With the Exspert Choice V11 software, the Consistency Ratio value can be seen when inputting pairwise comparison data. So that the incontency value can be found easily if more than 10%. Furthermore, one of the Consistency Ratio values is shown in Figure 4 below.

Figure 4. Consistency Ratio

3.4.4 Weighted Value of Criteria and Subcriteria

By using the AHP method, the weight value is obtained for each of the criteria and sub-criteria in selecting the type of warship. The results of weighting the criteria and sub criteria are shown in Figure 5.

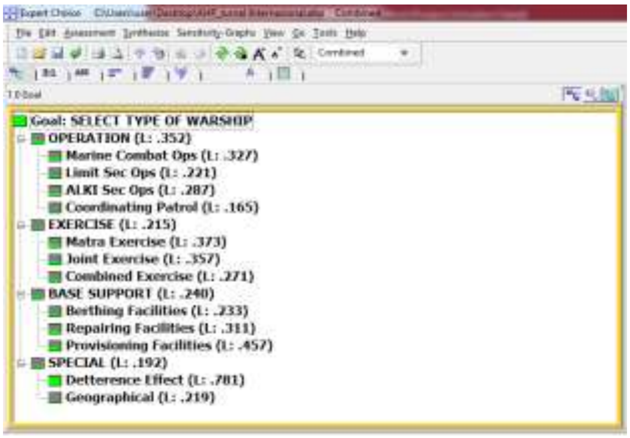


Figure 5. Weight Value

3.4.5 Determination of Alternative Priorities

Data processing using Expert Choice software which can manage the relationship between criteria, between sub-criteria or between alternatives provides the final calculation result in the form of a ranking value of the priority of each alternative to determine the type of warship.

Figure 6. Weighted Value of Alternatives

From the picture above, it can be seen that the alternative priorities are based on the weight value of each criterion. The alternative priority ranking is in accordance with the table below.

Table 7. Priority Ranking for Types of Warship

Rank	Type of Warship	Weight
1	Combatant warship	0.299
2	Fast warship	0.184
3	amphibious warship	0.154
4	auxiliary warship	0.131
5	mine warship	0.119
6	submarines	0.144

3.4.6 Sensitivity Analysis

The priority weight obtained from the results of the assessment data processing is highly dependent on the hierarchical structure developed and on the relative pairwise comparation given from various problem elements. Changes in the hierarchy or ratings can change the weighted priority generated.

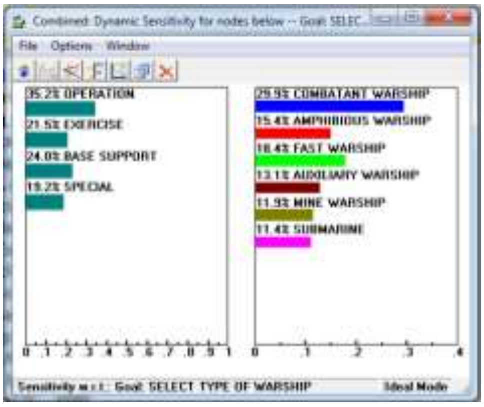


Figure 7. Initial Performance of Criteria Againts Priority Order

Priority order Figure 7. Above shows the performance/ sensitivity for each of the criteria considered in determining the pririty of a warship with an initial operating criterion weight of 35.2 %, exercise criteria 21.5 %, base support criteria 24.0 % and special criteria 19.2 %. Figure 3.8 shows the performance after changing the weight of the special criteria specifically for 25 %, which thwn affects the order of priority of warship types.

Figure 8. Criteria performance against priority order after weight change

The study of the two images above shows that the shift in priority order will only occur in the order of Submarines and Mine warships. Meanwhile, Combatant warship, Fast warship, Amphibious warship and Auxiliary warship are still in the order they were started.

4. CONCLUSION

The study succeeded in obtaining a consensus of significant criteria and sub-criteria in the process of selecting the appropriate type of warship. A total of four criteria and 12 sub-criteria have been validated by the expert group to be used in making decisions about choosing the type of warship. These criteria are Operations (marine combat operations, limited security operations, sea-line operations, coordination patrols), Exercises (field training, joint training, joint training), Support bases (berthing facilities, repair facilities, supply facilities), Special (prevention, geographical). Operational criteria are the top priority in determining the type of warship, the next priority is base support, training and special. Based on the AHP results, the type of warship is recommended as the top priority.

ACKNOWLEDGEMENTS

The authors greatly acknowledge the support from Naval Technology College, STTAL Surabaya Indonesia for providing the necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

REFERENCES

Albayrak oglu, M. Murat (2006). *Configuring A Major Amphibious Vessel: A Multi-Criteron Decision Making Model Using the Analytic Hiearchy Process.* Jurnal Internasional Business Informatics Program Istanbul Bilgi University, Turkey.

Bartolomius Harpard. *Penerapan metode AHP dan metode TOPSIS dalam sistem pendukung keputusan pemilihan asisten laboratorium komputer pada stmik widya cipta dharma samarinda.* Jurnal STMIK Widya Cipta Dharma, Samarinda.

Carla Olyvia, (2019). *Pemilihan multi-kriteria pemasok department store using fuzzy AHP dan TOPSIS methode*. Jurnal Ilmiah Teknik Industri Universitas Tarumanagara, Jakarta.

Dağdeviren, Metin, Serkan Yavuz, dan Nevzat Kılınç, (2009). *Weapon selection using the AHP and TOPSIS methods under fuzz environment***.** Jurnal Int. *Expert Systems with Applications volume 36, pages* 8143-8151, USA.

I Made Arya, (2017). *Sistem Pendukung Keputusan Kelompok Penentuan Karyawan Terbaik Menggunakan Metode Topsis dan Borda*. Jurnal Program Studi S2 Ilmu Komputer FMIPA UGM, Yogyakarta.

Irlan, Adiyatma Rum. (2018). *Modul Metode Delphi*. Universitas Padjadjaran, Bandung.

Juliyanti, (2011). *Pemilihan Guru Berprestasi Menggunakan Metode AHP dan TOPSIS*. Jurnal Jurusan Matematika FMIPA ITS, Surabaya.

Keppres, (2018). *Pembentukan Satuan Baru dan Perubahan Nama Satuan TNI.* Keputusan Nomor 12 tahun 2018 tanggal 8 Mei 2018, Jakarta.

Kadarsyah Suryadi, (2010). *Sistem pendukung Keputusan Suatu Wacana Struktural Idealisasi Dan Impementasi Konsep Pengambilan Keputusan*. PT. Remaja Rosdakarya, Bandung.

Mahan, Alfred Thayer. (1890). *The Influence of Sea Power Upon History.* Boston: Little Brown Company.

M. Nasir, (2015). *Metode Topsis dan Borda dalam Sistem Pendukung Kelompok Seleksi Personil*. Prosiding Seminar Nasional Teknik Informatika Universitas Islam Sultan Agung, Semarang.

Marsetio, (2014). *Sea Power Indonesia*. Universitas Pertahanan, Jakarta.

Perkasal, (2016). *Nomenklatur Kapal, Pesawat Udara dan Material Tempur di Lingkungan*

TNI Angkatan Laut. Peraturan Nomor 10 Tahun 2016 Tanggal 4 Agustus 2016, Jakarta.

PerPang TNI, (2019). *Pokok-Pokok Organisasi dan Prosedur Markas Besar Tentara Nasional Indonesia Angkatan Laut.* Peraturan Nomor 49 Tahun 2019, Jakarta.

Publikasi Umum TNI-AL (Pum-1.01), (1987). *Pola Pembinaan dan Penggunaan Kekuatan TNI-AL*. Skep Kasal Nomor 1020 Tahun 1987, Jakarta.

Proceeding, (2006). *The 4th Indonesian symposium on Analitic Hierarchy Process*, Jakarta.

Saaty, Thomas L. (1993). *Pengambilan Keputusan Bagi Para Pemimpin*. PT. Pustaka Binaman Pressindo, Jakarta.

Sarjon Defit, (2010). *Multi Criteria Decision Making (MCDM) Pada Sistem Pendukung Keputusan*. Deepublish, Jakarta.

TNI AL, (2005). *Rancangan Postur TNI AL Tahun 2005-2024*. Jakarta.

UU TNI, (2004). *Tentara Nasional Indonesia.* Undang-Undang RI Nomor 34 Tahun 2004, Jakarta.

V. Alpagut Yavuz, (2016). *Analysis of job change decision using a hybrid MCDM Method.* International Journal of Business and Social Research Volume 06, Issue 03, 2016.

OPTIMIZING THE ROLE OF THE INDONESIAN MARINE CORPS IN ORGANIZING COASTAL DEFENSE OPERATIONS

Taufik Ramdhan[1], Juang Pawana[2], Kukuh Setyo Pambudi[2]

[1]*STTAL,* Bumimoro, Morokrembangan*, Surabaya, 60178, Indonesia*
[2] *Universitas Pertahanan, Kompleks IPSC, Sentul Bogor 16810, Indonesia*
e-mail: kukuhpambudi@ymail.com

ABSTRACT

This study aims to analyze the marine corps to play a bigger role in coastal defense operations in Indonesia. Based on Presidential Regulation Number 66 of 2019, article 63 states that the Marine corps is designated as the Main Operations Command. This provision has implications for the Marines to carry out several operations under the direct command of the TNI Commander. Some of the operations that can be carried out include amphibious operations, coastal defense operations, and securing strategic outer islands within OMP and OMSP. In particular, coastal defense operations are essential operations that the Marine Corps will be able to carry out properly because the coastal defense is one of its primary capabilities. The Marine Corps as the central coordinator in Coastal Defense Operations is also supported by article 153 which states the authority of the Marine Corps as the Main Guidance Command in fostering Marine unit elements and maritime potential in the region. Thus, it becomes a necessity if the Marine Corps becomes the main driving force for the implementation of Coastal Defense Operations along with the frontier coastal areas in Indonesia. This study used a qualitative descriptive analysis approach with the primary data source obtained from a literature review. It is hoped that the results of this study can contribute to the Republic of Indonesia in considering the Marine Corps to be able to play an active role by starting to develop the Composite Marine Unit organization. Then it will be more optimal if the Composite Marine Unit is dislocated throughout the Indonesian homeland, especially in areas that have the Main Base of the Indonesian Navy as the central role in the implementation of the current Coastal Defense Operations.

Keywords: O*ptimizing ,Marine, Coastal Defense Operations.*

1. INTRODUCTION

Indonesia is a country with the second-longest coastline in the world. With a total of more than 17 thousand islands and a coastline of more than 10 thousand kilometres, Indonesia has characteristics, unlike most continental countries. This, of course, has a massive influence on how Indonesia's defense system should be structured. The defense that prioritizes the elements of the sea and the coast should be one of the priorities because this element has a significant threat from its marine area.

The threat in the marine area cannot be underestimated and deserves attention to all components of the Indonesian nation. This is inseparable from the many threats from the sea that have recently become increasingly visible. One of these threats can be seen from the tension in many border areas. Perhaps the hottest part of this time is the South China Sea, where the intense conflict is taking place in the Indonesian sea area.

The South China Sea continues to heat up until now. According to Prabowo (2013), both the policies and strategies applied by Indonesia in tensions at sea have not been well formulated. Therefore, a comprehensive formula is needed to respond to threats in Indonesia's oceans and beaches. The condition of Indonesia's defense at sea, which is not yet fully integrated, makes Indonesia vulnerable in facing various threats at sea. This is again proven by the lack of equipment that can carry out coastal defense operations.

In general, coastal defense operation (coastal defense) is a cross-dimensional joint operation which aims to protect and block threats on the coastline and attack other objects in the coastal area. In the context of Coastal Defense, beaches are identified as land-sea and air areas bounded by operating agreements (paradigmindonesia.com, 2019). This operation has strategic value because Indonesia is a country that has a very long coastline. Until now, coastal areas have not been enormously developed in Indonesia. This can be seen from the absence of a particular unit that is placed on the outer coasts of Indonesia.

If a country can use the coastal area properly, the potential that can be developed is enormous. This has been proven by many studies analyzing the potential of the coastal region as a maritime buffer. One of the studies conducted by Nasution (2009) found that the coastal area has a defense potential that can be developed as an effort to strengthen the defense aspect in Indonesia. This proves the strategic position of the coast in Indonesia's defense.

One fact that coastal defense has not been developed is a problem in itself for Indonesia. Given that Indonesia has a coastline that is so long that it is very vulnerable to threats from various parties (Putra and Hakim, 2016). Also, the elements of coastal defense that are still not yet integrated make the defense problem on the outer lines of Indonesian territory even more severe. The author sees this as a threat that needs to be resolved immediately. One that the writer tries to develop in this case is improving coordination in coastal defense operations, which until now has not appointed a particular city as the main driver in operations.

One of the corps that has the most capable capabilities in conducting coastal defense is the Marines. Historically the Marine Corps was a unit formed to fill the Indonesian military force with several tasks such as coastal defense, amphibious operations, and defense on the outer islands. This capability is coupled with the allusista that is owned, which is quite complete in protecting and defending coastal areas in Indonesia. Thus, the author believes that the Marines are the most suitable units to coordinate coastal defense operations in Indonesia.

2. LITERATURE REVIEW

2.1 Indonesian Marine Corps

The Indonesian Marine Corps is one of the combat units included in the Main Operations Command under the TNI commander who has outstanding abilities in terms of landing and coastal defense. Apart from serving as Main Operations Command, the Marines through Presidential Decree No. 66 of 2019 was also appointed as Main Command of Development or served as a supervisor in coastal and maritime defense.

In the historical context of the formation of the Marines, they were starting in 1945 were at that time there was the Mariniers Corps at the main headquarters of the Republic of Indonesia's navy in Tegal (Irianto et al., 2014). The formation of the Marine Corps was then preceded by the existence of the Marine Operations Command Corps (KKO) where the Marines entered with an initial force of 7 Battalion. Furthermore, with the changes that occurred within the KKO, in 1950, the Marines stood alone and became the Marine Corps like in 1945 at the beginning of its establishment.

The Indonesian Marine Corps is currently quite large, with three divisions divided into three cities in Indonesia. The three divisions consist of Marine Forces 1 in Marunda, Jakarta, Marine Forces 2 in Sidoarjo, East Java, and Marines 3 in Sorong, West Papua. This sizeable strength is also supported by several units under it, such as the Marine Infatuation Brigade, Artillery, Amphibious Reconnaissance, and the elite Denjaka Troops. Thus, the Marines can be said to be the central amphibious unit owned by Indonesia.

In its history, the Marines have also been involved in various operations and events that have occurred in Indonesia. One of the most memorable ones is Operation Dwikora, which involved two

Marines (KKO) to carry out bombings in Singapore (Saefudin, 2018). Also, the Marines were also assigned to eradicate the DI / TII rebels led by Kartosuwiryo, known as the Mount Gede operation (Setiyono and Triyana, 2014). The footprint of the Marines is quite large, proving that the Marines are a reliable commando unit in national defense.

The great strength of the Marines was also driven by the designation of the Marines as Main Operations Command through Presidential Regulation Number 66 of 2019. This designation certainly had several impacts on the Marine Corps, especially in terms of the assignment and authority to the Marines in maintaining Indonesian sovereignty. As a Main Operations Command the Marines have the same level as several other units such as Kogabwilhan, Kodam, Kostrad, and Kopassus.

The Marines have their specialties compared to some of the other Main Operations Command. A characteristic of the Marines is that they can be deployed in amphibious operations and on the coast. These characteristics are supported by the abilities possessed by Marines and their alusista. Besides, in the past, the Marines have also received a special place as troops ready to be deployed in existing operations in swampy areas or beaches as well as amphibious landings.

As one of the Main Operations Command, the Marines are charged with several assignments including amphibious operations, coastal defense operations, and security operations for the outer islands, as well as other operations concerning OMP and OMSP according to the policies of the TNI Commander. Especially about coastal defense operations, so far this operation has been a cross-dimensional operation commanded by the main Navy Base. So that the Marines only act as one of the supporting elements in process. Likewise with Coastal Defense Commander, until now it is still held by the Assistant Operation of the Navy Main Base.

Main Operations Command has one further consequence for the Marines in terms of coastal defense operations. As a unit with the most capable capabilities in the amphibious field, the Marines should not only act as a support unit. This needs to be elaborated further, because in practice, currently, the coordinator of Coastal Defense Operations has not involved too many Marines. Thus, the role of the Marines both as Main Operations Command and as a unit that has the most capable capabilities in the field of Coastal Defense Operations has not been optimal.

2.2 Marines as Prime Mover of Coastal Defense Operations

Based on the determination as Main Operations Command and its capabilities, the Marines should not only be a support unit in coastal defense operations. The Marines should be further charged with being the leading sector in the coastal defense operation which so far has been mostly held by Lantamal. Making the Marines a leading sector will optimize the role of the Marines.

Based on several studies that have been done, several issues make the author believe in the research topic. Some of them are, (1) The Marines are a combat operations unit with primary qualifications (one of which) is coastal defense. (2) The role that is not too big in coastal defense operations in Indonesia. (3) The need for sizeable coastal defense personnel in Indonesia, and (4) the designation of the Marines as Main Operations Command.

Based on the enormous need for coastal defense, the consequences of Indonesia as an archipelago make this need more complex. Likewise, Indonesia's maritime defense strategy has not fully answered the need for coastal defense (Armados et al., 2017). Therefore an adequate solution is needed to answer this problem. In this context, pushing for the optimization of the Marines role would make sense.

One of the studies conducted by Farick et al. (2019) also proves that so far, the role of the Marines in carrying out operations is not optimal. Lack of personnel and capabilities have been a significant problem on coastal defense operations assignments. This is then exacerbated by the absence of a unit that focuses on developing coastal defense operations. Thus, coastal defense operations which are very crucial are less well developed.

Assigning the Marines to coordinate Coastal defense operations can be a quick step towards filling the shortage of coastal defense personnel. By becoming a coordinator of the Marines, they will be able to concentrate their strength to deploy coastal defenses. Also, the Marines will be better at providing an assessment of threats on the coast compared to other units because the Marines are a unit with this specialty.

On the other hand, the assignment of the Marines as prime mover of Coastal defense operation can later become an embodiment of one of the Marine's primary duties as Main Command of Development. Main Command of Development is an Operations Command whose task is to guide other units (Rohimat et al., 2020). The Marines who serve as supervisors in amphibious operations and coastal defense, it is only natural that the Marines also become coordinators at this level. It would be counterproductive if the Marines were not coordinating this field.

As Prime Mover of the coastal defense operation, Marine units can be upgraded in status and position on each Navy Main Base. Currently, the Marine units available at Navy Main Base are only in the Marine Defense Battalion Base (Yonmarhanlan) form, not too many. The only function as a unit to defend the base. This number is certainly not very significant and needs to be increased.

In this case, the authors argue that for each Lantamal region, a separate Marine brigade can be formed. This will be very productive because each Navy Main Base can have a particular unit that can carry out one Marine Unit Composite on Coastal defense operation independently and is ready in Indonesia's region. Besides, in their function of guidance, the Marines will also be better able to provide advice in units in the area. So that the Marines will be more effective in carrying out their functions as Main Operations Command and Main Command of Development. The formation of a separate brigade in each Navy Main Base can also welcome the plan to adjust the Navy Main Base, planned to be aligned with units at the Kodam level.

The solution of holding a Marine’s komposit unit in each Navy Main Base will also encourage the spread of Marines throughout Indonesia. This solution will increase the Marines' effectiveness as an Main Operations Command as well as its role if it can be approved as coordinator of coastal defense operations. This is very appropriate and will add to the posture of the TNI, especially the Navy, to be more ideal. Given that the current state of defense at sea is still not perfect, there is always an impression that the reason is based on land (Bakrie, 2007).

3. RESULT AND DISCUSSION

3.1 Coastal Defense Operations and Maritime Potential

One of the advantages that the Marines have in their units is the ownership of personnel who have sufficient territorial understanding. This is in line with the establishment of a new desk in the Navy, namely the Maritime Potential. The personnel in the Maritime Potential field are mostly include personel from the Marines, and it is characteristic that the Marines are the most flexible unit in developing territorial areas in the Navy.

This territorial advantage can make the Marines more effective in maintaining coastal defenses. Apart from the strength, personnel, and defense equipment they have, the marine personnel serving at Maritime Potential can also embrace the community to work together and participate in security on the coast. This is very effective because community involvement can enlarge and multiply the strength of the TNI wherever it is on duty. Apart from being a supporter in logistics and personnel, a well-developed community will be able to become the eyes and ears for the Army to anticipate threats that arise.

It is on this basis that the authors argue that the Marines will be more effective in becoming the prime mover of Coastal defense operation. Apart from the specialization of their abilities, the Marines can also foster coastal communities to participate in maintaining aspects of coastal defense. If this can be carried out well, the author believes that defense in the coastal area will be strong and will get support from the whole community.

4. CONCLUSION

Indonesia is a country with the second-longest coastline in the world. This fact makes Indonesia need an adequate and robust aspect of coastal defense. Unfortunately, so far the coastal defenses built in Coastal Defense Operations have not been well established.

Seeing the current conditions, the authors see the potential to make the Marines prime mover of Coastal defense operation. This aims to make Coastal defense operation as the backbone of coastal defense more optimal. The author based this view on several reasons including the designation of the Marines as Main Operations Command and Main Command of Development, the ability of Marines who are indeed trained to carry out Coastal defense operation, and the territorial capabilities of Marines in coastal areas which can be maximized if they become the coordinator of Coastal defense Operations.

Several proposals to be able to develop the Marines as an operations coordinator, among others. (1) Improve the position of the Marines in each Navy Main Base area by holding a Marine Unit Composite in each Navy Main Base's Area. (2) Deploy Marine units throughout Indonesia with coordination of permanent operations under Pasmar as Main Operations Command. If some of these suggestions can be followed up, the author believes that Indonesia will have capable strengths in Coastal Defense Operations.

ACKNOWLEDGEMENT

This research has been Supported by Indonesia Naval Technology College (STTAL).

REFERENCES

Atmaja, S. B., & Nugroho, D. (2016). Distribusi spasial upaya penangkapan kapal cantrang dan Permasalahannya di laut jawa. Jurnal Penelitian Perikanan Indonesia, 18(4), 233-241.

Antariksa, A. Y. (2018). Diplomasi Pertahanan Laut Indonesia dalam Konteks Pergeseran Geopolitik di Kawasan pada Masa Depan. Jurnal Pertahanan & Bela Negara, 4(2), 1-24.

Armandos, D., Yusnaldi, Y., & Purwanto, P. (2017). Implementasi Kebijakan Pertahanan Laut dalam Mendukung Keamanan Maritim di Pulau Nipa. Keamanan Maritim, 3(2).

Bastari, A., Toruan, T. S. L., & Suhirwan, S. (2018). Strategi Pemberdayaan Wilayah Pertahanan Laut Dalam Meningkatkan Kesadaran Bela Negara di Kabupaten Tangerang, Banten (Studi di Lantamal III/JKT). Strategi Perang Semesta, 4(3).

Bakrie, C. R. (2007). Pertahanan negara dan postur TNI ideal. Yayasan Obor Indonesia.

Farick, F., Salim, A., & Widodo, S. S. 2019. Optimalisasi Kemampuan Personel Batalyon A Dalam Melaksanakan Tugas Operasi Pertahanan Pantai X. JUPIIS: Jurnal Pendidikan Ilmu-Ilmu Sosial, 11(2), 428-437.

http://paradigmaindonesia.com/2019/04/10/danpuslatmar-kodiklatal-kuasai-mekanisme-proses-ppkm-pada-pelaksanaan-operasi-pertahanan-pantai/

Irianto, T., Pattinasarani., Budiman. 2014. ENSIKLOPEDIA KORPS MARINIR TNI AL : Selayang Pandang. Jakarta: Lentera Abadi.

Indrawan, J. (2018). Perubahan Paradigma Pertahanan Indonesia Dari Pertahanan Teritorial Menjadi Pertahanan Maritim: Sebuah Usulan. Jurnal Pertahanan & Bela Negara, 5(2), 93-114.

Marsetio, A. P. P. W. L. (2013). Dalam Mendukung Pembangunan Indonesia Sebagai Negara Maritim Yang Tangguh. UNY.

Muzakky, A. A. (2018). Pasang Surut Pasukan Elit Angkatan Laut: Dari KKO AL Menjadi Korps Marinir TNI Al, 1948–1975 (Doctoral dissertation, Universitas Airlangga).

Nasution A. 2009. Pengaruh Pengembangan Wilayah (Aspek Ekonomi Sosial Dan Budaya) Terhadap Pertahanan Negara Di Wilayah Pantai Timur Sumatera Utara. Jurnal Perencanaan dan Pengembangan Wilayah WAHANA HIJAU. 3 (4) : 117-130.

Prabowo, E. E. (2013). KEBIJAKAN DAN STRATEGI PERTAHANAN INDONESIA (Studi Kasus Konfl ik Di Laut Cina Selatan). Jurnal Ketahanan Nasional, 19(3), 118-129.

Putra, I. N., & Hakim, A. (2016). Analisa Peluang dan Ancaman Keamanan Maritim Indonesia sebagai Dampak Perkembangan Lingkungan Strategis. JOURNAL ASRO, 6, 1-22.

Rohimat, U., Mulyadi, R. A., & Ansori, A. (2020). Optimalisasi Pembinaan Mental Fungsi Komando Dalam Mendukung Pencegahan Paham Radikalimse Di Komando Lintas Laut Militer Jakarta. Strategi Pertahanan Laut, 6(2).

Saefudin, A. (2018). Usman Janatin dan Harun Tohir, Kisah Perjuangan Pahlawan Dwikora. Deepublish.

Setiyono, B., & Triyana, B. (2014). Revolusi Belum Selesai. Serambi Ilmu Semesta.

Wardhana, W. (2016). Poros Maritim: Dalam Kerangka Sejarah Maritim Dan Ekonomi Pertahanan. Jurnal Masyarakat dan Budaya, 18(3), 369-386.

Indonesian Naval Technology College, STTAL
Postgraduate International Conference, Vol. 4
ICMST 2020 September, 24th 2020

OPTIMIZATION WITH JACOBIAN APPROACH FOR DIVING MOTION OF ROV SYSTEM

Teguh Herlambang

Department of Information System, Faculty of Engineering, UNUSA, Indonesia
teguh@unusa.ac.id

ABSTRACT

Indonesia is a country with a large watery area of about two thirds of the country's total territory. Therefore, the country requires a multifunctional vehicle that can be utilized for a mitigation in river and a maritime defense system. One of the multifunctional vehicles is the Remote Operated Vehicle (ROV). In this paper the optimization of ROV system with Jacobian approach for ROV system is studied. With jacobian approach, linearization of nonlinear ROV system to analyze controllabity and observability without control system could be accomplished. Linear system for diving motion of ROV has a 3 DOF model, which are surge, heave, and pitch. Results of the optimization with Jacobian approach show that the ROV system is controllable and observable.

Keywords: *AUV, optimization, Jacobian, linear system, controllable, observable*

1. INTRODUCTION

More than 70% of Indonesian teritory comprises of seas, so it has a great potency which need to be looked after. Advanced technology is required to aid in managing the potential resources at sea. Remote Operated Vehicle (ROV) is one of the advanced technology necessary in this case, in particular to assist variours activities of underwater exploration in the deepsea. ROV is very useful for ocean observation since it require a tethered cable, and it can swim freely without restriction [1]. ROV can be used for underwater exploration, mapping, underwater defense system equipment, sensor off board submarines, inspection of underwater structures and natural resources, observing condition of the earth surface plates, and so on.

One important aspect that should be established in the design of ROV is the clarification on its observability and controllability, based on a mathematical model [2]. The mathematical model contains various hydrodynamic force and moment expressed collectively in terms of hydrodynamic coefficients [3]. ROV nonlinear system causes many uncertainties in the modeling, so requires linearization to obtain more viable results.

This paper presents a study to solve problems in optimization utilizing the Jacobian approach for ROV system. Optimization of ROV system is considered as the foundation with regards to navigation, control and guidance system in ROV.This study emphasized on basic development control, navigation and guidance of ROV.

2. REMOTED OPERATED VEHICLE (ROV) MODEL

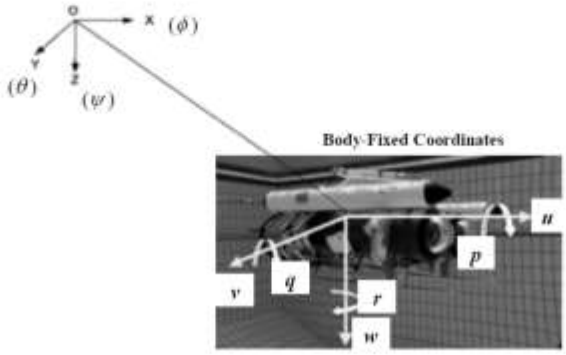


Figure 1. 6 DOF in ROV motions [7]

Two important things need to be first recognized on the Remote Operated Vehicle (ROV), that is the Earth Fixed Frame (EFF) and the Body Fixed Frame (BFF) [4]. EFF is used to describe the position and orientation of the ROV with the position of the *x*-axis direct to the north, the *y*-axis to the east and the *z*-axis toward the center of the earth.While BFF is used to describe the speed and acceleration of the ROV with the starting point at the center of gravity, *x*-axis direct to the ship bow, positive *y*-axis direct to the right hand side of the ship and positive *z*-axis direct downward [5,6].

As shown in Figure 1 and Table 1, an AUV or ROV has 6 DOF mode of motions, where 3 DOF for translational motion and 3 DOF for rotational motion in with regards to*x*, *y* and *z* axis. In the dynamics problem, motion of the ROV is influenced byexternal forcesas follows [8]:

$$\tau = \tau_{hidrostatis} + \tau_{addedmass} + \tau_{drag} + \tau_{lift} + \tau_{control}$$

Table 1. Notation of ROV Motion Axis [4,8]

DOF	Translational And Rotational	Force / Moment	Linear and Anguler Velocity	Potition /Angle Euler
1	Surge	*X*	*U*	*x*
2	Sway	*Y*	*V*	*y*
3	Heave	*Z*	*W*	*z*
4	Roll	*K*	*P*	ϕ
5	Pitch	*M*	*Q*	*θ*
6	Yaw	*N*	*R*	Ψ

General equation of ROV motions in 6 DOF consists of 3 first equation for translational motion and 3 second equation for rotational motions, as described in the following.

$\eta = [\eta_1^T, \eta_2^T]^T$, $\eta_1 = [x, y, z]^T$, $\eta_2 = [\emptyset, \theta, \Psi]^T$;
$v = [v_1^T, v_2^T]^T$, $v_1 = [u, v, w]^T$, $v_2 = [p, q, r]^T$;
$\tau = [\tau_1^T, \tau_2^T]^T$, $\tau_1 = [X, Y, Z]^T$, $\tau_2 = [K, M, N]^T$;

Where ***η*** vector is the position and orientation of the EFF, ***v*** vector velocity of linear and angular of the BFF, the position and orientation of the BFF, and τ description of force and moment in ROV of the BFF.
By combining equations hydrostatic force, lift added mass, drag, thrust and assuming a diagonal tensor of inertia (I_o) is zero then the total forces and moments of models obtained from the following [4,9]. This paper is using equation of motion in the form of three Degree of Freedom (3-DOF), those are surge, heave and pitch. General equation of motion in 3-DOF ROV consists of surge, heave and pitch motion as follows:

Surge : $\dot{u} = \frac{X_{res} + X_{|u|u}u|u| + +X_{wq}wq + X_{qq}qq + X_{prop} - m[wq - x_G(q^2) + z_G(\dot{q})]}{m - X_{\dot{u}}}$

Heave :

$$\dot{w} = \frac{Z_{res} + Z_{|w|w}w|w| + Z_{q|q|}q|q| + Z_{\dot{q}}\dot{q} + Z_{uq}uq + Z_{uw}uw + Z_{uu\delta_s}u^2\delta_s - m[-uq - z_G(q^2) + x_G(-\dot{q})]}{m - Z_{\dot{w}}}$$

Pitch:

$$\dot{q} = \frac{M_{res} + M_{w|w|}w|w| + M_{q|q|}q|q| + M_{\dot{w}}\dot{w} + M_{uq}uq + M_{uw}uw + M_{uu\delta_s}u^2\delta_s - (m[z_G(\dot{u} + wq) - x_G(\dot{w} - uq)])}{I_y - M_{\dot{q}}}$$

This type of ROV, shown in Table 2, using only single propeller on the tail ROV which will produces x_{prop} and additional moments K_{prop}. External forces and moments acting on the ROV are the hydrostatic force, thrust and hydrodynamic force and where every object in the water will have a hydrostatic force consisting of gravity and buoyancy forces. While hydrodynamic component consists of added mass, drag and lift. Thrust use fin to control the balance of the ship which require a constant rate. ROV specifications include, among others, weight of 20 kg, length of 2 m, and a diameter of 30 cm

In this paper the nonlinear system of ROV model can be linearized with Jacobian approach where the nonlinear ROV system in general as follows :

$$\dot{x}(t) = f(x(t), u(t), t)$$
$$y(t) = g(x(t), u(t), t) \qquad (9)$$

Sothe Jacobian matrix is formed as follows [2]:

$$\frac{\partial f(\bar{x},\bar{u},t)}{\partial x} = \begin{bmatrix} \frac{\partial f_1(\bar{x},\bar{u},t)}{\partial x_1} & \frac{\partial f_1(\bar{x},\bar{u},t)}{\partial x_2} & \cdots & \frac{\partial f_1(\bar{x},\bar{u},t)}{\partial x_n} \\ \frac{\partial f_2(\bar{x},\bar{u},t)}{\partial x_1} & \frac{\partial f_2(\bar{x},\bar{u},t)}{\partial x_2} & \cdots & \frac{\partial f_2(\bar{x},\bar{u},t)}{\partial x_n} \\ \vdots & \vdots & \vdots & \vdots \\ \frac{\partial f_n(\bar{x},\bar{u},t)}{\partial x_1} & \frac{\partial f_n(\bar{x},\bar{u},t)}{\partial x_2} & \cdots & \frac{\partial f_n(\bar{x},\bar{u},t)}{\partial x_n} \end{bmatrix} \qquad (10)$$

So equation 3 - 8 can be expressed as follows:

$$\begin{bmatrix} m - X_{\dot{u}} & 0 & mz_G \\ 0 & m - Z_{\dot{w}} & mx_G + Z_{\dot{q}} \\ mz_G & mx_G - M_{\dot{w}} & I_y - M_{\dot{q}} \end{bmatrix} \begin{bmatrix} \dot{u} \\ \dot{w} \\ \dot{q} \end{bmatrix}$$
$$= \begin{bmatrix} X_{res} + X_{|u|u}u|u| + +X_{wq}wq + X_{qq}qq + X_{prop} - m[wq - x_G(q^2)] \\ Z_{res} + Z_{|w|w}w|w| + Z_{q|q|}q|q| + Z_{uq}uq + Z_{uw}uw + Z_{uu\delta_s}u^2\delta_s - m[-uq - z_G(q^2)] \\ M_{res} + M_{w|w|}w|w| + M_{q|q|}q|q| + M_{uq}uq + M_{uw}uw + M_{uu\delta_s}u^2\delta_s - (m[z_G(wq) - x_G(-uq)]) \end{bmatrix}$$

Furthermore linear system is obtained as follows :

$$\dot{x}(t) = A\,x(t) + Bu(t)$$
$$y(t) = Cx(t) + Du(t) \qquad (17)$$

$$A = \begin{bmatrix} \frac{Z_1}{Z} & \frac{Z_2}{Z} & \frac{Z_3}{Z} \\ \frac{Z_4}{Z} & \frac{Z_5}{Z} & \frac{Z_6}{Z} \\ \frac{Z_3}{Z} & \frac{Z_7}{Z} & \frac{Z_8}{Z} \end{bmatrix} \begin{bmatrix} 2uX_{|u|u} & q(X_{wq} - m) & 2qX_{qq} + wX_{wq} - mw + 2qmx_G \\ qZ_{uq} & 2wZ_{|w|w} + uZ_{uw} & 2qZ_{q|q|} + uZ_{uq} + mu + 2qmz_G \\ qM_{uq} + wM_{uw} + 2uM_{uu\delta_s}\delta_s & 2wM_{w|w|} + uM_{uw} - qmz_G & 2qM_{q|q|} + uM_{uq} - mwz_G - mux_G \end{bmatrix} (18)$$

with $Z = CB^2 - ACF + ADE$
$Z_1 = -(CF - DE)$, $Z_2 = -BE$ $Z_3 = BC$, $Z_4 = -BD$, $Z_5 = B^2 - AF$, $Z_6 = AD$, $Z_7 = AE$, $Z_8 = -AC$ dan $A = m - X_{\dot{u}}$, $B = mz_G,\ C = m - Z_{\dot{w}},\ D = mx_G + Z_{\dot{q}},\ E = mx_G - M_{\dot{w}},\ F = I_y - M_{\dot{q}}$

with

$$B = \begin{bmatrix} \frac{Z_1}{Z} & \frac{Z_2}{Z} & \frac{Z_3}{Z} \\ \frac{Z_4}{Z} & \frac{Z_5}{Z} & \frac{Z_6}{Z} \\ \frac{Z_3}{Z} & \frac{Z_7}{Z} & \frac{Z_8}{Z} \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & Z_{uu\delta_s}u^2 & 0 \\ 0 & 0 & M_{uu\delta_s}u^2 \end{bmatrix} \qquad (19)$$

$$C = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \text{ and } D = 0 \qquad (20)$$

3. CONTROLLABILITY AND OBSERVABILITY

Linear system in Equation 18 is said controllable if Matriks : $Ctr = (B|AB|A^2B|\ldots|A^{n-1}B)$ have the *n* rank. Observable if matriks

$Obsv = \begin{pmatrix} C \\ CA \\ CA^2 \\ \vdots \\ CA^{(n-1)} \end{pmatrix}$ have the *n* rank [5].

In equation 19 and 20 obtained controllabity and observability matrix as follows $Ctr = (B|AB|A^2B) = 3$ and

$Obsv = \begin{pmatrix} C \\ CA \\ CA^2 \end{pmatrix}$=3

So linier system of ROV with Jacobian approach is found to be controllable and observable.

4. CONCLUSION

Based on the analysis of Jacobian, controllability and observability ROV system is confirmed. It is also found that linearization of nonlinear ROV system can produce controllable and observable linear ROV system.

REFERENCES

Kondo, H. and Ura, T. (2003), Navigation of an AUV for Investigation of Underwater Structures, . *Elsevier Journal of Control Enginerring Practice.*

Yoerger, D.R. and Slotine, J.J.E. (1985), Robust Trajectory Control of Underwater Vehicle,*IEEE Journal of Ocean Engineering*, 10 (4).

Kim, K.H. and Choi, H.S. (2006), Analysis on the Controlled Nonlinear Motion of Test Bed AUV-SNUUV I, *Elsevier Journal of Ocean EngINerring*

Nurhadi, H., Subchan, and Gustiyadi, F.R. (2012), Design of Position Estimation Algorithm of Navigation and Trajectory System for Unmanned Underwater Vehicle ITS AUV-01 using Ensemble Kalman Filter (EnKF) Method, *Proc. of the 13th Seminar on Intelligent Technology and Its Applications*, SITIA 2012, Surabaya, May.

Perez, T., Smogeli, O.N., Fossen, T.I and Sorensen, A.J. (2005), An Overview of Marine Systems Simulator (MSS): A Simulink Toolbox for Marine Control System,*Proc. of Scandanavian Conference on Simulation and Modelling*, SIMS2005.

Fossen, T.I.(2005), A Nonlinear Unified State-Space Model for Ship Maneuvering and Control in A Seaway, *Journal of Bifurcation and Chaos.*

C, Chin, M.W.S, E. Lan, E and G.G.L, Seet, 2006, “Software for Modelling and Simulation of a Remotely-Operated Vehicle (ROV)”, International Journal Simlation Model Vol 5 no 3, pp114-125.

T.Herlambang, E.B.Djatmiko, and H.Nurhadi “Ensemble Kalman Filter with a Square Root Scheme (EnKF-SR) for Trajectory Estimation of AUV SEGOROGENI ITS”, *International Review of Mechanical Engineering* IREME Journal, Vol. 9, No. 6. Pp. 553-560, ISSN 1970 – 8734. *Nov.* (2015.

T.Herlambang, E.B.Djatmiko, and H.Nurhadi, “Navigation and Guidance Control System of AUV with Trajectory Estimation of Linear Modelling”, *Proc. of International Conference on Advance Mechatronics, Intelligent Manufactre, and Industrial Automation,* IEEE , ICAMIMIA 2015, Surabaya, Indonesia, pp. 184-187, Oct 15 – 17. (2015)

FIELD II

LOGISTIC MANAGEMENT

ANALYSIS OF THE RELIABILITY OF THE BUILDING SAFETY SYSTEM IN KI HADJAR DEWANTARA KODIKLATAL BUILDING ON FIRE HAZARDS PREVENTION

Dodiek Alfianzi[1], Avando Bastari[2], Okol Sri Suharyo[3]

[1,2,3]Indonesian Naval Technology College
Bumimoro Morokrembangan Surabaya 60178 Indonesia
e-mail: alhfianzi@gmail.com

ABSTRACT

This study aims to determine the reliability value of the fire system and the safety of the KI Hadjar Dewantara building in the case of a fire. This research questionnaire was conducted twice. The Analytical Hierarchy Process (AHP) method will be applied to the first questionnaire to obtain the weighting of the fire variables which includes site completeness, rescue facilities, passive protection systems, and active protection systems. The second questionnaire used the check-list method based on the Minister of Public Works Regulation Number 26 of 2008 to determine the reliability value of the building in the event of a fire. The results for the reliability value of the Ki Hadjar Dewantara building from Mako Kodiklatal using the AHP method and the check-list respectively are as follows: 91.93% and 91.45%. So, it can be concluded that the building security system in case of a fire is in “Good” condition.

Keywords: *Fire, Reliability, AHP*

1. INTRODUCTION

Building in a building is a physical form of construction work that is integrated with its position, partly or wholly which functions as a residence or residence and other activities. (Permen PU No.26 of 2008). The need for open or closed space is needed to carry out all activities, along with organizational development. The development of the building requires developers and building owners to consider safety aspects, one of which is fire safety. Fire incidents have occurred in buildings owned by the Indonesian Navy, the last incident in 2020 there was a fire at the Headquarters building. Research on the building reliability system in the Indonesian Navy for preventing fire hazards has never been carried out to date. The Indonesian Navy has many buildings that have stood on average for more than 10 years, from several buildings in the Indonesian Navy, including the building at the Indonesian Navy Educational Institute in the Surabaya area, namely the building at Ki Hadjar Dewantara Command of the Doctrine and Training of the Indonesian Navy (Kodiklatal), where many main officials have offices in the building. In the building there are also many military activities in terms of administration and important items or archives, this is the basis for researching fires to ensure safety and disaster prevention for the building itself and its contents. (Permen PU No.26 of 2008).

In multi-story buildings there is a high risk of fire hazards, therefore a reliable fire protection system is needed. A reliable fire protection system is a means of preventing fire. For fire prevention, Ki Hadjar Dewantara Mako Kodiklatal Building, the building is equipped with a reliable fire protection system.

To find out the existing protection system in the Ki Hadjar Dewantara Mako Kodiklatal Building, further research is needed. This research refers to the "Regulation of the Minister of Public Works Number 26 of 2008"

The objectives of this study include:

a. Analyzing the reliability of the building at Ki Hadjar Dewantara Mako Kodiklatal Building using the Analytical Hierarchical Process (AHP) method.

b. Reviewing the suitability of the fire protection system at the Ki Hadjar Dewantara Mako Kodiklatal Building with the "Minister of Public Works Regulation Number 26 of 2008" as a guide in conducting this research.

2. MATERIAL AND METHODS

2.1 Definition of Fire

The definition of a fire according to the Department of Manpower (Depnaker) is a rapid exothermic oxidation reaction of a fuel accompanied by the onset of fire or ignition.

2.2 Understanding The Analytical Hierarchy Process (AHP) Method

Analytical Hierarchy Process (AHP) is a decision support method developed by a mathematics professor at the University of Pittsburgh, Thomas L. Saaty. AHP is a method for making a sequence of alternative decisions and selecting the best alternative when deciding with several objectives or criteria for making certain decisions.

AHP method completion stages

a. Analyze the problem and determine the solution as desired.

b. Creating a hierarchical structure of AHP that begins with a general-purpose, then continues with criteria and is finalize with alternatives.

c. Form a pairwise comparison matrix. The paired matrix filling is obtained from the results of the questionnaire to the respondents. An example of a pairwise comparison matrix can be seen in Table 1

Table 1 Pairwise Comparison Matrix

Elemen	A1	A2	A3	A4
A1	A_{11}	A_{12}	A_{13}	A_{14}
A2	A_{21}	A_{22}	A_{23}	A_{24}
A3	A_{31}	A_{32}	A_{33}	A_{34}
A4	A_{41}	A_{42}	A_{43}	A_{44}
Total	ΣA_1	ΣA_2	ΣA_3	ΣA_4

(source: Saaty, 1990)

The matrix elements are obtained by comparing one element to another. A11 is a comparison between element A1 and element A1. A12 is a comparison between element A1 and element A2.

d. Calculate the eigenvector value of each matrix pair. The vector's eigenvalues are the weight of each element. The steps to get the eigenvector value are as follows:

1) Multiply the elements of the matrix in one row and be rooted in the power of n like the formula below:

$$Wi = \sqrt[n]{a11 \times a12 \times \dots\dots\dots a1n}$$

2) Calculate priority vector or eigenvector

$$Xi = \frac{wi}{\Sigma wi}$$

e. Then perform the weighted sum vector obtained from the multiplication between the original matrix and the normalized eigenvector.

1) Test the consistency vector (CV) by dividing the weighted sum vector with normalized vector values.

2) Calculate the value which is the average value of the consistency vector.

3) To test the consistency of the hierarchy, the terms of the comparison matrix are acceptable if the CR value is <0.1. The CR value is obtained from the equation:

$$CR = \frac{CI}{RI}$$

$$CI = \frac{(\lambda\, maks - n)}{(n-1)}$$

With:

CR = consistency ratio

CI = consistency index

λmaks = the largest eigenvalue of the matrix

RI = eigenvalues in the matrix order

The RI value depends on the matrix order, the RI value can be seen in Table 2

Table 2. RI Value

Ordo (n)	1	2	3	4	5	6	7	8
Nilai RI	0,00	0,00	0,58	0,90	1,12	1,24	1,32	1,41
Ordo (n)	9	10	11	12	13	14	15	
Nilai RI	1,45	1,49	1,51	1,48	1,56	1,57	1,59	

4) Repeat steps number 3, number 4, number 5, and number 6 for all levels of the hierarchy.

Value of Reliability Level

Table 3 Criteria for assessing the reliability of a fire protection system

Value	Suitability	Reliability
80% < B ≤ 100%	according to requirements	Good
60 % < C ≤ 80%	It is attached but there is a small proportion of agencies that do not meet the requirements	Fair
K ≤ 60%	It doesn't fit at all	Poor

(Source: Research and Development Center for Housing, Ministry of Public Works, building fire safety inspection, 2005)

Fire Protection System

The fire protection system in buildings is a system that consists of equipment, equipment, and facilities, both installed and constructed in buildings that are used both for active protection systems, passive protection systems, and management methods to protect the building and its environment against fire hazards

a. Completeness of the site

Site completeness components include water sources, environmental roads, distances between buildings and yard hydrants

b. Means of rescue

Fire rescue means include egress and egress construction.

c. Passive Protection System

The Passive protection system covers levels of fire resistance of building structures, compartmentalization of spaces, and protection of openings.

d. Active protection system

The Active protection system includes detection of fire alarms both manual and automatic, water-based fire extinguishing systems such as sprinklers, standpipes, and fire hoses, and chemical-based fire extinguishing systems, such as fire extinguishers and the occurrence of fires (Permen PU No.26 of 2008).

e. The Weighting of KSKB components (reliability of the building safety system)

Table 4 Weighting of Protection Parameters Building fire

No.	Component	Weight
1.	Completeness of Site	25
2.	Rescue Facility	25
3.	Passive Protection	26
4.	Active Protection	24

(Source: Research and Development Center for Housing, Ministry of Public Works, building fire safety inspection, 2005)

3. RESEARCH METHODOLOGY

This research was conducted at Ki Hadjar Dewantara Building, Kodiklatal Bumimoro Krembangan, Surabaya.

4. RESULTS AND DISCUSSION

4.1 Analysis of Building Safety System Component Assessment (KSKB)

Assessment of Building Safety System Components (KSKB) against fire hazards in the Ki Hadjar Dewantara Kodiklatal building was carried out using 2 methods, namely, the Analytical Hierarchy Process (AHP) method and the checklist method based on Regulation of the Minister of Public Works No. 26 of 2008. The components of a fire protection system in buildings: site equipment, rescue facilities, passive protection systems, and active protection systems.

4.2 Analysis of Research Results Based on Technical Guidelines for Building Fire Safety Inspection Using the Analytical Hierarchy Process (AHP) Method

Establish a hierarchy of protection systems fire in buildings.

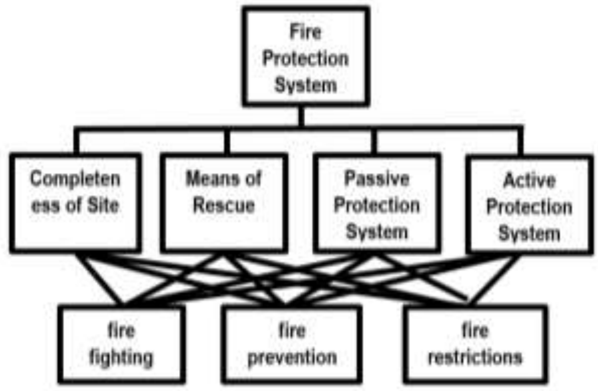


Figure 1. The Hierarchical arrangement of fire protection systems in buildings

The next step is, each the fire protection system carried out a comparative assessment for each of the criteria, with the following ratings:

a. Calculation of weight regarding fire prevention by comparing each component, with a comparative assessment as follows:

1) Completeness of site: means of rescue = 3: 1 means that completeness of site is slightly more important in supporting fire prevention than means of rescue.

2) Site completeness: passive protection system = 1: 1 means that site completeness is as important as a passive protection system in supporting fire prevention.

3) Completeness of the site: active protection system = 3: 1 means that the completeness of the site is a little more important in supporting fire prevention rather than active protection systems.

4) Rescue means passive protection system = 3: 1 means that the means of rescue are slightly more important in supporting fire prevention than passive protection systems.

5) Means of rescue: active protection system = 5: 1 means that the means of rescue are more important in supporting fire prevention than an active protection system.

6) Passive protection systems: active protection systems = 3: 1 means that passive protection systems are slightly more important in supporting prevention fire rather than active protection systems.

The paired comparison component with the reference for fire prevention is then assessed in the form of a matrix as follows:

Table 5. Comparison components paired with reference fire prevention

	Completeness of Site	Means of Rescue	Passive Protection System	Active Protection System
Completeness of Site	1	3	1	3
Means of Rescue	1/3	1	1	5
Passive Protection System	1	1	1	3
Active Protection System	1/3	1/5	1/3	1

b. Calculate the weight of each matrix pair. The steps for getting weighted are as follows:

1) Calculate the eigenvalues of the vector by multiplying the elements of the matrix in one row and the power of n as the formula below:

$$Wi = \sqrt[n]{a11 \times a12 \times \ldots\ldots\ldots\ldots a1n}$$

Site Completeness System	$Wi = \sqrt[4]{1x3x1x3}$	$= 1{,}732$
Rescue Facility System	$Wi = \sqrt[4]{1/3x1x1x5}$	$= 1{,}136$
Passive Protection System	$Wi = \sqrt[4]{1x1x1x3}$	$= 1{,}316$
Active Protection System	$Wi = \sqrt[4]{(1/3x1x\ 1/3\ x1)}$	$= 0{,}386$
	Total	$= 4{,}547$

2) Calculate normalized eigenvector for each component, with the following formula:

$$Xi = \frac{wi}{\Sigma wi}$$

The Weight of The Site Completeness System	$X_1 = 1{,}732/4{,}547 = 0{,}379$
The Weight of The Rescue Facility System	$X_2 = 1{,}136/4{,}547 = 0{,}249$
The Weight of The Passive Protection System	$X_3 = 1{,}316/4{,}547 = 0{,}288$
The Weight of The Active Protection System	$X_4 = 0{,}386/4{,}547 = 0{,}084$

3) Then perform the weighted sum vector which is obtained from the multiplication between the original matrix and the normalized eigenvector.

$$\begin{vmatrix} 1 & 3 & 1 & 3 \\ 1/3 & 1 & 1 & 5 \\ 1 & 1 & 1 & 3 \\ 1/3 & 1/5 & 1/3 & 1 \end{vmatrix} \times \begin{vmatrix} 0{,}379 \\ 0{,}249 \\ 0{,}288 \\ 0{,}084 \end{vmatrix} = \begin{vmatrix} 1{,}666 \\ 1{,}085 \\ 1{,}169 \\ 0{,}357 \end{vmatrix}$$

Thus, the value of the weighted sum vector is obtained that is:

- Completeness system weight = 1.666 footprint
- The weight of the facility system = 1.085 rescue
- Passive protection system weight = 1.169
- The weight of the active protection system = 0.357

4) Test the consistency vector (CV) by dividing the weighted sum vector with normalized vector values

The Weight of The Site Completeness System	CV = 1,666/0,379 = 4,397
The Weight of The Rescue Facility System	CV = 1,085/0,249 = 4,365
The Weight of The Passive Protection System	CV = 1,169/0,288 = 4,060
The Weight of The Active Protection System	CV = 0,357/4,547 = 4,220

5) Calculate the value which is the average value of the consistency vector.

$$\lambda\, maks = \frac{(4{,}397 + 4{,}365 + 4{,}060 + 4{,}220)}{4} = \frac{17{,}042}{4} = 4{,}260$$

6) Calculate the value of the consistency index (CI) with equations

$$CI = \frac{(\lambda\, maks - n)}{(n-1)}$$

$$CI = \frac{(\lambda\, maks - n)}{(n-1)} = \frac{(4{,}260 - 4)}{(4-1)} = 0{,}087$$

7) Testing the consistency ratio (CR) value, the random index value (RI) for the matrix order of 4 was 0.90 from Table 2.4. The value of the consistency ratio (CR) can be accepted if the value is less than 0.1. The value of the consistency ratio (CR) can be calculated using the formula

$$CR = \frac{CI}{RI}$$

$$CR = \frac{0{,}087}{0{,}90} = 0$$

The value of the consistency ratio (CR) was obtained 0.096 is smaller than 0.1, the value is consistent and acceptable

8) Repeat the above steps for all criteria thus, the weighting of the fire variables can be seen in Table 6

Table 6. Weighting of fire variables for Ki Hadjar Dewantara Kodiklatal building using the AHP method

No	Component	The Weight (%)
1	Site Completeness	41
2	Rescue Facility	23
3	Passive Protection	21
4	Active Protection	15
TOTAL		100

(**Source**: the result of data processing, 2020)

4.3 Calculation of the Reliability Value of the Building Safety System (NKSKB) Against Fire Hazard Using the Analytical Hierarchy Process (AHP) Method

a. Completeness of Site

Table 7. Results of the completeness of site calculation

No	SUB KSKB	Assessment Notation	Investigative Value (%)	The Weight (%)	Assesment Condition (%)
I.	Completeness Of Site				
1	Water Sources	B	100	41	41
2	Road Neighborhood	B	100	41	41
3	Distance Between Buildings	C	70	41	29
4	Hydrant Page	B	100	41	41
Avarage					38

b. Rescue facility

Table 8. The Result of rescue facility calculation

No	SUB KSKB	Assessment Notation	Investigative Value (%)	The Weight (%)	Assesment Condition (%)
I.	Passive Protection				
1	Exit	B	90	23	21
2	Road Construction	B	100	23	23
	Avarage				22

c. Passive protection system

Table 9. The Result of Passive Protection System Calculation

No	SUB KSKB	Assessment Notation	Investigative Value (%)	The Weight (%)	Assesment Condition (%)
I.	Passive Protection				
1	Fire Resistance of Building Structure	B	100	21	21
2	Compartementalization of Space	C	100	21	21.06
3	Protections of Opening	B	88.99	21	18.72
	Avarage				20.28

d. Active Protection System

Table 10. The Result of Active Protection System Calculation

No	SUB KSKB	Assessment Notation	Investigative Value (%)	The Weight (%)	Assesment Condition (%)
I.	Active Protection				
1	Fire Alarm Detector	B	100	15	15
2	Siamese Connection	B	100	15	15
3	Light Fire extinguisher	B	100	15	15
4	Hidran	B	100	15	15
5	Sprinkler	B	83.33	15	12.26
6	Smoke Control	K	50	15	7.4
7	Smoke Detection	C	75	15	11
8	Smoke Disposal	C	62.5	15	9.2
9	Fire Elevator	K	0	15	0
10	Emergency light	C	80	15	12
11	Emergency electricity	B	100	15	15
12	Space control operation	B	100	15	15
	Avarage				11.66

(Source: The Result of Data Processing)

4.4 Calculation of the Reliability Value of the Building Safety System (NKSKB) Against Fire Hazard Based on Regulation of the Minister of Public Works Number 26 Years 2008 (Checklist Method)

a. Completeness of Site

Table 11. The Result of the Completeness of Site

No	SUB KSKB	Assessment Notation	Investigative Value (%)	The Weight (%)	Assesment Condition (%)
I.	Completeness of Site			25	
1	Water Sources	B	100	27	6.75
2	Road Neighborhood	B	100	25	6.25
3	Distance Between Buldings	C	70	23	4.03
4	Hydrant Page	B	100	25	6.25
	TOTAL				23.28

(Source: The Result of Data Processing)

b. Rescue facility

Table 12. The Result of the Rescue Facility

No	SUB KSKB	Assessment Notation	Investigative Value (%)	The Weight (%)	Assesment Condition (%)
II	Rescue Facility			25	
1	Exit road	B	90	52	11.7
2	Road Construction	B	100	48	12
	TOTAL				23.7

(Source: The Result of Data Processing)

c. Passive Protection System

Table 13. The Result of the the Passive Protection System

No	SUB KSKB	Assessment Notation	Investigative Value (%)	The Weight (%)	Assesment Condition (%)
III.	Passive Protection System			26	
1	Fire Resistance of Bulding Structures	B	100	36	9.36
2	Compatementalization of Space	B	100	32	8.32
3	Protections of Opening	B	88.99	32	7.40
	TOTAL				25.08

(Source: The Result of Data Processing)

d. Result of the the Active Protection System

Table 14. The Result of the the Active Protection System

No	SUB KSKB	Assessment Notation	Investigative Value (%)	The Weight (%)	Assesment Condition (%)
IV	Active Protection				
1	Fire Alarm Detector	B	100	9	2.16
2	Siamese Connection	B	100	8	1.92
3	Light Fire extinguisher	B	100	9	2.16
4	Hidran	B	100	9	2.16
5	Sprinkler	B	83.33	9	1.80
6	Smoke Control	K	50	8	0.96
7	Smoke Detection	C	75	9	1.62
8	Smoke Disposal	C	62.5	7	1.05
9	Fire Elevator	K	0	7	0
10	Emergency light	C	80	9	1.728
11	Emergency electricity	B	100	8	1.92
12	Space control operation	B	100	8	1.92
	TOTAL				19.40

(Source: The Result of Data Processing)

4.5 Comparison between the Reliability Value of the Building Safety System (NKSKB) Against Fire Hazards Using the Analytical Hierarchical Process (AHP) Method based on the Minister of Public Works Regulation Number 26 of 2008 (Checklist Method)

Table 15. The recapitulation results of the NKSKB calculation for the KI Hadjar Dewantara Kodiklatal building use the AHP method

No	Component	The Weight (%)	The Rating Result (%)
1	Site Completeness	41	38
2	Rescue Facility	23	22
3	Passive Protection	21	20.28
4	Active Protection	15	11.66
TOTAL		100	91.94

(Source: The Result of Data Processing)

Table 16. Results of the recapitulation of the NKSKB calculation results for the KI Hadjar Dewantara Kodiklatal building using the checklist method

No	Component	The Weight (%)	The Rating Result
1	Site Completeness	25	23.28
2	Rescue Facility	25	23.7
3	Passive Protection	26	25.08
4	Active Protection	24	19.40
TOTAL		100	91.46

(Source: The Result of Data Processing)

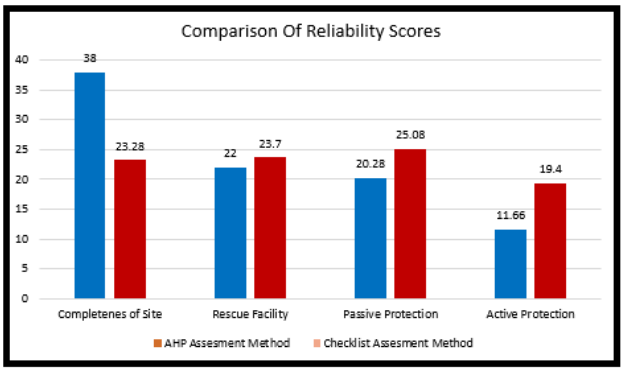


Figure 2. Comparison of the NKSKB reliability value of the KI Hadjar Dewantara Kodiklatal building (Source: 2020 data processing results)

Based on the calculations and system above, it is known that there is a difference between the assessment using the Analytical Hierarchy Process (AHP) and using the checklist method. The assessment using the Analytical Hierarchy Process (AHP) obtained a value of 91.93%, while the assessment used the checklist method obtained a value of 91.45%. From the two methods used there is a difference of 0.48%. From the assessment of the reliability of the Ki Hadjar Dewantara Kodiklatal building using both methods, the reliability value was obtained in good condition.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

The conclusions of this research are as follows:

a. Equipment for fire protection system in Ki Hadjar Dewantara Kodiklatal building in "good" condition.

b. The fire protection system in the building is almost complete, only there is no fire lift.

c. Based on the calculations made, the reliability value of the Building Safety System (NKSKB) against fire hazards in the Ki Hadjar Dewantara Kodiklatal Surabaya building was obtained using the AHP method, the value was 91.93%, while the assessment using the checklist method obtained a value of 91.45%. From the two methods used there is a difference of 0.48%. Based on this NKSKB, the fire protection system in this building is classified as reliable.

d. Core The technical recommendations given to the results of this research are periodic maintenance and repair of any existing fire protection facilities, repair of damaged elements, and addition of fire protection elements that are not yet available.

5.2 Suggestion

The suggestions of this research are as follows:

a. Filling the questionnaire using the AHP method must be done carefully. Filling the questionnaire with the AHP method should be done to those who are experts in their fields with a sufficient number of questionnaires so that the results are more accurate.

b. The "checklist form" that is used is quite effective in checking the fire protection system in the Ki Hadjar Dewantara Kodiklatal Surabaya building

c. It is hoped that the building manager will maintain an active protection system and complement the missing protection system, so that fire risk awareness can run well.

d. To achieve the "GOOD" criteria for buildings in the Indonesian Navy in the Surabaya region in particular and in Indonesia, in general, requires synergy between the government, in this case, the Fire Service and the Indonesian Navy as evidenced by professionalism in implementing regulations regarding the system. building safety against fire hazards.

ACKNOWLEDGEMENTS

The authors greatly acknowledge the support from Indonesian Naval Insitute of Technologyand Indonesian Navy Institution for providing necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

REFERENCES

Blogspot.co.id/2013/02/pengentuk-analitycal-hierarchy-process.html, accessed on 28 September 2017, 14.00 WIB.

Donnya, 2013. Fire extinguisher. http: //www. fire extinguishing tool. co / smoke-detector /, accessed at 1September 2017, at 08.00 WIB.

Https://WorkSafetySystem.blogspot.co.id/2015/08/system designer basics.html, accessed on September 1, 2017, at 08.30WIB.

Http://semiberbagi.blogspot.com/2016/03/penjelas-complete-ahp-analytical.html, accessed on 28 September 2017, 14.00 WIB.

Iskandar, 2016. Smoke detection. https://patigeni.com/fungsi-pendeksi- asap /. accessed on September 1, 2017, at 11.00 WIB.

Decree of the Minister of Public Works. (2000). No.10 / KTSP / 2000 Technical Provisions for Safeguarding Against Fire Hazards in Buildings and the Environment.

Nono purnomo, 2015. The working principle of hydrants. https://patigeni.com/princip-kerja-hydrant-system, accessed at 1September 2017, 10:00 WIB.

Nurul amalia humaira, 2017. Fire protection system. Https://infomigas.org/sistem- fire-protection-active-and-passive /, accessed on September 1 2017, at 08.30 WIB.

Regulation of the Minister of Public Works. (2008). No.26 / PRT / 2008 Technical Requirements for Fire Protection Systems in Buildings and the Environment.

Rangga Pratama, 2017. Reliability Analysis of Building Safety Systems Against Fire Hazards (Case study: Eria Bunda Mother and Child Hospital Building, Pekanbaru City). Undergraduate Thesis, Faculty of Engineering, Riau University.

Saberindo pacific, 2017. The theory of the fire triangle. http://saberindo.co.id/teori-segektronik- api /. Accessed on 1 December 2017, 14.35 WIB

SNI 03-1735-2000, Planning Procedures for Building Access and Environmental Access for Prevention of Fire Hazards in Buildings.

SNI 03-1736-2000, Planning Procedures for Passive Protection Systems for Prevention of Fire Hazards in Houses and Buildings.

SNI 03-1746-2000, Procedure for Planning and Installing Exit Means for Rescue of Fire Hazards in Buildings.

SNI 03-3985-2000, Procedures for Planning, Installation and Testing of Fire Detection and Alarm Systems for Prevention of Fire Hazards in Buildings.

SNI 03-3989-2000, Procedure for Planning and Installing Automatic Sprinkler Systems for Fire Hazard Prevention in Buildings.

SNI 03-6571-2001, Fire Smoke Control System in Buildings.

SNI 03-6574-2001, Procedures for Designing Emergency Lighting, Directional Signs and Hazard Warning Systems in Buildings.

Tirta meydanu dirja, 2011. System smoke control.http: //elektronikaindustri3.blogspot.co.i d / 2014/03 / smoke-control-systems-and.html, accessed September 12017, 11.00 WIB.

Tri Gunawan, 2011. Building reliability inspection system in preventing fire hazards. Postgraduate Thesis, Faculty of Engineering, Sebelas Maret University, Surakarta.

Wahyu asyari muntoha, 2015. siamese-connection.

APPLICATION *OF IMPORTANCE PERFORMANCE ANALYSIS* (IPA) AND *CUSTOMER SATISFACTION INDEX* (CSI) METHOD TO ANALYZE INDONESIAN NAVAL 2ND FLEET COMMAND MATERIEL SERVICE PERFORMANCE

Juni Heri Budianto[1], Abdul Rahman[2], Sutrisno[3]

[1,2,3]Indonesian Naval Technology College, STTAL,
Bumi Moro, Moro Krembangan Surabaya - 60178, Indonesia

ABSTRACT

Indonesian naval 2nd fleet command materiel service (Dismatbek) is responsible for fulfilling all Indonesian warship (KRI) spare parts material, distribution of individual equipment and distribution of oil and lubricant fuel needs for KRI and other user. In order to increase the services, a research is needed to analyze the performance of service attributes provided by Indonesian naval 2nd fleet command materiel service. By using the Importance Performance Analysis (IPA) method, will be known the service attribute position in quadran analysis , and to know the satisfaction level of the user, it can use the Customer Satisfaction Index (CSI) method, the result get a value of 71.4%, even if it is in the category of satisfied (66% - 80%) there are still 4 attributes from 12 service attributes located in the first quadrant wich means it is need to be fixed immediately so the level of satisfaction level will be better.

Keywords: *Service Attributes, Importance Performance Analysis, Quadran Analysis, Customer Satisfaction Index*

1. INTRODUCTION

Logistical support is essentially an effort and activity to maintain the operating units is always in combat-ready conditions, in order to maintain the continuity of the implementation of capacity building activities and use of force activities, where logistics support functions include maintenance support, logistic support and base facility support. The supply support is directed at the readiness of material support provisions consisting of:

a. Material support provisions for maintenance
b. Material support provisions for operations
c. Material support provisions for personnel

This is in accordance with the General Publication of the Indonesian Armed forces (TNI) (PUM-7) on the master manual of logistics coaching of the Indonesian Navy, Indonesian naval 2nd fleet command materiel service is an implementing element of 2nd fleet command in charge of fostering, organizing and carrying out all activities related to the supply of materiel and personnel for the elements of 2nd fleet both training and operation. In carrying out the tasks, Indonesian naval 2nd fleet command materiel service held functions such as:

a. To compile and implement plans and programs for the provision of materiel supplies and personnel supplies for the elements of 2nd fleet.
b. To compile and prepare technical instructions of material supply and personnel of 2nd fleet.
c. To compile a materiel requirements and personal supplies requirements plan in the context of maintenance and procurement.
d. Coordinate and cooperate with another unit inside or outside 2nd fleet command.
e. Supervise, control and evaluate the implementation program of Indonesian naval 2nd fleet command materiel service, to ensure the achievement of the program objectives successfully and effectively.
f. Submit considerations and suggestions to Commander of the 2nd, fleet especially regarding things related to his duty.

In carrying out its duties and functions, Indonesian naval 2nd fleet command materiel service can take policy of supply in preparing on board spares for KRI, meet the needs of fuel and lubricant for KRI of 2nd fleet command that are in or outside the base, meet the needs of individual equipment for operations and training. Policy in budget planning by prioritizing supporting procurement activities by sharpening the scale of budget priorities in accordance with the received budget.

Material guidance is the readiness of spare and non-spare parts in adequate quantities and conditions with the form of implementation of materiel procurement activities based on request to receive (PUT). In carrying out the daliy activities a Head of Material Service (kadismat) has several staff consisting of planning staff, procurement staff, inventory staff and a warehouse head who all perform their respective functions and roles in order to perform the duties and functions Indonesian naval 2nd fleet command materiel service.

Looking at its duties and functions that are quite Importance in supporting the readiness of the

2nd element in carrying out the main duties of the Indonesian Navy, then it takes a good service in order to support logistics to all elements of KRI and the bases can be done well. 2nd fleet command has more KRI or naval base than 1st fleet and 3rd fleet, so that the burden of duty received by Indonesian naval 2nd fleet command materiel service is more than the others.

from the explanation above a scientific study is needed to find out the level of performance Indonesian naval 2nd fleet command materiel service from the side of users and how much Indonesian naval 2nd fleet command materiel service understands what users want in order to be used as evaluation this service will certainly affect the readiness of the KRI or the naval base located at 2nd fleet.

2. MATERIALS AND METHODS

2.1 Importance Performance Analysis

Martila and james (1997) introduced the Importance Performance Analysis (IPA) method which is a multi-attribute model and can be used to analyze the performance of the organization, this concept contains how to translate what customers want measured in relation to what service providers

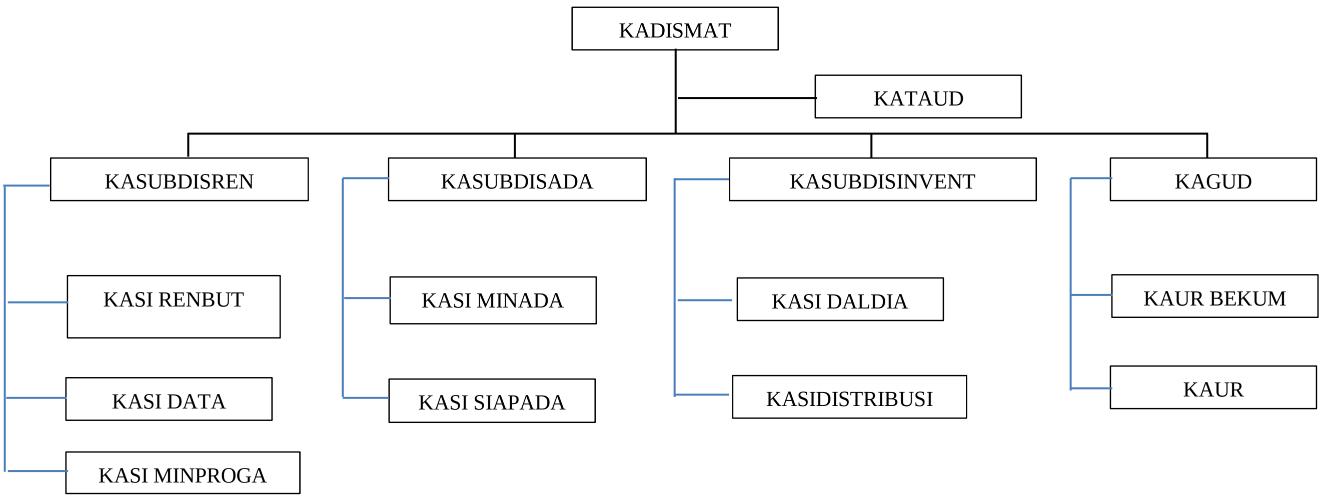


Figure 1. Indonesian naval 2nd fleet command materiel service Organization Chart

Table 1. Activities of Indonesian naval 2nd fleet command materiel service in the last three years

No	Activity	amount of activity/year		
		2017	2018	2019
1	Procurement of spare part for Indonesian warship	190	185	170
2	Receipt and Distribution of supplies material from Indonesian Naval headquarters to Indonesian warship and bases	88	65	72
3	Fuel Distribution for Indonesian warship	71.000.0500 Liter	79.345.000 Liter	69.925.300 Liter
4	Distribution of Indonesian warship lubricants	805.690 Liter	750.465 Liter	547.848 Liter
5	Receipt of material to remove from another user	90	95	105

have to do in order to produce quality products, intangibles or intangibles (Supranto, 2001). Respondents were asked to assess the level of peformance and Importance about service attributes that is shown .The scale used is a scale of one to five.

Table 2. Performance and importance level assessment scores

Value	Performance	Importances
1	Very dissatisfied	Very unImportance
2	Not satisfied	Not Importance
3	Quite satisfied	Quite Importance
4	Satisfied	Importance
5	Very satisfied	Very imporyant

This study used two variables X and Y, where X is the level of performance and Y is the level of Importance / expectation from users Indonesian naval 2nd fleet command materiel service, after the data is collected then the data is processed to assess the level of performance and level of Importance / expectations. The formula:

$$Tki = \frac{Xi}{Yi}\, x\ 100\% \qquad (1)$$

Description :

Tki = Respondent's level of conformity

Xi = Performance scoring scores

Yi = Importance assessment score

then the service attribute is mapped into quadran Analysis where the horizontal axis (X) will be populated by the performance value and the upright axis (Y) will be filled with the Importances value:

$$x = \frac{\sum xi}{\mathrm{n}} \qquad (2)$$

$$y = \frac{\sum yi}{n} \qquad (3)$$

Description :

X = Average performance score

Y = Average Importance score

n = number of Respondents

Importance Performance

I **Concentrate here**	**II** **Keep up the good work**
III **Low priority**	**IV** **Possible overkill**

Performance

Figure 2 Importance Performance Quadran Analysis

a. The first quadrant (I), requires handling that needs to be prioritized by the management level due to high importance, while the satisfaction level is low.

b. The second quadrant (II), indicates the area to be maintained due to the high level of importance, while the level of performance is also high. .

c. The third quadrant (III), as a low priority area due to low Importance rates while performance satisfaction levels are also low. In this quadrant there are several factors that are less Importance influence for customers. But the company should always display something better among other competitors.

d. The fourth quadrant (IV), is categorized as redundant because there are factors that for customers are not Importance, but by the company is implemented very well. In addition, due to the low level of Importance while the level of satisfaction of performance is high so it is not a priority that is improved.

2.2 Customer Satisfaction Index (CSI)

Customer satisfaction is the customer's perception that his expectations have been met or exceeded (Gerson, 2004). Customer satisfaction also means a comparison between what consumers expect and what consumers feel when using the product, Consument Satisfaction Index (CSI) is a quantitative analysis of the overall percentage value of consumers who are satisfied with the service of a product, the steps in calculating CSI are as follows (Stratford, 2004 in Nurmalia and astuti, 2012) :

a. Calculating weight factor (WF) that is to convert the average value of Importance into a percentage number.

b. Calculating weight score (WS) which is multiplication value between WF value and Mean satisfaction Score (MSS)

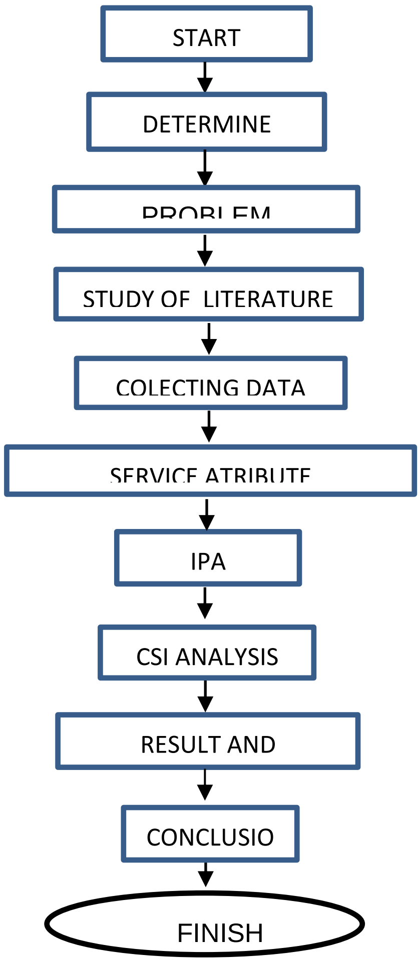
c. Collecting Total Weight (WT) by summing all WS values

d. Calculating satisfaction index by dividing WT with the maximum scale used is 5

Table 3. CSI Values and Criteria

CSI Value	CSI Criteria
0,81 – 1,00	Very satisfied
0,66 – 0,80	Satisfied
0,51 – 0,65	Quite satisfied
0,35 – 0,50	Less satisfied
0,00 – 0,34	Not satisfied

2.3 Experimental procedure



3. RESULT AND DISCUSSION

3.1 Performance Analysis of Dismatbek Second Fleet

The data obtained is primary data in the form of questionnaires to user of Indonesian naval 2nd fleet command materiel service. KRI represented by 55 officers of chief engginer (Kepala Departemen mesin), 6 task force 2nd fleet command represented by 6 Officers of the Material Maintenance Unit (Pasharmat) and the officers of Indonesian naval 2nd fleet command materiel service represented by 5 officers..the data is analyzed using IPA

(Importance Performance Analysis) method,. The service attributes provided by Indonesian naval 2nd fleet command materiel service are obtained from literature studies and interviews with the officers so that 11 service attributes are obtained, namely:

a. Administrative services request for spare part.
b. Timely procurement of spare part.
c. Procurement of the right type of spare part.
d. Procurement of the right quantity of spare part.
e. Fuel administration services and Individual equipment.
f. Timely distribution of fuel and the quantity
g. Timely distribution of individual equipment and quantity.
h. Fuel filling monitoring service at the base.
i. Timely distribution of supplies and the quantity.
j. Storage facilities in the warehouse.
k. Administration services for taking goods and delivery of goods to be removed and destruction at Indonesian naval 2nd fleet command materiel service warehouse.

From the results of data collection continued data processing to get the result of the value of the conformity of attributes between performance and the importance of each attribute.

Table 4. Assessment of the importance and performance level of Dismatbek 2nd fleet

No	Service Atribut	Performance	Importance	Level of conformity
1	Administrative services request for spare part.	3,45	4,42	78,2
2	Timely procurement of spare part.	3,70	4,40	84,1
3	Procurement of the right kind of spare part.	3,72	4,43	83,83
4	Procurement of the quantity of spare part.	3,42	4,38	72,8
5	Fuel administration services and Individual equipment.	3,79	4,36	87,01
6	Timely distribution of fuel and the quantity	3,45	4,36	72,72
7	Timely distribution of individual equipment and quantity.	3,30	4,38	71,12
8	Fuel filling monitoring service at the bases	3,64	4,23	86,16
9	Timely distribution of supplies and quantity.	3,72	4,36	81,38
10	Storage facilities in the warehouse	3,70	4,30	78,5
11	Administration services for the collection of goods and delivery of goods to be removed in Indonesian naval 2nd fleet command materiel service warehouse.	3,40	4,23	87,94
	Total	39,28	47,83	

The results are then mapped into quadran analysis, by determining the X and Y axes first

$$x = \frac{jtotal\ amount\ of\ performance}{\text{number of attributes}} \quad \frac{38,42}{11} = 3,57$$

$$\mathrm{Y} = \frac{jtotal\ number\ of\ Importance}{\text{number of attributes}} \quad \frac{48,3}{11} = 4,35$$

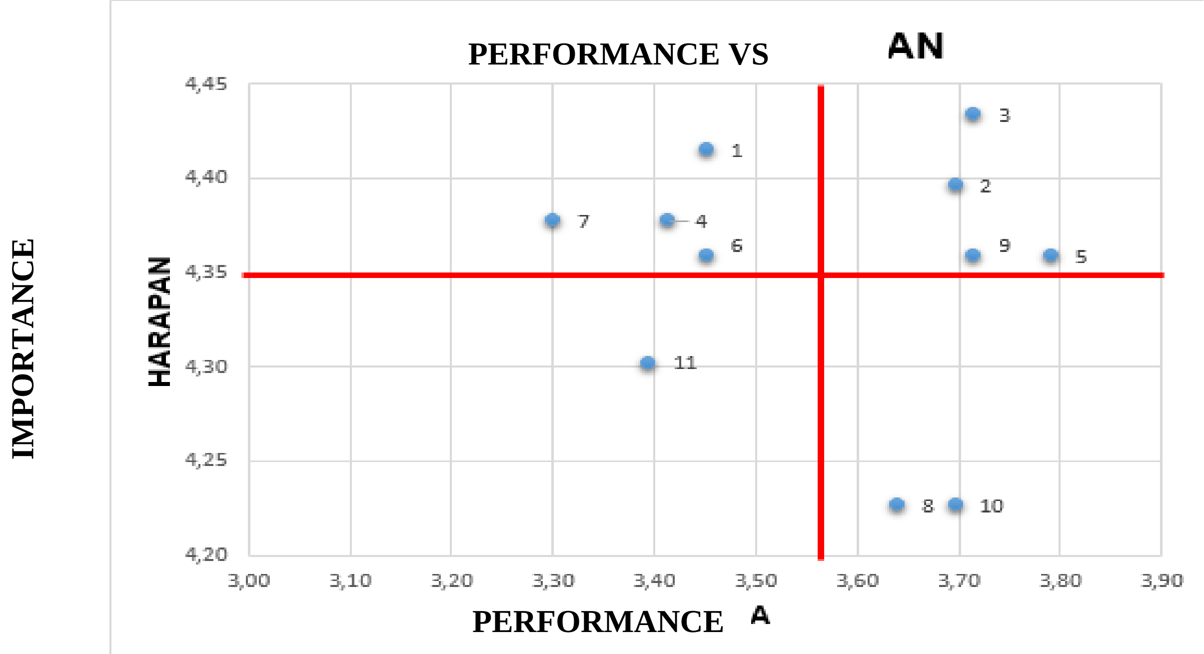


Figure 3. Quadran Analysis service Indonesian naval 2nd fleet command materiel service

3.2 Consument Satisfaction Index (CSI)

The satisfaction index is used to measure the overall level of user satisfaction based on the attributes of the service attributes of a product or service assessed.

Table 5. CSI Calculation of Indonesian naval 2nd fleet command materiel service Service

Atribut	Level of Importance	Importance weighting factor %	Level of performance	Scoring Average
	(a)	(b)=(a/Sa)x100	(c)	d=(bxc)
A	4,42	9,23	3,45	0,32
B	4,40	9,19	3,70	0,34
C	4,43	9,27	3,72	0,34
D	4,38	9,15	3,19	0,32
E	4,36	9,11	3,79	0,35
F	4,36	9,11	3,17	0,32
G	4,38	9,15	3,11	0,30
H	4,23	8,84	3,64	0,32
I	4,36	9,11	3,55	0,34
J	4,30	8,99	3,70	0,30
K	4,23	8,44	3,40	0,33
Total	39,28	100		
Total average				3,57
Satisfaction index				71,4

Based on the calculation shown in the table above obtained the value of satisfaction index (CSI) of 71.4 %, from the value obtained shows the position of the value in the range of 0.66 – 0.80. it means over all users are satisfied.

4. CONCLUSION

From the results of the analysis using IPA method to the services provided by Indonesian naval 2nd fleet command materiel service, it's mapped into Quadran Analysis to see the main priority that must be made improvements in the performance of Indonesian naval 2nd fleet command materiel service are : Administrative services request for spare part. (A). Procurement of the quantity of spare part (D), Timely distribution of fuel and the quantity (F) and Timely distribution of individual equipment and quantity (G) is looks from the level of expectations assessed by the user considerable but the performance given is still below average. While the performance for fuel distribution supervision services to KRI and spare parts storage services in warehouses (H and J) is good even though the expectations of user are not so high.

Overall user served by Indonesian naval 2nd fleet command materiel service are satisfied, this is seen from the value of satisfaction index that is worth 71.4 %, nevertheless it is necessary to improve the service so that the satisfaction value can increase, this can be seen with the provision of some services attributes that are in the position of 1st quadrant.

ACKNOWLEDGEMENTS

The authors greatly acknowledge the support from Indonesian Naval Insitute of Technologyand Indonesian Navy Institution for providing necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

REFERENCES

Gerson, F. Richard, 2017. *Mengukur Kepuasan Pelanggan*. Jakarta: PPM

Irham Fahmi, *Manajemen Strategis (Teori dan Aplikasi)*, Bandung: Alfabeta, 2014

Dismatbek, *laporan evaluasi Dismatbek Koarmada II* (2017-2019)

Martilla JA and James JC (1977) Importance–performance analysis. *Journal of Marketing 41(1): 77–79*

Nurmalina R dan Astuti EP. 2012. Analisis Preferensi dan Kepuasan Konsumen terhadap Beras di Kecamatan Mulyorejo Surabaya Jawa Timur. *Jurnal Sains Terapan. 1(1) : 42-47.*

Prof H. A Jazuli dan Drs. Yadi Janwari M.Ag *Lembaga Lembaga Perekonomian Umat : Sebuah Perkenalan* (Jakarta : PT Raja Grafindo Persada, 2002) hal 183

Supranto, J. 2001. *Pengukuran Tingkat Kepuasan pelanggan Untuk Menaikkan Pangsa Pasar*, Jakarta: Rineke Cipta.

ANALYSIS OF SELECTION OF ARSENAL WAREHOUSE LOCATIONS TO SUPPORT KRI OPERATIONS IN THE KOARMADA II AREA

Muhammad Arif[1], Avando Bastari[2], Ahmadi[3]

[1]Indonesian Naval Technology Collage
Bumimoro Morokrembangan, Surabaya 60178, Indonesia
e-mail: morvita.oi2001@gmail.com

ABSTRACT

The global dynamics that are uncertain is one of the main factors affecting the success of achieving the goals and interests in the field of national defense. This reflects how important it is for stakeholders in the defense sector, to understand the dynamics of the strategic environment which presents a series of opportunities, obstacles to threats to the existence of the Republic of Indonesia, which in the end will obtain strategic steps to overcome them. The consideration of the development of the strategic environment that is constantly changing will affect the planning process for the development of the Indonesian Navy, one of which is increasing the operational capability supported by logistical capabilities. In particular, the need for ammunition and weapons that are included in the class V provision to support KRI in an operation. Therefore, it is very necessary to have an Arsenal area warehouse specifically for the Koarmada II region. The speed and accuracy of class V supply support for the KRI elements of the Koarmada II region can be seen from the huge function and role of logistical support, especially in the field of ammunition logistics support distribution, a thought is needed to establish another Arsenal regional warehouse to assist the duties and roles of Arsenal Batu Poron. The choice of location determination has several factors that need to be considered so that it is categorized in a multicriteria decision environment, so the proposed model is the right methodology to accommodate the criteria divided into qualitative and quantitative by using the Fuzzy MCDM (Multi Criteria Decision Maker) approach. Qualitative criteria for selecting the best warehouse location in Arsenal area include security criteria, transportation access, and warehouse support facilities, while quantitative criteria include distance to enemies, distance to settlements and earthquake factors that affect the construction of Arsenal area warehouses. In this study, from five alternative locations, namely Lantamal V Surabaya, Lantamal VI Makassar, Lantamal VII Kupang, Lantamal VIII Manado and Lantamal XIII Tarakan.

Keywords: *Strategic Environment, Arsenal area warehouse, Fuzzy MCDM, facility design.*

1. INTRODUCTION

The global dynamics that are uncertain is one of the main factors affecting the success of achieving the goals and interests in the field of national defense. This reflects how important it is for stakeholders in the defense sector, to understand the dynamics of the strategic environment which presents a series of opportunities, obstacles to threats to the existence of the Republic of Indonesia, which in the end will obtain strategic steps to overcome them.

The Indonesian Navy has the main task of carrying out the duties of the TNI in the maritime sector of defense, enforcing the law and maintaining security in the maritime territory of national jurisdiction in accordance with the provisions of national law and international law that have been ratified. Carrying out the diplomatic duties of the Navy in order to support the foreign policy set by the government, carry out TNI duties in the development and development of the strength of the marine dimension, and carry out the empowerment of the marine defense area. (Law No. 34 on TNI, 2004). The Indonesian Navy can mobilize elements of the KRI (Battleship of the Republic of Indonesia) in order to maintain defense, state sovereignty, law enforcement and security at sea.

The Indonesian Navy is strongly influenced by several components, such as the strength structure, the level of readiness, the level of sophistication or technological sophistication and the operational durability of its Alutsista. The synergy of the four components of strength is very much determined by the country's ability to build and maintain the ability of the defense equipment. Ships of the Republic of Indonesia (KRI) as one of the components of the Integrated Fleet Weapon System. is a vital force at the forefront of Indonesia's defense to guard the maritime territory of the Republic of Indonesia (NKRI). The direct correlation of the increase in defense equipment, of course, must be balanced between the level of need and support capacity so that it can directly improve operational capabilities in the field. Where the operational readiness of the unit can only be done optimally if it is supported by optimal logistics availability. One of them is through the logistical support role of weapons and ammunition from Arsenal (TNI AL's arsenal of weapons and munitions) to meet the needs of KRI.

Currently, Arsenal do not have a regional warehouse and there is only one central warehouse in Surabaya. The wide working area of Koarmada II, of course, requires a large number of KRI elements. The same should be true for other supporting facilities. Arsenal really need regional warehouses to be able to increase KRI's operational support in the Koarmada II working area. This is necessary considering the implementation of operations at sea requires a very high presence of KRI. So that if there is a need for ammunition supplies, the process of supplying them can be carried out quickly.

Currently meeting the needs for KRI ammunition and weapons is carried out at Arsenal. Arsenal has a role in storing, maintaining and distributing under the Indonesian Navy (Dissenlekal) Weapons and Electronics Service Task Force. Some of Arsenal's functions are listed in KASAL Decree Number: Kep / 31 / VII / 1997.

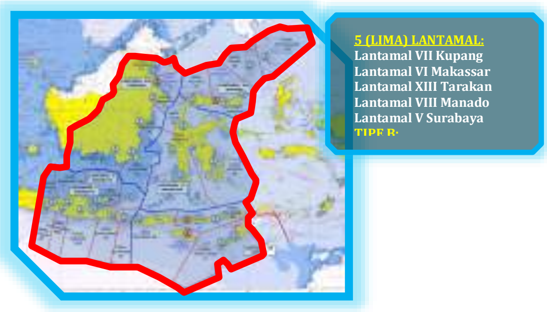


Figure 1.1 Koarmada II Working Area
Source: Sops Koarmada II

In carrying out operations at sea, it is demanded the presence of KRI elements that are very high in the sea. So that if there is a need for ammunition supplies, the process of supplying them must be carried out quickly and precisely. In the wide working area of Koarmada II, which requires a number of elements of the presence of KRI in the operational area and so should other supporting facilities such as Arsenal, so that one more ammunition warehouse location is needed in the Koarmada II work area so that it is better able to support the operations of KRI elements. munitions, the process of supplying them must be carried out quickly and precisely. In the wide working area of Koarmada II, which requires a number of elements of the presence of KRI in the operational area and so should other supporting facilities such as Arsenal, so that one more ammunition warehouse location is needed in the Koarmada II work area so that it is better able to support the operations of KRI elements. The absence of supporting facilities and only one Arsenal ammunition warehouse will certainly be a loss if the presence of KRI elements in the operating area is disrupted by the implementation of ammunition logistical support at Arsenal Surabaya.

Figure 1.2 The TNI AL Weapons and Ammunition Distribution System
Source: Sops Koarmada II.

2. MATERIAL

2.1 Fuzzy Theory.

The concept of fuzzy theory was initiated by Lotfi A. Zadeh in 1965 with his seminary paper "Fuzzy Sets" (Zadeh, 1965). Before working with fuzzy theory, Zadeh used control theory. He developed the concept of "state", which is the basic form of modern control theory. Fuzzy theory shows that all theories can be used as the basic concept of fuzzy or continues membership function. Broadly speaking, fuzzy theory can be classified into five main areas, namely:Fuzzy Mathematics,
Fuzzy Logic & Artificial Intelligence, where estimates for classical logic are introduced and expert systems are developed based on fuzzy information and thought forecasts;

a. Fuzzy System, which includes fuzzy control and fuzzy approach with processing and communication signals;Uncertainty and Information,

b. Fuzzy Decision Making, where consideration exists for optimization problems.Fuzzy Keanggotaan.

2.2 Membership function

Is a curve that shows the mapping of data input points into their membership values (often called membership degrees) which have an interval of 0 to 1. One way that can be used to obtain membership values is through the function approach.

There are several functions that can be used:

a. Represeniasi Linear

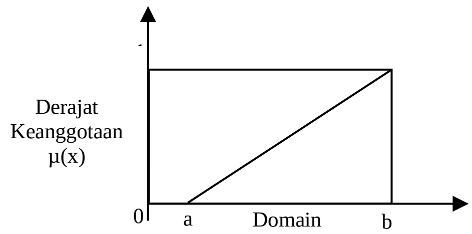


Figure 2.1 Upward Linear Representation

Membership function:

$$\mu[x] = \begin{cases} 0; & x \leq a \\ (x-a)/(b-a); & a \leq x \leq b \\ 1; & x \geq b \end{cases} \quad ..(2.3)$$

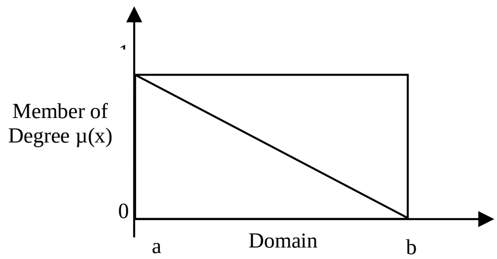


Figure 2.2 Derivative Linear Representation

Membership function:

$$\mu[x] = \begin{cases} (b-x)/(b-a); & a \leq x \leq b \\ 0; & x \geq b \end{cases} \quad ..(2.4)$$

b. Representasi Kurva Segitiga

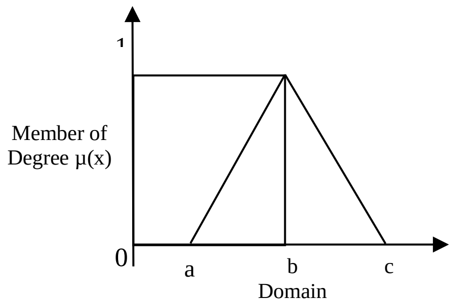


Figure 2.3 Triangular Curve

Membership function:

$$\mu[x] = \begin{cases} 0; & x \leq a \; atau \; x \geq c \\ (x-a)/(b-a); & a \leq x \leq b \\ (c-x)/(c-b); & b \leq x \leq c \end{cases} \quad .. (2.5)$$

c. Trapezoid Curve Representation

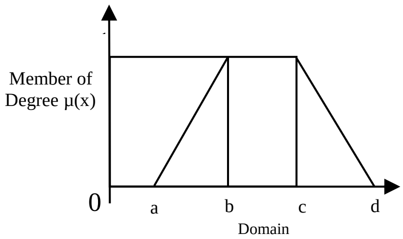


Figure 0.1 Trapesium Curve

Member Function:

$$\mu[x] = \begin{cases} 0; & x \leq a \text{ atau } x \geq d \\ (x-a)/(b-a); & a \leq x \leq b \\ 1; & b \leq x \leq c \\ (d-x)/(d-c); & c \leq x \leq d \end{cases}$$

2.3 Triangular Fuzzy Number (TFN)

In TFN, every single value (crisp) has a membership function consisting of three values, each of which represents the lower value, the middle value and the upper value. Graphically the membership function with TFN can be illustrated as in the following figure:

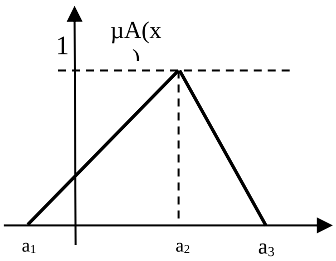


Figure 2.5 Triangular Fuzzy Number

A = (a_1, a_2, a_3)

The membership function for TFN in the picture above is as follows:

$$\mu[x] = \begin{cases} = 0 & \text{untuk } x < a_1 \\ = \frac{x - a_1}{a_2 - a_1} & \text{untuk } a_1 < x < a_2 \\ = \frac{a_3 - x}{a_3 - a_2} & \text{untuk } a_2 < x < a_3 \end{cases} \quad \text{..........2.7}$$

2.3 Defuzzifikasi value

Defuzzification is a process of converting and fuzzy quantity into a definite quantity, where the output and fuzzy process can be a logical combination of two or more fuzzy membership functions defined in accordance with the universe of discussion. Defuzzy input and process is a fuzzy set obtained from the composition of fuzzy rules, while the resulting output is a number in the domain of the fuzzy set. There are several defuzzification methods that are commonly used as follows:

a. Centroid Method (Center Of Gravity / COG)

b. Bisector Method

c. Mean of Maximum (MOM) method

d. Largest of Maximum (LUM) method

e. Smallest of Maximun (SOM) Method

2.4 Linguistik Variabel

Linguistic variables are variables that have a description in the form of fuzzy numbers and more generally a word that is represented by a fuzzy set. For example, descriptions of linguistic variables for temperature can be LOW, MEDIUM and HIGH where the descriptions are expressed as fuzzy values. (Tsoukalas, 1997). Like algebraic variables that use numbers as their values while linguistic variables use words or sentences as their values which form a set called a set of "terms", each value of the "term" is a fuzzy variable defined based on the base variable. Meanwhile the base variable defines the universe of speech for all fuzzy variables in the set of "terms" (Jantzen, 1998).

2.5 Multiple Criteria Decision Making (MCDM)

Multi-Criteria Decision Making (MCDM) is a decision-making method consisting of theories, processes, and analytical methods for decision making that involves uncertainty, dynamics, and multi-criteria aspects of decisions. Multi-Criteria Decision Making (MCDM) is the terminology used in solving problems where the MCDM approach is expected to get the best alternative.

3. METHODS

3.1 Data processing.

After obtaining data from each expert, the next step is to recapitulate the results of the questionnaire and perform data processing. The processing of data uses the MCDM fuzzy algorithm (Liang & Wang, 1994):

a. Table weighting results of the qualitative criteria level assessment to obtain the aggregate weight value.

b. Tables the results of the assessment rating or preferences for each alternative based on existing qualitative criteria.

c. Determine the mean value of fuzzy numbers, by adding the values that appear at each level of the linguistic scale and then dividing the sum by jumlah kriteria yang the value is included in the level of linguistic assessment. The mathematical notation is as follows:

$$a_t = \frac{\sum_{i=1}^{k} \sum_j T_{ij}}{\sum_{i=1}^{k} n_{ij}}$$

a_t = Mean fuzzy number for level

T = the rating level is very low, low, medium, high and very high.

n = the sum of the scaling factors of the linguistic scale T for the 1st alternative of the i-factor

T_{ij} = numerical value of the linguistic scale T for the 1st alternative of the j-factor.

d. Determine the lower limit value and the upper limit value of fuzzy numbers, where the lower limit value (ct = b (i - 1)) is equal to the middle value of the level below, while the upper limit value (bt = b (i - 1)) is the same with the middle value of the level above it.

e. Determining the aggregate weight of each qualitative criterion, because in this study a form of linguistic assessment is used that already has a triangular fuzzy number definition, the aggregation process is carried out by finding the aggregate value of each lower limit value (c), the middle value (a) and the upper limit value (b), which can be modeled as follows:

$$c_t = \frac{\sum_{j=1}^{n} c_{tj}}{n} \qquad a_t = \frac{\sum_{j=1}^{n} a_{tj}}{n} \qquad b_t = \frac{\sum_{j=1}^{n} b_{tj}}{n}$$

Where:

c_{tj} = the value of the lower limit of the t-th qualitative criteria by the j-th decision maker

a_{tj} = the mean value of the t-qualitative criterion by the j-decision maker

b_{tj} = the upper limit value of the t-th qualitative criterion by the j-th decision maker

n = number of appraisers (decision makers)

The aggregate value is N = (cj, aj, bj Where:

Nt.= aggregation weight values for the t-qualitative criteria

f. Calculating the preference value of each alternative based on qualitative criteria. In calculating the aggregate weight of each alternative for each criterion, the aggregate fuzzy value can be found using the following model:

$$q_t = \frac{\sum_{j=1}^{n} q_{tj}}{n} \quad o_t = \frac{\sum_{j=1}^{n} o_{tj}}{n} \quad p_t = \frac{\sum_{j=1}^{n} p_{tj}}{n}$$

q_{itj} = the alternative lower bound value for the t-th qualitative criterion by the j-th leader.

o_{itj} = the mean value of alternatives for the qualitative criterion t by the jth decision maker.

o_{itj} = the value of the alternative upper bound for the t-th qualitative criterion by the j-th leader.

n = number of appraisers (decision makers).

The aggregate value is $M_{itj} = (q_{it}, o_{it}, p_{it})$

Where :

M_{itj}= the aggregation weight value for the i-th alternative for the t-qualitative criteria.

g. Calculating the fuzzy index value from the results of the assessment of each alternative for the qualitative criteria denoted by G_i. First, get a value M_{it} and N_t, to get the match index value *fuzzy* G_i for each subjective criterion. Here G_i is not a number *fuzzy triangular*, it's numbers *fuzzy*:

$G_i = (Y_i, Q_i, Z_i, H_{i1}, T_{i1}, H_{i2}, U_{i1}),\ i = 1,2,..........m$

The fuzzy index value is obtained by operating each element of the triangular fuzzy number from the results of numbers 2 and 4 with the following notation:

$$T_{i1} = \frac{\sum_{t=1}^{k}(o_{it} - q_{it})(a_t - c_t)}{k}$$

$$T_{i2} = \frac{\sum_{t=1}^{k}[q_{it}(a_t - c_t) + c_t(o_{it} - q_{it})]}{k}$$

$$U_{i1} = \frac{\sum_{t=1}^{k}(p_{it} - o_{it})(b_t - a_t)}{k}$$

$$U_{i2} = \frac{\sum_{t=1}^{k}[b_t(o_{it} - p_{it}) + p_t(a_t - b_t)]}{k}$$

$$H_{i1} = \frac{T_{i2}}{2T_{i1}}$$

$$H_{i2} = -\frac{U_{i2}}{2U_{i1}}$$

$$Y_i = \frac{\sum_{t=1}^{k} q_{it}c_t}{k}$$

$$Q_i = \frac{\sum_{t=1}^{k} o_{it}a_t}{k}$$

$$Z_i = \frac{\sum_{t=1}^{k} p_{it}b_t}{k}$$

h. Calculate the utility value of each alternative for the qualitative criteria.

$$U_t(G_t) = \frac{1}{2}\left[H_{i2} - \left(H_{i2}{}^2 + \frac{X_R - Z_i}{U_{i1}}\right)^{\frac{1}{2}} + 1 + H_{i1} - \left(H_{i1}{}^2 + \frac{X_L - Y_i}{T_{i1}}\right)^{\frac{1}{2}}\right]$$

$$X_R = \frac{1}{2}\left\{2x_1 + 2H_{i2}(x_2 - x_1) + \frac{(x_2 - x_1)^2}{U_{i1}} - (x_2 - x_1)\left[\langle 2H_{i2} + \frac{(x_2 - x_1)^2}{U_{i1}} + 4\frac{x_1 - z_1}{U_{i1}}\rangle\right]^{\frac{1}{2}}\right\}$$

$$X_L = \frac{1}{2}\left\{2x_2 + 2H_{i1}(x_2 - x_1) + \frac{(x_2 - x_1)^2}{T_{i1}} - (x_2 - x_1)\left[\langle 2H_{i2} + \frac{(x_2 - x_1)^2}{T_{i1}} + 4\frac{x_1 - z_1}{T_{i1}}\rangle\right]^{\frac{1}{2}}\right\}$$

The first step is to find the defuzzification value of the criteria and alternative preferences against the criteria, where the defuzzification method used is the centroid method. The formula for the criteria defuzzification is as follows:

Defuzzifikasi N_{it}

$$= \frac{\left[\left[\int_{c_t}^{a_t}\frac{(x - c_t)}{(a_t - c_t)}xdx + \int_{a_t}^{b_t}\frac{(x - b_t)}{(a_t - b_t)}xdx\right]\right]}{\left[\left[\int_{c_t}^{a_t}\frac{(x - c_t)}{(a_t - c_t)}dx + \int_{a_t}^{b_t}\frac{(x - b_t)}{(a_t - b_t)}dx\right]\right]}$$

Where : t = Criteria 1,2,3..................n

Meanwhile, the formula for determining the defuzzification value for alternative preferences to qualitative criteria is as follows:

Defuzzifikasi M_{it}

$$= \frac{\left[\left[\int_{q_{it}}^{o_{it}}\frac{(x - q_{it})}{(o_{it} - q_{it})}xdx + \int_{o_{it}}^{p_{it}}\frac{(x - p_{it})}{(a_t - p_{it})}xdx\right]\right]}{\left[\left[\int_{q_{it}}^{o_{it}}\frac{(x - q_{it})}{(o_{it} - q_{it})}dx + \int_{o_{it}}^{p_{it}}\frac{(x - p_{it})}{(a_t - p_{it})}dx\right]\right]}$$

Where : i = alternative 1,2,3,...............m;
t = Criteria 1,2,3..................n

i. Calculating the ranking value of each alternative based on qualitative criteria using the following formula:

$$ST_i = \frac{U_T(G_i)}{\sum_{i=1}^{m} U_T(G_i)}$$

Where :

ST_i = the ranking value of alternative i based on qualitative criteria.

j. Calculate the ranking value of each alternative based on quantitative criteria using the following formula:

$$OT_i = \frac{\sum_{j=1}^{p}\left[T_{ij}\, l\left(\sum_{i=1}^{m} T_{ij}\right)\right]}{p}$$

Where :

T_{ij} = the score (score) of the i-th alternative for the j-th quantitative criterion

M = number of alternatives

p = number of quantitative criteria
OT_i = the ranking value of alternative i based on quantitative criteria

k. Calculate the total (final) ranking value of each alternative for the qualitative criteria and the quantitative criteria using the following formula:

$$FT_i = \frac{ST_i + OT_i}{\sum Vk} \quad ,0 \leq x \leq 1$$

Where :
ST_i = the ranking value of alternative i based on qualitative criteria.
OT_i = the ranking value of alternative i based on quantitative criteria
ΣV_k = number of variables
FT_i = total ranking value for alt i

l. Choose the best alternative based on the highest ranking value.

4. RESULT AND DISCUSSION

4.1 Alternative Arsenal warehouse locations

a. Lantamal VII Kupang

Domiciled in East Nusa Tenggara (NTT) which is directly adjacent to East Timor.

b. Lantamal VI Makassar.

Domiciled in Makassar City or Ujung Pandang, South Sulawesi.

c. Lantamal XIII Tarakan

Domiciled in the City of Tarakan, East Kalimantan.

d. Lantamal VIII Manado

The main base of the Indonesian Navy VIII Manado, domiciled in Manado City, North Sulawesi.

e. Lantamal V Surabaya.

Located directly under Koarmada II, the main task is to develop strength and ability to carry out logistical and administrative capabilities, conduct maritime security patrols in the Lantamal V work area, and empower marine areas.

4.2 Criteria Data in each Alternative

a. Quantitative Criteria

1) Distance to operating field.

The alternative distance to the operating field is an important thing to pay attention to considering the KRI which will carry out the loading of ammunition from the operating area to the alternative warehouse in the Arsenal area requires a short time to return to the field of operation quickly..

Table 4.1 Alternative Distance to the Operation Area

ALTERNATIF	SUB KRITERIA	
	DISTANCE ALKI II	DISTANCE AMBALAT
Lantamal VII Kupang	99 NM	702 NM
LantamalVI Makassar	1108 NM	1670 NM
Lantamal XIII Tarakan	872 NM	535 NM
Lantamal VIII Manado	350 NM	398 NM
Lantamal V Surabaya	700 NM	140 NM

2) Distance to city center.

Based on the standardization of the arsenal of weapons and ammunition in the Indonesian Navy, it is stated that for security from the impact of an explosion for some reason, the location of the ammunition warehouse for vital civilian and military objects is not less than 200m. (Perkasal No. Perkasal/100/XII/2010, 2010). Here are the Alternative distances to the city center and the closest settlement:

Table 4.2 Distance of alternative locations to City Center and Settlements

ALTERNATIF	SUB KRITERIA	
	DISTANCE PUSAT KOTA	DISTANCE PEMUKIMAN
Lantamal VII Kupang	1,2 KM	290 M
Lantamal VI Makassar	13 KM	210 M
Lantamal XIII Tarakan	5,5 KM	135 M

Lantamal VIII Manado	5,6 KM	250 M
Lantamal V Surabaya	4,8 KM	205 M

3) The threat of an earthquake

Table 4.3 Value of Alternative Location Gravitational Acceleration
Source: (Kementrian Pekerjaan Umum, 2010)

N0	Alternatif Lokasi	PGA
1.	Lantamal VII Kupang	0,25
2.	Lantamal VI Makassar	0,50
3.	Lantamal XIII Tarakan	0,25
4.	Lantamal VIII Manado	0,15
5.	Lantamal V Surabaya	0,05

b. Qualitative Criteria

In determining the qualitative criteria for determining the location of Arsenal's warehouse area, based on references to the Final Project Marine Major (E) Dwi, Marine Major Final Project (P) I Komang and discussion of researchers with Arsenal expert staff on the basis of Perkasal No. 17.

4.3 Data Processing

Data processing using fuzzy MCDM, requires people who are experts in determining the scoring of the questionnaire that has been compiled by the researcher. Among these experts:

a. Kaarsenal as an expert in the field of warehousing and weapons,

b. Kadissenlekal as an expert in weapons and ammunition,

c. Kadisfaslanal as an expert in the field of base facilities throughout Indonesia, and

d. Asops Koarmada II as an expert in the operational field of the Koarmada II area.

1) Table the results of the weighted criteria level assessment.

There are two scales for the weighting results in the assessment, namely the numerical scale. Rating for a numeric scale between 1-10.

Tabel 0.1 Criteria Expert Data

Source: Expert Data

NO	KRITERIA	SUB KRITERIA	EXPERT 1	EXPERT 2	EXPERT 3	EXPERT 4
			N	N	N	N
	Kualitatif					
1.	Keamanan	aman dari musuh	9	10	10	10
		bebas konflik sosial	9	8	8	8
2.	Akses trans portasi	pelabuhan militer	10	10	10	10
		pelabuhan umum	7	5	5	8
		bandar udara	8	5	5	7
3.	Sarana pendukung	fas. kom	8	8	10	9
		fas. listrik	7	8	8	7
		fas. air	6	8	8	6
		fas. angkutan	9	9	10	9
		fasharkan	9	9	8	8
	Kuantitatif					
1.	Jarak medan operasi	ALKI 2	9	8	6	10
		AMBALAT	10	8	8	10
2.	Jarak pusat kota	pusat kota	9	9	7	10
		pemukiman	10	9	9	10
3.	Ancaman gempa		10	10	10	10

Keterangan : N = Numerik

2) Table the results of alternative rating ratings.

The labeling of the alternative rating results can be seen in table 4.8 with the same scale as the assessment criteria, namely the linguistic scale and the numerical scale.

Table 4.8 Expert Data Recapitulation for Assessment of Alternative Locations

Source: Expert Data Collection

NO	KRITERIA	SUB KRITERIA	ALTERNATIF	*EXPERT 1*	*EXPERT 2*	*EXPERT 3*	*EXPERT 4*
				N	N	N	N
1.	Keamanan	aman dari musuh	LANT. VII	8	6	6	7
			LANT. VI	9	8	6	6
			LANT. XIII	8	10	8	8
			LANT. VIII	5	4	6	7
			LANT. V	8	6	7	7
		bebas konflik	LANT. VII	7	6	6	6
			LANT. VI	8	8	6	7
			LANT. XIII	6	6	8	6

NO	KRITERIA	SUB KRITERIA	ALTERNATIF	*EXPERT 1* N	*EXPERT 2* N	*EXPERT 3* N	*EXPERT 4* N
			LANT. VIII	7	8	5	5
			LANT. V	8	8	5	6
2.	Akses transportasi	pel. Militer	LANT. VII	9	8	7	9
			LANT. VI	6	10	6	7
			LANT. XIII	7	10	7	6
			LANT. VIII	8	10	6	7
			LANT. V	9	6	6	7
		pel. umum	LANT. VII	9	8	6	8
			LANT. VI	9	6	6	8
			LANT. XIII	9	8	7	9
			LANT. VIII	8	8	5	8
			LANT. V	8	8	5	8
		bandar udara	LANT. VII	9	6	5	7
			LANT. VI	8	6	5	7
			LANT. XIII	9	8	6	8
			LANT. VIII	8	6	5	8
			LANT. V	8	6	5	7
3.	Sarana pendukung	fas. komunikasi	LANT. VII	7	8	6	6
			LANT. VI	7	8	6	6
			LANT. XIII	7	8	8	8
			LANT. VIII	7	8	6	6
			LANT. V	7	8	6	6
		fas. listrik	LANT. VII	8	6	6	7
			LANT. VI	8	6	6	7
			LANT. XIII	8	8	7	8
			LANT. VIII	8	6	6	8
			LANT. V	8	4	6	8
		fas. air	LANT. VII	6	8	6	7
			LANT. VI	7	8	6	7
			LANT. XIII	7	8	6	6
			LANT. VIII	8	8	6	7
			LANT. V	8	8	6	7
		fas. angkutan	LANT. VII	6	8	6	8
			LANT. VI	7	8	6	9
			LANT. XIII	8	8	7	6
			LANT. VIII	8	8	6	6
			LANT. V	8	8	6	6
		Fas harkan	LANT. VII	6	8	7	7
			LANT. VI	6	4	5	6
			LANT. XIII	7	8	7	9
			LANT. VIII	6	8	7	9
			LANT. V	7	4	5	6

3) Determine the mean value of a fuzzy number.

The fuzzy middle number is the number obtained from the sum of the values that appear at each level of the linguistic scale divided by the number of these scales with the formula (3.1). The results of these calculations are then used to make TFN.

Table 4.9 TFN Expert for Assessment of Location Criteria

NO	LEVEL LINGUISTIK	EXPERT 1 ct	EXPERT 1 at	EXPERT 1 Bt	EXPERT 2 ct	EXPERT 2 At	EXPERT 2 Bt	EXPERT 3 Ct	EXPERT 3 at	EXPERT 3 bt	EXPERT 4 ct	EXPERT 4 at	EXPERT 4 bt
1	Sangat rendah												
2	Rendah												
3	Sedang	1,00	6,00	7,50	1,00	5,00	7,83	1,00	5,00	6,86	1,00	6,00	7,60
4	Tinggi	6,00	7,50	9,10	5,75	7,83	9,43	5,00	6,86	9,83	6,00	7,60	9,78
5	Sangat tinggi	7,50	9,10	10,00	7,83	9,43	10,00	6,86	9,83	10,00	7,60	9,78	10,00

Source: Data Processing

Where: c_t = lower limit of assessment criteria

a_t = the middle limit of assessment criteria

b_t = upper limit of assessment criteria

Table 4.10 is a TFN expert for the assessment of each alternative based on qualitative criteria. It can be shown in the graph of the membership function of each expert for alternative assessments. Where the value of each expert is shown in the lower limit value, the middle value and the upper limit value, according to equation (3.1).

Table 4.10 TFN Expert for the Assessment of Each Alternative Based on Qualitative Criteria

NO	LEVEL LINGUISTIK	EXPERT 1 q_{it}	EXPERT 1 o_{it}	EXPERT 1 p_{it}	EXPERT 2 q_{it}	EXPERT 2 o_{it}	EXPERT 2 p_{it}	EXPERT 3 q_{it}	EXPERT 3 o_{it}	EXPERT 3 p_{it}	EXPERT 4 q_{it}	EXPERT 4 o_{it}	EXPERT 4 p_{it}
1	Sangat rendah												
2	Rendah				1,00	4.00	6,00						
3	Sedang	1,00	5,90	7,59	4,00	6,00	8,00	1,00	5,74	7,26	1,00	5,84	7,41
4	Tinggi	5,90	7,59	9,00	6,00	8,00	8,00	5,74	7,26	10,00	5,84	7,41	9,00
5	Sangat tinggi	7,59	9,00	10,00	8,00	8,00	10,00	0,00	0,00	0,00	7,41	9,00	10,00

Source: Data Processing

Information : q_{it} = lower limit of qualitative based alternative assessment

o_{it} = qualitative based alternative assessment middle limit

p_{it} = the upper limit of the qualitative based alternative assessment

5) Determine the aggregate weight of each qualitative criterion.

Respondents evaluated each selection criterion by using a linguistic scale to obtain a weight level for the sake of the criteria. The expert weight scores for criteria on the linguistic scale are shown in table 4.7 and then evaluated against the TFN expert for criterion assessment (table 4.9) using equations (3.2), (3.3), and (3.4), namely :

Table 4.11 Aggregate Weight Qualitative Criteria

Source: Data Processing

NO	SUB KRITERIA	RATA-RATA BOBOT		
		c_t	a_t	b_t
1	Aman dari musuh	7,448	9,535	10,000
2	Bebas konflik	6,063	7,848	9,760
3	Pelabuhan militer	7,448	9,535	10,000
4	Pelabuhan umum	3,500	6,275	8,392
5	Bandar udara	3,500	6,275	8,392
6	Faskom	6,552	8,736	9,632
7	Fasilitas listrik	5,688	7,448	9,535
8	Fasilitas air	3,188	6,673	8,590
9	Fasilitas angkutan	7,448	9,535	10,000
10	Fasharkan	6,583	8,246	9,903

6) Calculating prefensi alternative criterion

Calculating the value of the preferences of each alternative based on qualitative criteria. In the calculation of the aggregate weight of each-masing alternatives for each criterion, look equation (3.5), (3.6) dan (3.7).

Tabel 0.2 Alternative prefensi value

Source: Author Data

NO	SUB KRITERIA	ALT	RATA RATA		
			q_{it}	o_{it}	p_{it}
1	Aman Dari Musuh	1	4,209	6,686	8,313
		2	3,898	7,169	8,166
		3	6,394	7,564	9,500
		4	2,234	5,763	7,461
		5	5,394	7,064	9,000
2	Bebas Kon Flik	1	2,975	6,317	7,916
		2	4,709	7,186	8,313
		3	2,934	6,272	8,252
		4	3,475	6,817	7,916
		5	3,475	6,817	7,916
3	Pel. Militer	1	6,686	8,313	9,500
		2	2,750	6,394	8,064
		3	5,159	7,195	9,103
		4	3,984	6,763	8,461
		5	4,633	7,038	8,563
4	Pel. Umum	1	5,133	7,538	8,563
		2	4,633	7,038	8,563
		3	5,502	7,934	8,813
		4	3,484	6,763	7,961
		5	4,709	7,186	8,313
5	B. Udara	1	4,633	7,038	8,563
		2	4,209	6,686	8,313
		3	5,133	7,538	8,563
		4	4,209	6,686	8,313
		5	4,209	6,686	8,313
6	Fas. Kom	1	3,475	6,817	7,916
		2	3,475	6,817	7,916
		3	5,894	7,564	9,000
		4	3,475	6,817	7,916
		5	3,475	6,817	7,916
7	Fas. Listrik	1	4,209	6,686	8,313
		2	4,209	6,686	8,313
		3	5,894	7,564	9,000
		4	5,894	7,564	9,000
		5	3,459	6,186	7,813
8	Fas. Air	1	3,484	6,763	7,961
		2	4,709	7,186	8,313
		3	3,475	6,817	7,916
		4	4,709	7,186	8,313
		5	4,709	7,186	8,313
9	Fas. Ang	1	3,484	6,763	7,961
		2	5,078	7,583	8,563
		3	4,659	7,195	8,603
		4	3,475	6,817	7,916
		5	3,475	6,817	7,916
10	Fasharkan	1	4,669	7,141	8,648
		2	1,000	5,394	7,064
		3	6,263	7,961	9,250
		4	5,038	7,538	8,898
		5	2,225	5,817	7,416

7) Calculating the fuzzy index value from the assessment results of each alternative for the qualitative criteria (G_i).

Here Gi is not a number *fuzzy triangular*, it's numbers *fuzzy*. $G_i = (Y_i, Q_i, Z_i, H_{i1}, T_{i1}, H_{i2}, U_{i1})$, with the formula (3.10), to (3.18) in searching G_i.

Table 4.13 Value Forming Evaluation

Source: Data Processing

INDEX	ALTERNATIF 1	2	3	4	5
Yi	24,79	21,51	30,02	22,47	22,49
Qi	56,19	54,59	58,92	54,83	54,16
Zi	78,82	76,75	83,05	77,38	76,71
Hi1	2,11	2,60	2,86	3,98	2,76
Ti1	5,98	5,11	4,14	4,34	4,62
Hi2	6,31	6,09	6,92	6,57	6,36
Ui1	1,95	1,98	1,88	1,86	1,92
Ti2	25,21	26,55	23,66	25,86	24,47
Ui2	-24,59	-24,15	-26,01	-24,40	-24,48

8) Calculate the utility value of each alternative for the qualitative criteria

Before calculating the utility value, the defuzzification process is carried out first with the method used is the centroid method. By using equations (3.24) and (3.25). So that it is produced:

Table 4.14 Defuzzification of the weights of qualitative and alternative criteria

Source: Data Processing

NO	KRITERIA	SUB KRITERIA		*DEFUZZY* BOBOT	DEFUZZIFIKASI ALTERNATIF ALT 1	ALT 2	ALT 3	ALT 4	ALT 5
I	Keamanan	1	Aman dari musuh	9,124	5,683	5,728	7,456	4,222	5,956
		2	Bebas konflik	7,281	4,856	6,184	4,881	5,356	5,355
II	Akses transportasi	3	Pel. Militer	8,569	7,784	4,956	6,621	5,769	6,061
		4	Pel. Umum	5,225	6,554	6,054	6,919	5,352	6,182
		5	Bandar udara	5,225	6,054	5,683	6,554	5,683	5,682
III	Sarana pendukung	6	Faskom	7,743	5,356	5,356	7,068	5,356	5,355
		7	Fas. Listrik	6,938	5,683	5,683	7,068	7,068	5,050
		8	Fas. Air	5,169	5,352	6,183	5,356	6,184	6,182
		9	Fas. Angkutan	8,569	5,352	6,538	6,217	5,356	5,355
		10	Fasharkan	7,707	6,217	3,403	7,415	8,010	4,225

Description: ALT = Alternative

The total of the multiplication of the weight of the criteria for each alternative is then divided by the number of criteria, in this case there are 10 qualitative criteria. So that the resulting performance values for each alternative are shown in the table below:

Table 4.15 Alternative Performance Values

Source: Data Processing

ALTERNATIF	G_i
Lantamal VII Kupang	42,144
Lantamal VI Makassar	40,013
Lantamal XIII Tarakan	46,478
Lantamal VIII Manado	40,387
Lantamal V Surabaya	39,984

From the count G_i and fG_i(x) then we can know the value x_1 = 40,013 and value x_2 = 46,478, Where x_1 is a value G_i minimum, whereas for x_2 is value G_i maximum. Score x_1 and x_2 This is used to calculate the utility value of each alternative.

Inside the formulation $U_t(G_i)$ need to find the value first X_R and value X_L. As for the results of calculating the value of other alternative utilities using Microsoft Exce*l.* The utility value of each alternative is shown in the following table:

Table 4.16 Utility Forming Index

Source: Data Processing

ALTERNATIF	$U_t(G_i)$
Lantamal VII Kupang	1,041
Lantamal VI Makassar	0,883
Lantamal XIII Tarakan	0,988
Lantamal VIII Manado	0,913
Lantamal V Surabaya	0,900

9) Calculating the ranking value of each alternative based on qualitative criteria*.*

Using equation (3.26) a ranking is generated:

Table 4.17 Alternative Rankings Based on Qualitative Criteria

Source: Data Processing

RANGKING	S_{ti}
Lantamal VII Kupang	0,220
Lantamal VI Makassar	0,187
Lantamal XIII Tarakan	0,209
Lantamal VIII Manado	0,193
Lantamal V Surabaya	0,191

From the ranking results based on the qualitative criteria above, it can be seen that of the five alternative locations, the first alternative, namely Lantamal I Belawan, is the best choice with a value of 0.220.

10) Calculating the alternative ranking values based on quantitative criteria

Before calculating the ranking value, it is necessary to carry out an evaluation of the weight of the expert scores for quantitative criteria on the linguistic scale shown in table 4.7. By using equations (3.2), (3.3), and (3.4), the aggregate weight of the quantitative criteria is produced, as shown in the following table:

Table 4.18 Aggregate Weight Quantitative Criteria

Source: Data Processing

NO	KRITERIA	RATA_RATA BOBOT		
		C_t	A_t	b_t
1	Jarak daerah ops. ALKI 2	6,463	8,31	9,815
2	Jarak daerah ops Ambalat	6,088	7,91	9,59
3	Jarak pusat kota	6,983	8,79	9,958
4	Jarak pemukiman	7,448	9,53	10,00
5	Ancaman gempa	7,448	9,53	10,00

Note: c_t = lower limit, a_t = middle boundary, b_t = upper limit

From the aggregate weight data table of the quantitative criteria above, the defuzzification method is carried out using the centroid method. By using equation (3.24) so that the defuzzification value for the quantitative criteria is obtained in the following table, then unit normalization is carried out:

Table 4.19 Defuzzification of Quantitative Criteria

Source: Data Processing

NO	KRITERIA	BOBOT KRITERIA	
1	Jarak daerah operasi ALKI 2	7,62	0,19
2	Jarak daerah operasi Ambalat	7,27	0,182
3	Jarak pusat kota	8,055	0,201
4	Jarak pemukiman	8,54	0,213
5	Ancaman gempa	8,54	0,213

The weights of the quantitative criteria above are then multiplied against the quantitative data of Arsenal's warehouse area below.

Table 4.20 Quantitative Criteria Data Recapitulation

KRITERIA	ALTERNATIF				
	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5
Daerah ops ALKI 2	99	1108	872	350	700
Daerah ops Ambalat	702	1670	535	398	140
Pusat Kota	1,2	13,00	6,50	2,9	4,8
Pemukiman	0,03	0,05	0,15	0,2	0,08
Ancaman Gempa	0,25	0,50	0,25	0,15	0,05
NORMALISASI SATUAN					
Daerah ops ALKI 2	0,242	0,161	0,180	0,222	0,194
Daerah ops Ambalat	0,199	0,129	0,211	0,221	0,240
Pusat Kota	0,042	0,458	0,229	0,102	0,169
Pemukiman	0,062	0,103	0,309	0,412	0,113
Ancaman gempa	0,198	0,146	0,198	0,219	0,240

Source:Disfaslanal

ALT = Alternatively, the sea distance unit uses NM, the land distance unit uses KM, and the earthquake threat uses PGA (Peak Ground Activity)

Furthermore, using equation (3.27) can be calculated the ranking value for the quantitative criteria.

Table 4.21 Ranking of Alternatives Based on Quantitative Criteria

Source: Data Processing

ALTERNATIF	O_{ti}
Lantamal VII Kupang	0,146
Lantamal VI Makassar	0,199
Lantamal XIII Tarakan	0,227
Lantamal VIII Manado	0,238
Lantamal V Surabaya	0,190

Based on the quantitative criteria in the table above, it can be seen that of the five alternatives, the fourth alternative has the highest-ranking value with a ranking value of 0.238.

11) Calculate the total (final) ranking value of each alternative for the qualitative criteria and the quantitative criteria.

With equation (3.28) the total ranking value for the best alternative can be calculated in the table below:

Table 4:22 Total Alternative Warehouse Location Ranking Value

Source: Data Processing

ALTERNATIF	F_{ti}	RANGKING
Lantamal VII Kupang	0,183	**V**
Lantamal VI Makassar	0,193	**III**
Lantamal XIII Tarakan	0,218	**I**
Lantamal VIII Manado	0,216	**II**
Lantamal V Surabaya	0,190	**IV**

12) Choose the best alternative based on the highest-ranking value.

From the table 4.23 above, it can be seen that choosing the best alternative with the highest total ranking value. The best alternative warehouse in the Arsenal area in the Koarmada II area is the third alternative, namely Lantamal XIII Makassar with a total value of 0.218.

5. CONCLUSIONS

After carrying out the entire research process, conclusions can be formulated based on the results of research methods and data processing and analysis, so the following conclusions can be drawn:

a. The decision-making process for determining the location of the Arsenal area can be modeled by applying the *Fuzzy Multi Criteria Decision Maker* model

b. Based on the results of literature studies and consultation with experts in determining the location of the Arsenal area for the Koarmada II area based on qualitative and quantitative criteria as consideration, the best location is obtained from alternative locations in the region.

c. The decision-making process in determining the location of Arsenal's warehouse was carried out by several experts as decision makers, namely Kadissenlekal, Kadisfaslanal, Kaarsenal and Asops Koarmada II, so that each decision maker will provide a different subjective assessment of the available alternative locations. Fuzzy algorithm is applied to the determination of warehouse location in Arsenal area, because it can eliminate the fuzziness or fuzziness of qualitative criteria data which have high subjective value.

d. Based on data processing using the Fuzzy MCDM method, the best location for the Arsenal warehouse location is Lantamal XIII Tarakan with the highest total ranking value of 0.218 then Lantamal VII Manado with a value of 0.216 and Lantamal VI Makassar with a value of 0.192.

ACKNOWLEDGEMENTS

The authors greatly acknowledge the support from Indonesian Naval Technology Collage for providing necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

REFERENCE

Andi. (2002). *Ilmu Dasar Pergudangan.* Jakarta: Salemba Empat.

Crispin, S. W. (2016, Agustus 3). *The Diplomat-ASEAN-Beat.* Diambil kembali dari Diplomat.com: http://thediplomat.com/2016/08/will-vietnam-file-a-south-china-sea-case-against-china/

Franky. (2000). *Database Pergudangan.* Bandung.

Hadiguna, R. A., & Setiawan, H. (2008). *Tata Letak Pabrik.* Yogyakarta: ANDI.

Jantzen, J. (1998). *Tutorial on Fuzzy Logic.* Lyngby, Denmark: Departement Of Automation Technical University of Denmark.

June, D. (2014). *Penentuan Lokasi Gudang Pendukung Arsnal di Koarmatim dengan Metode Analityc Hierarchy Process (AHP) dan Systematic Layout Planning (SLP) .* Surabaya: Sekolah Tinggi Teknologi Angkatan Laut.

Kementerian Pekerjaan Umum . (2010). *Peta Hazar Gempa Indonesia Sebagai Acuan Dasar Perencanaan dan Perancangan Infrastruktur Tahan Gempa.* Jakarta: Kementerian PU.

Kementrian Pekerjaan Umum. (2010). *Peta Hazard Gempa Indonesia 2010 sebagai acuan dasar Perencanaan dan Perancangan Infrastruktur Tahan Gempa.* Jakarta: Kementrian PU.

KEP KASAL NOMOR KEP/31/VII/1997. (1997). *Organisasi dan Prosedur Dinas Material Senjata Elektronika TNI Angkatan Laut.* Jakarta: TNI Angkatan Laut.

KEP/31/VII/1997, K. K. (1997). *Organisasi &Prosedur Dinas Material Senjata Elektronika TNI AL .* Jakarta: Mabesal.

Liang, & Wang. (1999). A Hierarchy *Fuzzy* MCDM method for studying electronic marketing strategies in the information service industry. *Jurnal of International Information Management*, vol 8.

Pascal. (2016). *China Diduga Tingkatkan Belanja Pertahanan di Laut China Selatan.* Jakarta: Kompas.

Perkasal No 17. (2008). *Tata Cara Penyimpanan Amunisi di Lingkungan TNI AL.* Jakarta: TNI Angkatan Laut.

Perkasal Nomor 24. (2015). *Kebijakan Strategis TNI AL tahun 2015 Sampai Dengan 2019.* Jakarta: TNI Angkatan Laut.

PUM 7.03. (2013). *Standarisasi Pangkalan TNI AL.* Jakarta: TNI Angkatan Laut.

Sritomo Wignjosoebroto. (2003). *Tata Letak Pabrik dan Pemindahan Bahan.* Surabaya: Gunawidya.

Tsoukalas. (1997). *Fuzzy and Neural Approaches in Engineering.* New York: Jhon Willey and Son, Inc.

Undang-Undang Nomor 34. (2004). *Tentara Nasional Indonesia.* Jakarta: Indonesia.

Zadeh, L. A. (1965). *Fuzzy Set. Information and Control.*

STRATEGIES TO IMPROVE OPERATIONAL READINESS OF THE INDONESIAN NAVY'S ANTI-SUBMARINE HELICOPTERS IN ANTI-SUBMARINE WARFARE USING THE TECHNOMETRIC METHOD

Muksin[1], Udi Subhakti[2], Sutrisno[3]

[1,3]Indonesian Naval Technology College Bumimoro - Krembangan, Surabaya 60187, Indonesia
[2]Industrial Engineering Department, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia

ABSTRACT

Naval operational readiness is readiness in building operational readiness for naval defense through budget fulfillment, utilization of existing resources, procurement and naval modernization by paying attention to Life Cycle Cost, and interoperability while still paying attention to paradigm shifts in naval capability.Combat readiness is the condition of the Indonesian Navy's defense equipment and its constituent units, resources and personnel, weapon systems and other military technology equipment in a condition that is ready to carry out military operations in an unspecified time, or function consistent with the purpose for which the defense equipment is organized or designed. , the management of resources and training personnel in preparation for combat in the face of the threat of modern warfare in a state of constant combat readiness. At this time, training in Anti-Submarine Warfare conducted by Indonesian Navy's Helicopter is still limited to carrying out flight procedures, communication procedures with the KRI and the command line, because Helicopters have sensors, weapons and command that need to be upgraded and The personnel also have underwater warfare capabilities that need to be upgraded, so there needs to be an increase in the capability of the helicopter and human resources. Technometry will be used to calculate the Heli's current readiness level.

Keywords: *Operational readiness*, *Technometic.*

1. INTRODUCTION

The development of the global, regional and national strategic environment has become the basis for determining national political policies, including defense and security. Currently submarines are the most strategic weapons in the world that can provide a deterrence effect which has a very significant impact on the maritime powers of the countries operating them in the era of generation 4.0 war. The pattern of relevant combat tactics needs to be applied in Indonesian Archipelago Waters when faced with areas of vulnerability and choke points, geographical constellations and sea contours.

Advances in weaponry technology have allowed aircraft to carry out attacks against sea opponents. Attacking naval battles using airplanes will greatly benefit our comrades, because in this case, in naval battles, it is not necessary to always confront the ship with an opponent who poses a very high risk. Operational readiness is very important, there are readiness in building operational readiness for naval defense through budget fulfillment, utilization of existing resources, procurement and naval modernization by paying attention to Life Cycle Cost, and interoperability while still paying attention to paradigm shifts in naval capability. It is useful to support combat readiness that is the condition of the Indonesian Navy's defense equipment and its constituent units, resources and personnel, weapon systems and other military technology equipment in a condition that is ready to carry out military operations in an unspecified time, or function consistent with the purpose for which the defense equipment is organized or designed. , the management of resources and training personnel in preparation for combat in the face of the threat of modern warfare in a state of constant combat readiness.

At this time, training in Anti-Submarine Warfare conducted by Indonesian Navy's Helicopter is still limited to carrying out flight procedures, communication procedures with the KRI and the command line, because Helicopters have sensors, weapons and command that need to be upgraded and The personnel also have underwater warfare capabilities that need to be upgraded. The question in this research is whether the Indonesian Navy's military strength, especially helicopters, has been able to overcome and anticipate threats and challenges to national maritime security. What is the actual condition of the capability in ASW (Anti Submarine Warfare) at this time when faced with the development of threats from the modern generation of warfare, faced with developments in science and technology, and faced with the strategy of building the operational strength of the Indonesian Navy in responding to challenges and anticipating threats to the sovereignty of the Republic of Indonesia in the future.

2. MATERIAL AND METHOD

2.1 Literature Review

In conducting current research, there are several relevant studies in the form of theories or findings in supporting problem solving. Researchers have conducted from either similar or different object, subject and approach methods used. This research identifies or studies the current level of Helicopter capability by providing a concrete threat benchmark basis, as well as analyzing technology forecasting and technological requirements that must be had in increasing operational readiness in the face of ASW (Anti Submarine Warfare).

2.2 Strategic Management Concepts

Strategic management can be defined as the art and science of formulating, implementing, and evaluating cross-functional decisions that enable an organization to achieve its goals. The term strategic management is synonymous with the term strategic planning more often used in the business world, while the former is often used in academia (David, 2011). Therefore, strategic management emphasizes monitoring and evaluating external opportunities and threats by considering the strengths and weaknesses of the company (Wheelen & Hunger, 2012). Strategic management is a set of managerial decisions and actions that determine the long-term performance of a company. This includes environmental scanning (both external and internal), strategy formulation (strategic or long-term planning), strategy implementation, and evaluation and control.

2.3 Operational Readiness

The operational readiness of the navy is readiness in building operational readiness for naval defense through budget fulfillment, utilization of existing resources, procurement and naval modernization by paying attention to Life Cycle Cost, and interoperability while still paying attention to the paradigm shift in naval capability in the 21st century. will determine current technology adoption (FICCI and KOAN, 2018). Military capability is the ability to achieve specified war objectives, for example winning battles or wars or destroying targets, which in broad terms cannot be easily quantified (Department of Defense, 2010)

2.4 Concept of Technology Management with Technometrics

Mastery of technology is one of the most important parts of the "Technology Management" discipline, and represents a process that must be managed in a systematic approach from start to finish. Narin et.al (1997) suggest that there is a continuum that extends from a variety of basic scientific research writing, through research and applied technology. The most active areas of high-tech growth are often very knowledge-intensive areas. Mackenzie and Wacjman (1985) suggest that technology is more than a product of scientific activity. Technology includes important normative, social, political, and ethical aspects, among others. As such, technology includes what is made and how things are made. In turn, the social and economic contexts are shaped by the technology that is produced and used. And through technology humans have acquired a strong ability to transform their natural environment locally, regionally and globally. The degree of sophistication for each technology component is based on the Technology Readiness Level of the Department of Defense (DoD) in the Defense Acquisition Guidebook 2010, according to the following table:

Table 1. Technology Readiness Level of DoD

score	TRL
1	Basic principles observed and reported)
2	Technology concept and/or application formulated
3	Analytical and experimental critical function and/or characteristic proof of concept
4	Component and/or breadboard validation in laboratory environment
5	Component and/or breadboard validation in relevant environment
6	System/subsystem model or prototype demonstration in a relevant environment
7	System prototype demonstration in an operational environment
8	Actual system completed and qualified through test and demonstration
9	Actual system proven through successful mission operations)

There are four technology components: (1) humanware; (2) infoware; (3) orgaware; and (4) technoware (Sharif, 1993). The four components interact dynamically to determine the level of mastery of technology. In principle, there are four levels of mastery of technology, starting from the lowest being operative ability, aquisitive ability, supportive ability, and innovative ability. According to UNESCAP (United Nation Economic and Social Commission for Asia and the Pacific) in Pradana (2011), technology is a combination of 4 basic components, namely technoware, humanware, inforware, and organware (THIO) which interact with one another in a transformation process.

The contribution value of each technology component item is calculated using the input value of the sophistication level limit and the state of the art rating, using the following formula:

1. State of the art for item **i** from technoware :

$$ST_i = 1/10 \sum_k \left(\frac{t_{ik}}{t_k} \right)$$

2. State of the art for item **j** of humanware :

$$SH_j = 1/10 \sum_l \left(\frac{h_{jl}}{h_l} \right)$$

3. State of the art for infoware :

$$SI = 1/10 \sum_m \left(\frac{f_m}{mf} \right)$$

4. State of the art for orgaware

$$SO = 1/10 \sum_n \left(\frac{o_n}{on} \right)$$

Contribution of each Technology Component (component contribution). Based on the limits for the level of sophistication and the state-of-the-art rating above, the contribution of each technology component can be calculated based on the following equation:

Ti = 1/9 [LTi + STi (UTi – LTi)]
Hj = 1/9 [LHj + SHj (UHj – LHj)]
I = 1/9 [LI + SI (UI – LI)]
O = 1/9 [LO + SO (UO – LO)]

To achieve the total contribution of all items, the values of Ti and Hj must be aggregated using appropriate weights based on the following formula:

$$T = \frac{\sum ui\, Ti}{\sum ui}$$

$$H = \frac{\sum vj\, Hj}{\sum vj}$$

Ui refers to the technoware investment cost for item i and Vj refers to the total labor for category j

Technology Contribution Coefficient (TCC) can be calculated using equation (1). Since the values 0 <T, H, I, O <1 and βt + βh + βi + βo = 1 (after normalizing), the maximum value of TCC is equal to one. The TCC rating scale and the level of the technology contribution coefficient can be determined based on the following table:

Table 2. TCC Rating Scale and Value Level

Score TCC	Value Level
0,1	Very bad
0,3	Bad
0,5	Moderate
0,7	good
0,9	Very good
1,0	Reaching *state of the art*

The technometry will be used to calculate the Heli's current readiness level, so as to determine strategic steps to increase operational readiness.

2.5 Analytical Hierarchy Proces (AHP) concept

The Analytic Hierarchy Process (AHP) is a theory developed by Thomas Saaty for measuring intangible factors through paired comparisons using judgments from a 1 to 9 fundamental scale and resulting in priorities for the factors. It can be applied to both tangibles and intangibles and is used for decision making by structuring a hierarchical model with a goal, criteria (sub-criteria), and alternatives then making pairwise comparison judgments about the dominance of groups of elements in a level below with respect to the element from which they are connected in the level above. In the end the priorities of all the elements are synthesized to rank the alternatives. These simple hierarchies can be extended to multi-level decision models with hierarchies of benefits, opportunities, costs and risks.

The AHP has been applied in many areas including resource allocation and conflict resolution. There are numerous intangibles that have great impact that we must first measure before we can include them as variables. What is most significant is that intangibles can only be measured through expert judgment and only relative to the goals of concern in a particular situation. In this study, AHP is used to measure the intensity or weight of each main aspect of each technology component by analyzing using pairwise comparisons of each criteria.

3. DATA ANALYSIS AND INTERPRETATION METHOD

Ability in Anti-Submarine Warfare by Indonesian Navy Helicopters in supporting the Operational Readiness concept is defined as an element that has operational readiness in accordance with its main task as Anti Submarine Helicopters in carrying out operational tasks by considering the readiness of personnel, platforms (engines and fuselage), sewaco. (sensors, weapons, command) and logistics. The first step is to analyze the assessment of technology components and operational stages and determine benchmarks so that research gaps can be identified. The next step is to conduct an analysis using technometrics on the status of technology, technological capabilities, technology content, and technology requirements. The results of this analysis are used to determine strategic steps in increasing the ASW (Anti Submarine Warfare) capability of Indonesian Navy helicopters on aspects of human resource readiness and readiness (platform and sewaco).

3.1 The stages of readiness

Helicopter operations towards Operational Ready served on the following diagram below:

Fly worthy
readiness of personnel
readiness of platform
readiness of logistic
readiness of sewaco

↓

Practice worthy
Manual exercice — EW ex
Regional naval control — ASW ex
Navigation — ASUW ex
System weapon — AJP
Flying and work safety in air operations
SBO — Vertrep
SAR — AME
Dropping — Air landed
Maritime Air Patrol

↓

Mission ready
ASW
ASUW
Humanitary assistance
SAR
Maritime air patrol

Figure 1. Helicopter Operations

3.2 Benchmarking of potential threats

Based on previous research, a thesis with the title strategy to increase the operational capability of the KRI in Koarmada II in supporting the operational ready force concept of the Indonesian Navy, author Harun Bekti ariyoko, STTAL – Surabaya. Based on the background of the development of threats, the State can be used as a benchmark for the direction of threats obtained through interviews with experts. Benchmarck Can be analyzed by several approaches.

a. Benchmark countries increase the intensity of safeguarding the waters of the ZEE which are claimed to be part of their country's sovereign sea area.

b. The benchmark country has significant trade competition, and there is no reciprocal advantage.

c. Benchmark countries have high morale in securing the territory of their country.

Then the determination of the direction of threats based on the criteria approach with the status of defense technology and technology capabilities, border problems, trade relations, the history of war with a country that has a strong military power, the direction of future threats is predicted to come from Vietnam.

3.3 Analysis of the Technology Status Indonesian Navy's Anti-Submarine Helicopters

The type of helicopter that was carried out on the technology status assessment is AS565 MBe Panther. Technology status assessment is one of the important steps in formulating technology transfer policies and developing technology selection strategies, so that technology development and technological competitiveness advantages can be achieved appropriately, quickly and efficiently in order to obtain an increase in its operational capabilities. Through the Technology Status assessment approach (ESCAP 1988), qualitative and quantitative identification and studies can be carried out. There are three indicators to show the status of technology in this approach : (technological gap), (technological change) and (technology life cycle). In this research, it is limited to only technology gap approach.

Table 3. Indicators to Show the Technology Status

no	Technology	Indonesia	ability	Vietnam	Ability
1	Sensor	Raytheon Whitehead A244/S. DS-100 HELRAS	60nm	planar E-801M OKO MAD dipping sonar	40nm
2	Weapon	Rockets : 68 mm or 70 mm unguided rocket Missiles : - Mistral air to air Missile - As 15 TT anti surface missile - HOT anti-tank missile - Mk 46 white head – ASW torpedoes	- - - - - -	Torpedoes: AT-1M VTT-1 UMGT-1 orlan APN-2 yastreb 36 RGD-NM RGB-NM-1 7.62 machine gun 30mm cannon 2A42	 1 1 1 1 1 1 1 1
3	Radio	V/UHF ICS PIA AM/FM	- - - -	V/UHF ICS PIA AM/FM	- - - -
4	Platform	Capacity Length Rotor Diameter Height Empty Weight Gross Weight Powerplant Maximum speed	10 13.68m 11.94m 3.97m 2380kg 4300kg 852hp 190mph	Capacity Length Rotor Diameter Height Empty Weight Gross Weight Powerplant Maximum speed	16 11.3m 15.8m 5.5m 6500kg 11000kg 2230hp 127mph
5	Number	Panther	11	Kamov-27	6

Globally Panther helicopters are better on platforms and sensors, but the biggest gap is in weaponry capabilities, where Vietnam is superior because each helicopter is equipped with weapons, The number of Indonesian helicopters is more than vietnam.

Table 4. Technology Status

Technology status	
strengh	explanation
Technology gap Substitution of technology Diffusion of technology Analysis technology innovation	Indonesia's technology is parallel to Vietnam Revitalization According to the type of KRI Independence in procuring helicopters
weakness	explanation
Technology gap Substitution technology Budget analysis Analysis technology innovation	The Indonesian Navy's anti-submarine helicopter weaponry is below Vietnam's weaponry capability Weapon revitalization Budget increase is less significant independence in the procurement of weapons

3.3.1. Development stage of human resources in anti-submarine helicopters

The human resources development stage is a holistic effort by considering the dynamics of the strategic environment and the demands of the assignment in the face of real conditions and budget availability, resulting in a priority, stages of human resource development that can change dynamically according to the level of achievement at the previous stage and developments in field.

Table 5. Development stage of human resources in anti-submarine helicopters

Degree of technical sophistication of the device		
	Indonesia	Vietnam
Maritime intelligence capabilities	7	9
Defense ability	7	9
Cooperative engagement capability	7	9

3.3.2. Information Development Stage in Anti-Submarine Helicopters

Military communication technology is critical to the success of an operation. The development of information and communication technology demands the implementation of an increasingly complex operation degree where the guarantee of smooth, robust, secure and trustworthy communication. Development of information tools based on the criteria for assessing the strength and capabilities of the two countries:

Table 6. Development Stage in Anti- Submarine Helicopters

Degree of technical sophistication of the device		
	Indonesia	Vietnam
Maritime intelligence capabilities	8	9
Defense ability	8	9
Cooperative engagement capability	8	9

3.3.3. The development stage of the organizational

It is hoped that the Indonesian Navy organization will become an organization capable of ensuring the implementation of the development and operation aspects of defense equipment, especially in anti-submarine helicopters that are capable of facing threats in different trouble spots.

Table 7. Development Stage of the Organizational

Degree of technical sophistication of the device		
	Indonesia	Vietnam
Maritime intelligence capabilities	8	9
Defense ability	8	9
Cooperative engagement capability	8	9

From the results of the analysis of technological capabilities in Indonesia and Vietnam, it can be concluded that the development of human resources in Indonesia in using technical tools has the highest gap compared to the development of information tools and the development of organizational instruments. This is because the factors in carrying out the exercises are still using many assumptions, in any implementation of HR training that is owned has never carried out in real time and is in accordance with real conditions.

The results of the analysis of the calculation of technological capabilities are presented in the form of table data below :

Table 8. Analysis of the calculation of technological capabilities

Analysis factor	Indonesia	Vietnam	Gap
HR development	21	27	6
Information development	24	27	3
Organizational development	24	27	3

The results of the analysis of technological capabilities, if based on information and data, will provide an overview of the weaknesses and strengths of the capabilities of anti-submarine helicopter technology. Supported by the ability to develop human resources in manning the ever-developing technical equipment.

3.4 Analysis of Component Content Analysis of anti-submarine helicopter technology

Estimation of the degree of sophistication of the technology component is carried out by assessing the actual conditions of the technology used. Assessment refers to the UNESCAP (1989) assessment procedure, with the recommended scoring method for all four technology components.
The degree of sophistication for each technology component is based on the Technology Readiness Level of the Department of Defense.

Table 9. Degree of Sophistication for Each Technology Component

The level of sophistication of technological components				
Technoware	Humanware	Infoware	Orgaware	score
Manual tools	Able to use	Able to provide and manage data	Small organization	1 2 3
Mechanic tools	Able to install	Able to provide and manage data	The organization begins to collaborate	2 3 4
General function equipment	Able to care	Able to provide and manage data	Organizations start to have networks	3 4 5
Special function equipment	Able to fix	Able to provide and manage data	The organization have a network, collaborations, continued to grow	4 5 6
Automatic equipment	Able to develop	Able to provide and analyze data information	Organization has a collaborative network and continues to grow	5 6 7
Computerized equipment	Able to innovate	Able to provide, analyze and process data	Organizations are able to develop and compete	6 7 8
Integrated equipment and facilities	Able to do their own innovation	Able to provide, analyze, process and manage data	the organization develops, is able to compete and is able to become a leader and establish international relations	7 8 9

Technology components have their own unique identity but in the implementation of technological activities all of these components interact with one another. The interaction of each technology component will show different contributions according to time, place, and actors in achieving the goal.

3.4.1 Transformation Stages in an Operational Process on an Anti-Submarine Helicopter

To describe the transformation process in preparing anti-submarine helicopters for operational readiness, it can be simplified into important stages as follows:

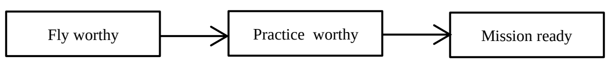


Figure 2. Transformation Stages

3.4.2 Degree of sophisticated technology components in anti-submarine helicopters

The degree of sophistication of the technology component is determined by giving a scale score ranging from 1-9. The estimation results will provide the upper limit / UL and lower limit / LL for each technology component.

Table 10. Degree of Sophisticated Technology

Technology Components	indonesia		vietnam	
	UL	LL	UL	LL
Technoware				
Fly worthy				
readiness of personnel	7	9	7	9
readiness of platform	7	9	7	9
readiness of logistic	6	8	7	9
readiness of sewaco	6	9	7	9
Practice worthy				
Manual exercice	7	9	7	9
EW ex	7	9	7	9
Regional naval control	7	9	7	9
ASW ex	7	9	7	9
Navigation	7	9	7	9
ASUW ex	7	9	7	9
System weapon	7	9	7	9
AJP	7	9	7	9
Flying and work safety in air operations	7	9	7	9
SBO	7	9	7	9
Vertrep	7	9	7	9
SAR	7	9	7	9
AME	7	9	7	9
Dropping	7	9	7	9
Air landed	7	9	7	9
Maritime Air Patrol	7	9	7	9
Mission ready				
ASW	7	9	7	9
ASUW	7	9	7	9
Humanitary assistance	7	9	7	9
SAR	7	9	7	9
Maritime air patrol	7	9	7	9
Humanware				
Pilot	7	9	7	9
Co-pilot	7	9	7	9
Crew	7	9	7	9
Infoware	7	9	7	9
Orgaware	7	9	7	9

3.4.3 State of the Art (SOTA) Calculation

The state of the art of each technology component is scored based on the assessment criteria for the complexity of the technology component in the anti-submarine helicopter determined by the expert according to the table.

Table 11. State of The Art (SOTA) Calculation

Criteria	Indonesia		Vietnam	
	Criteria score	Score	Criteria score	Score
Fly worthy				
readiness of personnel	Qualitative	8	Quantitative	9
readiness of platform	Qualitative	8	Quantitative	9
readiness of logistic	Qualitative	8	Quantitative	9
readiness of sewaco	Qualitative	8	Quantitative	9
Practice worthy				
Manual exercice	Quantitative	8	Quantitative	9
EW ex	Quantitative	8	Quantitative	9
Regional naval control	Quantitative	8	Quantitative	9
ASW ex	Quantitative	7	Quantitative	9
Navigation	Quantitative	8	Quantitative	9
ASUW ex	Quantitative	7	Quantitative	9
System weapon	Quantitative	8	Quantitative	9
AJP	Quantitative	9	Quantitative	9
Flying and work safety in air operations	Quantitative	9	Quantitative	9
SBO	Quantitative	8	Quantitative	9
Vertrep	Quantitative	8	Quantitative	9
SAR	Quantitative	9	Quantitative	9
AME	Quantitative	8	Quantitative	9
Dropping	Quantitative	9	Quantitative	9
Air landed	Quantitative	9	Quantitative	9
Maritime Air Patrol	Quantitative	9	Quantitative	9
Mission ready				
ASW	Quantitative	7	Quantitative	9
ASUW	Quantitative	8	Quantitative	9
Humanitary assistance	Quantitative	8	Quantitative	9
SAR	Quantitative	9	Quantitative	9
Maritime air patrol	Quantitative	9	Quantitative	9

3.4.4. Calculation Technology Coefficient Contribution (TCC)

Table 12. Calculation Technology Coefficient Contribution (TCC)

Technology Components	TCC						gap
	indonesia			vietnam			
	Contribution Value	Intencity	TCC	Contribution Value	Intencity	TCC	
Technoware	34,2	0,19	6,5	35,12	0,19	6,67	0,17
Humanware	29,69	0,15	4,45	33,05	0,15	4,96	0,50
Infoware	23,60	0,3	7,08	24,39	0,3	7,32	0,24
Orgaware	31,36	0,33	10,35	32,22	0,33	10,63	0,29

3.10 Technology Needs to support the Operational Readiness

Technology needs to increase capabilities in the operational and direction fields according to general, specific, and integrated technology needs:

a. General technology : Navigation Radar, Implementing transfer of technology with the long-term goal of creating its own radar and weapons.
b. Specific technology : fire control radar, torpedo weapon, ASM, machine gun; research and development and engineering of radar, sonar, CIWS and ASM equipment.
c. Intregated technology : Integrated Combat System updated, Self-produced Radar, Sonar, CIWS, ASM and Integrated Combat System tools.

4. RESULT AND DISCUSSION

The result from the data analysis and calculation above are:
a. Strategy 1. Implement budget efficiency and effectiveness for increasing the number of weapons and completing the sewaco system.
b. Strategy 2. Improve the pattern of logistics development in maintenance and maintenance to increase the pattern of degrees in support of presence at sea at all times
c. Strategy 3. Increase the use of domestically produced defense equipment, the results of research, development and technology engineering in accordance with the government's commitment to develop the national defense industry.
d. Strategy 4. Increasing the capability and professionalism of equipment manning including materials, platforms, weapons, radar, communications, and facilities and infrastructure.
e. Strategy 5. Optimizing operational and procurement, repair and maintenance budgets to prepare and improve helicopter operations and combat capabilities
f. Strategy 6. Increasing the intensity of cooperation for operations and training as well as supporting naval diplomacy.

5. CONCLUSION

By identifying capabilities through the Technology Status Analysis, the capabilities between Indonesian Navy helicopters and Vietnamese helicopters are almost equal, but long distances are within the capabilities of technoware in procuring missiles independently. In the analysis of technological capabilities, there is a huge gap in HR development. Meanwhile, in the analysis of the content of technology contributions, there is a big gap in the humanware component. This shows that the capabilities of the helicopter in terms of infoware and orgaware components are not that far away, in terms of technoware components there is a large gap in the capabilities of the weapons components owned, besides that there is also a gap in the humanware component. So it is necessary to increase the human resource capacity of its soldiers through education and training

The results of the analysis of technological needs in the modern era, an important and urgent need to be met is the adjustment and dynamism of the Doctrine of Warfare, increasing the capability of personnel, updating and researching platforms and Radar equipment and Weapons and Communications

The formulated strategy is to increase the capability of the Soldier's human resources in supporting the readiness of helicopter combat operations in facing ASW and the strategic aspects of increasing readiness capabilities (Platform and Sewaco).

The results of the Risk Assessment analysis show that the steps that must be taken are Correction Required (need to be corrected immediately), this means that there is a need for immediate evaluation and correction in order to increase capacity through routine and directed and measured training steps that have concrete objectives.

ACKNOWLEDGEMENTS

The authors would like to thank the supervisors, commanders and staff of STTAL, the Indonesian Navy flight command and training commander, air wing 2 operational staff, the 400 air squadron commander and all colleagues who helped complete this paper. With all our humility and limited knowledge, we realize that there are still many shortcomings and are still far from perfection in writing this paper, therefore criticism and suggestions from readers really hope for improvement and can provide input for future writers, for the fix. Finally, I hope that the results of writing this paper can be useful for the development of knowledge for writers in particular and for readers in general.

REFERENCE

Department of Defence. (2010). *Defence Acquisition Guidebook*. USA: Department of Defence

Harun, B., (2019) *Strategi peningkatan kemampuan operasi KRI di koarmada II dalam mendukung konsep Operational Ready Force TNI Angkatan Laut*. Surabaya: STTAL

Mabesal,(1988). *Buku Petunjuk Taktis Penerbangan TNI Angkatan Laut*. Jakarta: Mabesal

Mabesal. (1989). *Buku petunjuk Pengintaian Taktis Udara TNI AL*. Jakarta: Mabesal.

Mabesal. (2009). *Perkasal Nomor Perkasal/35/V/2009 tanggal 19 Mei 2009 tentang Pokok-Pokok Organisasi dan Prosedur Pusat Penerbangan TNI Angkatan Laut.* Jakarta : Mabesal

Mabesal. (2018) Rencana Strategi Penerbangan TNI AL Tahun 2020-2024. Jakarta: Mabesal

Mabesal. (2019). Kebijakan Perencanaan TNI Angkatan Laut Tahun 2020. Jakarta: Mabesal

Puspenerbal. (2009). *Penerbangan Laut Wing Buku Taktik Udara* . Jakarta: Puspenerbal

Saaty, T. (1987). The analytic hierarchy process – what is it and how it is used. *International journal of math modelling*, 167-176

Saaty,T. & Sodenkamp, M. (2008). Making Decisions In Hierarchic And Network System. *International Journal of Applied Decision Sciences*, 24-79.

David, F. R. (2011). *Strategic management: Concepts and Cases* (14th ed.). Person Academic

United States Coast Guard, (1999). *Operational Risk Management* (ORM): *COMDTINST 3500.3*. Washington: US.*Department of Transportation United States Coast Guard*

TIME-COST TRADE-OFF ANALYSIS ON JETTY CONSTRUCTION PROJECT (CASE STUDY : INDONESIAN NAVY JETTY CONSTRUCTION PROJECT)

Raditya Novianto[1], Avando Bastari[2], Abdul Rahman[3]

[1,2,3]*Indonesian Naval Technology College,*
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia

ABSTRACT

The performance of a project can be assessed based on the aspects of time, cost, and quality. The project is said to be successful when it can achieve the goals in the form of these three aspects by the initial planning. But the reality on the ground, often project implementation is not following the plan, resulting in project delays. Contractors can overcome the delay through various methods of accelerating time. This study aims to determine the acceleration of time through the Time-Cost Trade-Off analysis on The Indonesian Navy Jetty Construction Project in Saumlaki (Phase I) by comparing alternative methods of overtime and additional manpower. The analysis was carried out by using a quantitative descriptive method. The data used is secondary data such as of related documents, Bill of Quantity, S Curve, work volume, list of wages, and a number of workers. The calculation results show that acceleration using overtime alternatives can reduce 18 days or 6.98% of the implementation duration with a reduction in costs of IDR. 1,220,546,167.00 of the total cost of implementation (efficiency 1.8%). Additional manpower can reduce the duration for 19 days or by 7.36% with a reduction of IDR. 1,076,481,972.00 (1.61% efficiency). So that in this study it was found that the alternative of working overtime was more efficient than the alternative of additional manpower.

Keywords : *Scheduling, PDM, Crashing,*

1. INTRODUCTION.

A port is one of the important infrastructures in the maritime world which consists of land and waters around it with certain boundaries as a place of activity for government and economic activities which is used as a place for ships to dock, anchor, pick up and drop off passengers and load and load-unload cargo equipped with shipping safety facilities and port support activities as well as a place for intramodal and intermodal transport, Widyatmoko (2008). The port serves as a gateway and facilitates relations between regions, islands, or even between continents and nations. With this function, the port construction project must be accountable socially, economically, and technically.

The project is said to be successful if the goals set are achieved and meet quality standards of time and cost. In general, project planning which consists of scheduling, budgeting and quality serves as the main basis that will lead a project to success. Scheduling is one component of planning results in terms of resource performance in the form of project duration, costs, manpower, materials and equipment that can provide information about the project implementation schedule and project progress. The work implementation schedule is planned in such a way as to be carried out on time, however in practice in the field often it is not in accordance with the determined planning so the project delays often occur. Project implementers need to accelerate time as a solution to the delay. The consequence of the accelerated project time is the increase in direct costs. Therefore, a Time-Cost Trade- Off (TCTO) analysis is needed in order to obtain optimal results. Crashing is a method that can be used to accelerate projects. Crashing is a deliberate, systematic and analytic process by testing all activities in a project that are focused on critical path activities (Soeharto, 1999). This research was conducted by analyzing the crashing method and using a case study on the Indonesian Navy Jetty Construction Project in Saumlaki Phase

I which experienced delays. This project is targeted for completion on September 13, 2019, with an implementation time of 240 working days. With the acceleration, it is expected to be used as an evaluation material so that the continuation of the project for the next step can be completed on time even faster than the initial planning. Efforts to accelerate it are carried out by using the alternative of adding working hours and increasing the manpower.

Previous research that has a relationship with this problem / research was carried out by, among others, Ririh, K. R., & Hidayah, N. Y. (2020) in a study entitled Reducing Project Duration of an Apartment Project by Waskita Karya using the Crashing Method. Ballesteros-Perez, P., Elamrousy, K. M., & Gonzalez-Cruz, M. C. (2019) studied Non-Linear Time-Cost Trade-Off Models of Activity Crashing: Application to Construction Scheduling and Project Compression with Fast-Tracking. Feylizadeh, M. R., Mahmoudi, A., BagheIDRour, M., & Li, D. F. (2018) in a study entitled Project Crashing using a Fuzzy Multi-Objective Model Considering Time, Cost, Quality and Risk Under Fast Tracking Technique: A case study. Novitasari, AD, Sandora, R., & Lestari, RL (2018) in their research entitled Project Scheduling Analysis using Presedence Diagram Method (PDM). In another title, Scheduling Project Crashing Time Using Linear Programming Approach: Case Study was researched by Chitra, K., & Halder, P. (2017). Another study entitled Monitoring and Controlling RCC Work in Delayed Construction Projects by Gujarati, N., & Balapgol, B. S. (2016). In this study, a network analysis in the form of the Precedent Diagram (PDM) method was carried out using the Ms Project 2016 application in order to obtain jobs on the critical path. Work that falls into the critical trajectory will be carried out by crashing calculations by adding work hours (overtime) and additional manpower. From the two alternatives to calculate the project acceleration, the final result of this research will be obtained in the form of a more efficient project time acceleration and cost.

2. MATERIAL AND METHOD

Project scheduling is one of the elements of planning results, which can provide information about the schedule of plans and project progress in terms of resource performance in the form of costs, manpower, equipment and materials as well as project duration plans and time progress for project completion (Husen, 2009). The precedent diagram (PDM) method is a node which is generally in the form of a rectangle, while the arrows are only a pointer to the relationship between the various activities concerned (Nurjaman, K et al, 2014). Time cost trade off is a deliberate, systematic and analytical process by testing all activities in a project that are focused on critical path activities (Erwianto, 2004).

2.1. Project Costs

a. Direct costs for the project include direct costs for manpower (wages for manpowerers, foremen, workers), materials and materials needed, and costs for the use of equipment that are closely related to project activities. Direct costs of a project are the total amount of each activity.

b. Indirect Costs, including project fixed costs which include tractor rental, diesel-electric rental, night guard / security fees, depreciation of equipments, bank interest and so on.

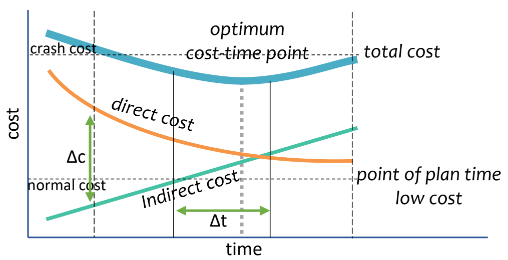


Figure 1. Graph of the Time and Cost Relationship

The method used is to review the slope of each line segment which can provide identification of the effect of costs on reducing project completion time (Nurjaman, K et al, 2014).

2.2. Preparation of Network Planning with the Precedence Diagram (PDM) Method

Precedence Diagram Method (PDM) is a network that is also known as an Activity on Node (AON) because the location of its activity is in the node section. The project schedule obtained is in the form of a block diagram, so that to make it a Network Diagram several steps must be taken to compile it, among others (Nurjaman, K et al, 2014):

- Identify the project scope and break it down into activity components.
- Arrange the components of activity according to the logical sequence of dependencies into a network.
- Provide an estimate of the time span for each job.
- Identification of critical paths, floats, and project completion timelines.
- Increase the efficiency and results in the use of resources.

Figure 2. Node symbol of activity in PDM

2.3. *Crashing the Duration*

There are ways to accelerate the duration of activities in the project, namely (Husen, 2014):

a. Organizing work shifts.
b. Increase working hours or overtime.
c. Use tools more productively.
d. Increase the number of workers.
e. Using faster materials.
f. Using a faster construction method.

2.4. The crashing method procedure is as arranged follows (Soeharto, 1999):

- Make a network planning a series of activities
- Calculate the duration of project completion and identification of PDM
- Determine the normal cost of each activity
- Determine the accelerating cost of each activity
- Determine the cost slope of each activity with the formula:

$$cost\ slope = \frac{crash\ cost - normal\ cost}{normal\ duration - crash\ duration} \quad (1)$$

- Shorten the duration of activities starting from the critical activity path with the lowest cost slope
- If a new critical path is formed during the acceleration process, it will accelerate the critical activities that have the lowest slope combination.
- Continue to reduce activity time until the point of PPC (Point of Project Crashing) or until there is no more critical path.
- Calculate and total direct and indirect costs to find total costs before reducing time.
- Comparing normal costs and acceleration costs with a percentage.

2.5. *Worker Productivity*

Productivity is defined as the ratio between output and input, or it can be said as the ratio between production output and total resources used. In a construction project, the ratio of productivity is the value measured during the construction process; which can be separated into manpower costs, material costs, methods, and tools. The success of a construction project depends on the effectiveness of resource management, and workers are one resource that is not easy to manage. The wages given really depend on the skills of each worker because each worker has their own character that is different from one another.

2.6. Implementation of Additional Working Hours (Overtime)

One strategy to speed up the project completion time is to increase the work hours (overtime) of the workers. The addition of working hours (overtime) is very often done because it can empower existing resources in the field and simply by streamlining the additional costs incurred by the contractor. The normal working time for workers on this project is 8 hours (starting at 08.00 and ending at 17.00 with one hour of rest), then overtime hours are carried out after normal working hours are finished.

Additional working hours (overtime) can be done by adding 1 hour, 2 hours, 3 hours, and 4 hours according to the desired addition time. The greater the addition of overtime hours can cause a decrease in productivity, an indication of the decrease in worker productivity towards the additional working hours (overtime) can be seen in Figure 3. This study uses the assumption of 1 hour of overtime per day.

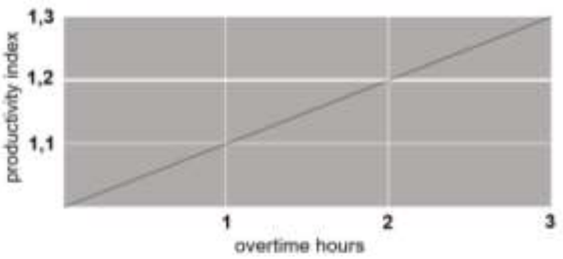


Figure 3. Graph of Decreased Productivity Indication

From the description above, it can be written as follows:

- Daily productivity

$$= \frac{volume}{normal\ duration} \quad (2)$$

- Hourly productivity

$$= \frac{daily\ productivity}{hours\ of\ work\ a\ day} \quad (3)$$

- Daily productivity after a crash

= (Hours of work per day × Hourly productivity) + (a × b × Hourly productivity) (4)

With:

a = duration of additional working hours (overtime)

b = productivity reduction coefficient due to additional working hours (overtime)

- *Crash duration*

$$= \frac{volume}{daily\ productivity\ after\ crash} \quad (5)$$

2.7 Additional Worker Costs (Crash Cost)

The additional working time will increase the cost for manpower from the normal cost of manpower. Based on the Decree of the Minister of Manpower and Transmigration of the Republic of Indonesia Number KEP. 102 / MEN / VI / 2004 that wages for additional work vary. In the addition of the first hour of work, the worker gets an additional wage of 1.5 times the normal hourly wage and in the next additional working hour, the worker will get 2 times the normal hourly wage.

The calculation for additional manpower costs can be formulated as follows:

- Normal manpower costs per day = Daily productivity × Unit price for workers' wages (6)
- Normal hourly manpower costs
  = Hourly productivity × Unit price for workers wages (7)
- Overtime costs for workers
  = 1,5 × the normal hour's wages for the first additional (overtime) hours worked + 2 × n × the normal hour's wages for the next additional hour of work (overtime) (8)

With :

n = the number of additional hours worked (overtime)

- Crash costs of workers per day= (Hours of work per day × Normal manpower cost) + (n × Hourly overtime cost) (9)

2.8. Additional Manpower

The increase in the number of workers will affect the efficiency of the project if it is planned realistically and takes into account several factors, namely the capacity of the job location, the ease and flexibility to do work, supervision of the manpower, and job security. The productivity of additional manpower can be calculated by the following formula:

Crashing productivity = (Normal daily productivity x Number of accelerated workers) / (Number of normal workers) (10)

This study uses the assumption of an additional manpower of 25% of the normal manpower considering the area of the project being undertaken.

2.9. Research methods

The data needed in this study are secondary data. In this study, the secondary data required is in the form of project documents, namely the S curve, details of the cost budget, work volume, list of wages, and the number of workers. After the required data is collected, the crashing process is then carried out. The acceleration process in this study is carried out by emphasizing the duration of activities on the critical path with additional treatment, namely the addition of working hours and additional manpower. After knowing the activities that are on the critical trajectory, then calculating the cost slope. Crashing is performed on activities with the lowest cost slope. The crashing process is repeated several times until it reaches saturation point.

3. RESULT AND DISCUSSION.

3.1. General Project Data

Project name : The Indonesian Navy Jetty Construction in Saumlaki (Phase I).

Project owner : Indonesian Navy

Contractor : X (Ltd)

Budget : IDR.79,367,378,000.00 (including 10% tax)

Time of execution : 240 working days

Start date of work : 17 January 2019

Delay : 18 working days

3.2. Critical Path

Based on data processing with the Ms Project 2016 application, the following critical path are obtained:

Table 1. Critical Path

No	Task Name	Normal Duration	ID	Predecessor
1	Steel Pile Ø 70 cm t 16 mm	42	5.1	1.6SS+53 days
2	Erection fee	42	5.2	5.2SS+33%
3	Pile peel & cut off	42	5.5	5.2SS
4	Pile filling concrete	105	5.6	55SS+50%
5	Single pile cap concrete	119	5.9	51;56ss+7%
6	Longitudinal beam 40/70, K-350	119	5.10	51SS;59
7	Transverse beam 40/70, K-350.	119	5.11	5.10
8	Platform concrete K-350	119	5.12	5.11SS+10%
9	Drainage pipe dia 3"	119	5.13	5.12
10	Cansteen + Ducting concrete	119	5.14	5.13+6%
11	Solar cell lighting lamp	14	5.17	5.14FF

The data above are activities that will be accelerated. Some reasons for selecting activity items in these critical activities are:

a. The selected critical activity has a resousce work or has workers so that it can be crashed.

b. In selected critical activities, acceleration can be done by adding overtime hours or by increasing the number of workers. If an additional manpower is carried out in other critical activities, the number of workers will not increase because these critical activities only have a small manpower index.

3.3. Calculation of Crash Duration and Crash Cost With The Overtime Method

Table 2. Overtime crashing calculations at First Itteration

No.	ID	Task Name	Normal Duration (Dn) (days)	Normal Cost (Cn) (IDR)	Crash Duration (Dc) (days)	Crash Cost (Cc) (IDR)	Cost Slope (Cc-Cn)/(Dn-Dc) (IDR)
1	5.1	Steel Pile Ø 70 cm t 16 mm	42	26.460.000	38	28.428.750	492.188
2	5.2	Erection fee	42	743.820.000	38	799.163.750	13.836.938
3	5.5	Pile peel & cut off	42	70.560.000	38	75.810.000	1.312.500
4	5.6	Pile filing concrete	105	132.300.000	94	140.647.500	758.864
5	5.9	Single pile cap concrete	119	257.040.000	107	274.455.000	1.451.250
6	5.10	Longitudinal beam 40/70, K-350	119	276.080.000	107	294.785.000	1.558.750
7	5.11	Transverse beam 40/70, K-350	119	188.020.000	107	200.758.750	1.061.563
8	5.12	Platform concrete K-350	119	345.100.000	107	368.481.250	1.948.438
9	5.13	Drainage pipe dia 3"	119	80.920.000	107	86.402.500	456.875
10	5.14	Cansteen + Ducting concrete	119	133.280.000	107	142.310.000	752.500
11	5.17	Solar cell lighting lamp	14	7.140.000	13	7.873.125	733.125
		Total		**2.260.720.000**		**2.419.115.625**	

In the first iteration, the results obtained from the acceleration of time to 227 days at a direct cost of IDR. 2,419,115,625.00. The calculation is continued with the second iteration of the new critical path because it has not reached PPC (Point of Project Crashing).

Table 3. Overtime crashing calculations at Second Itteration

ID	Task Name	Normal Duration (Dn) (days)	Normal Cost (Cn) (IDR)	Crash Duration (Dc) (days)	Crash Cost (Cc) (IDR)	Cost Slope (Cc-Cn)/(Dn-Dc) (IDR)
4.1	Rubble stone masonry	63	666.540.000	57	716.133.750	8.265.625
4.2	Armour stone stone masonry	63	1.111.320.000	57	1.194.007.500	13.781.250
4.3	Geotextile non woven	42	211.680.000	38	227.430.000	3.937.500
4.4	Land Fill CBR 30%	91	758.030.000	82	811.133.750	5.900.417
4.5	Lean concrete K-175 on cansteen	7	30.100.000	6	30.637.500	537.500
4.8	Ducting concrete	28	113.120.000	25	119.937.500	2.272.500
4.11	Rigid pavement-concrete K350	35	1.113.000.000	13	1.170.637.500	2.619.886
	Total		**4.003.790.000**		**4.269.917.500**	

The second iteration is carried out on activities 4.5, 4.8 and 4.11. The result of this iteration is that the time acceleration becomes 222 (has reached the Point of Project Crashing) with a direct cost of IDR. 4,269,917,500.00.

3.4. Calculation of Crash Duration and Crash Cost With The Method of Additional Manpower

In the first iteration, the results obtained from the acceleration of time to 233 with a direct cost of IDR. 2,486,400,000.00 according to table 4.

Table 4. Additional manpower crashing calculations at First Itteration

No.	ID	Task Name	Normal Duration (Dn) (days)	Normal Cost (Cn) (Rp)	Crash Duration (Dc) (days)	Crash Cost (Cc) (Rp)	Cost Slope (Cc-Cn)/(Dn-Dc)
1	5.1	Steel Pile Ø 70 cm t 16 mm	42	26.460.000	34	31.220.000	595.000
2	5.2	Erection fee	42	743.820.000	34	898.520.000	19.337.500
3	5.5	Pile peel & cut off	42	70.560.000	34	80.080.000	1.190.000
4	5.6	Pile filling concrete	105	132.300.000	93	145.320.000	1.085.000
5	5.9	Single pile cap concrete	119	257.040.000	105	286.440.000	2.100.000
6	5.10	Longitudinal beam 40/70, K-350	119	276.080.000	105	305.480.000	2.100.000
7	5.11	Transverse beam 40/70, K-350.	119	188.020.000	108	203.140.000	1.374.545
8	5.12	Platform concrete K-350	119	345.100.000	103	388.360.000	2.703.750
9	5.14	Cansteen + Ducting concrete	119	133.280.000	104	147.840.000	970.667
		Total		**2.172.660.000**		**2.486.400.000**	

Then the second iteration is continued to the new critical path because it has not reached the Point of Project Crashing with the results according to table 5.

Table 5. Additional manpower crashing calculations at Second Itteration

No.	ID	Task Name	Normal Duration (Dn) (days)	Normal Cost (Cn) (IDR)	Crash Duration (Dc) (days)	Crash Cost (Cc) (IDR)	Cost Slope (Cc-Cn)/(Dn-Dc)
1	4.5	Lean concrete K-175 on cansteen	7,00	30.100.000	6	36.220.000	6.120.000
2	4.8	Ducting concrete	28,00	113.120.000	23	136.580.000	4.692.000
3	4.11	Rigid pavement-concrete K350	35	1.113.000.000	28	1.344.280.000	33.040.000
		Total		1.256.220.000		1.517.080.000	

The second iteration is carried out on activities 4.5, 4.8 and 4.11. The result of this iteration is the time acceleration to 221 (has reached the Point of Project Crashing) with the required cost of IDR. 1,517,080,000.00.

3.5. Indirect Project Costs

Costs in a project consist of direct costs and indirect costs. Direct costs are costs for everything that will become a permanent component of the final project outcome. Determination of indirect costs based on the results of the project data obtained by the percentage for indirect costs of 2% of the total project value in detail, the calculation is as shown below:

Indirect Cost = 2% x IDR. 72,152,162,704.00 = IDR.1,443,043,254.00

Indirect Cost / day = Indirect Cost / Normal Project Duration = IDR. 1,443,043,254.00 / 240 days

= IDR. 6,012,680.00 / day

3.6. Project Cost and Time Analysis

Based on the analysis and calculation of the project time and costs, the results are in the following table 6. The results of the cost and time calculations can be displayed in a cost and time relationship graph as follows figure 4 :

Table 6. Time and cost analysis

	Normal	Real	Over time	Addition of Manpower
Duration (days)	240	258	222	221
Crast Duration (days)			18	19
Direct Cost (IDR)	64.936.946.434	64.936.946.434	65.361.469.559	65.511.546.434
Indirect Cost (IDR)	1.443.043.254	1.551.271.498	1.334.815.010	1.328.802.330
Indirect Cost/day (IDR)	6.012.680	6.012.680	6.012.680	6.012.680
Total Cost	66.379.989.688	66.488.217.932	66.696.284.569	66.840.348.763
Penalty (1/1000 per day)		1.428.612.804		
	66.379.989.688	67.916.830.736	66.696.284.569	66.840.348.763

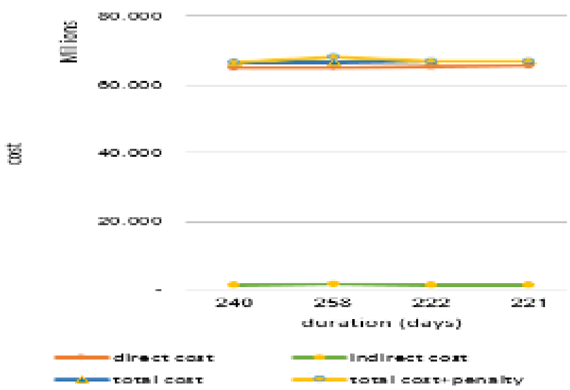


Figure 4. Graph of time and cost comparation

Furthermore, from the analysis results obtained the calculation of each project duration according to table 7.

Table 7. Recapitulation of Duration Project Analysis.

Project	Duration (days)				
	Plan	Real	Crash	Δ(days)	
Realization	240	258		-18	Delay
Overtime	240	240	222	0	Not Delay
Additional Manpower	240	239	221	1	Not Delay

4. CONCLUSIONS.

The real duration of project implementation is 258 days from the planned 240 days at a cost of IDR.66,379,989,688.00 from the planned cost of IDR.66,379,989,688.00. After crashing with the overtime alternative, the project duration is 240 days at a cost of IDR. 66,696,284,569.00 (efficiency 1.8%). In the alternative of adding manpower, the duration after crashing is 239 days at a cost of IDR.66,840,348,763.00 (efficiency 1.61%). So that in this study it was found that the alternative of working overtime was more efficient than the alternative of additional manpower.

ACKNOWLEDGEMENTS

The authors greatly the Support from Indonesia Naval Technology College (STTAL) for providing the necessary resources to carry out this research work.

REFERENCE

Ballesteros-Perez, P., Elamrousy, K. M., & González-Cruz, M. C. (2019). Non-Linear Time-Cost Trade-Off Models of Activity Crashing: Application to Construction Scheduling and Project Compression with Fast-Tracking.*Automation in Construction*, *97*, 229-240.

Decree of the Minister of Manpower and Transmigration of the Republic of Indonesia Number 102 of 2004 concerning Overtime Time and Overtime Wages, June 25, 2004.

Ervianto, W. 2004, *Construction Project Management Theory and Applications*. Yogyakarta : Andi

Feylizadeh, M. R., Mahmoudi, A., BagheIDRour, M., & Li, D. F. (2018). Project Crashing using a Fuzzy Multi-Objective Model Considering Time, Cost, Quality and Risk Under Fast Tracking Technique: A Case Study. *Journal of Intelligent & Fuzzy Systems*, *35*(3), 3615-3631.

Gujarati, N., & Balapgol, B. S. (2016). Monitoring and Controlling RCC Work in Delayed Construction Projects. *International Research Journal of Engineering and Technology (IRJET)* Volume: 03 Issue: 05, 2999-3003

Husen, Abrar. (2011), Project Managemet, Yogyakarta : Andi.

Novitasari, A. D., Sandora, R., & Lestari, R. L. (2018). Project Scheduling Analysis using Presedence Diagram Method (PDM). *Journal of Engineering and Management in Industrial System*, *6*(1), 36-45.

Nurjaman, K. dan Dimyati, H. 2014, *Project Management,* Bandung: Pustaka Setia

Ririh, K. R., & Hidayah, N. Y. (2020). Reducing Project Duration of An Apartment Project by Waskita Karya using Crashing Method. In *IOP Conference Series: Materials Science and Engineering* (Vol. 852, No. 1, p. 012087). IOP Publishing.

Soeharto, Iman. (1999*), Project Management: From Conceptual To Operational (Volume 1),* Jakarta: Erlangga.

Widyatmoko, Y, (2008), *Time Acceleration Analysis Using the Crashing Method in Erection Activities at the Port 115 Tanjung Priok Project with the PERTMaster Program Application*. Undergraduate Thesis, Civil Engineering University of Indonesia. Jakarta.

Indonesian Naval Technology College, STTAL
Postgraduate International Conference, Vol. 4
ICMST 2020 September, 24th 2020

IMPLEMENTATION OF ANALYTIC NETWORK PROCESS (ANP) METHOD IN THE ORDER OF SELECTING THE ALTERNATIVE SUBMARINE OF THE INDONESIAN NAVY

Dani Hutabarat[1], Ahmadi[2],Avando Bastari[3]

[1,2,3]*Indonesian Naval Technology College, STTAL*
Bumimoro-Morokrembangan,Surabaya 60187, Indonesia

ABSTRACT

This paper describes the application of the Analytic Network Process (ANP) method in submarine selection as one of the defence equipment with very strategic value, the procurement of submarines is directed at realizing a deterrence strategy and a strategy of balancing with state actors that have the potential to threaten the sovereignty of the Republic of Indonesia. Apart from threats, the procurement of submarines also considers the geographical constellation of the Republic of Indonesia and the government's wishes, such as the interest of the minister of defence during visits to countries that offer their submarines. Therefore, before the procurement, an analysis was made in terms of the selection of submarine alternatives, both analysis of information and identification of various essential and interrelated requirements regarding data from submarine alternatives that would later be selected. In addition to other options, it is hoped that the main criteria for selecting submarines will be known. In submarine procurement decisions, where the existing problems cannot be arranged in a hierarchical form because it involves the interaction and dependence of the higher-level elements on the lower-level elements. Therefore, in this study the ANP method is used, which can accommodate the linkages between criteria or alternatives. The results obtained are the most substantial alternative priority weight on the S-Class submarine made by P-Country of 0.383283. While the results of the importance of the criteria are sequential starting from the sensor criteria of 0.125127, Threat 0.089076, Neighbors power state 0.080153, Geographical conditions 0.75735, Interoperability 0.071664, Weaponry 0.068672, Navigation 0.047301, Platform 0.044235 and finally Machinery 0.020580.

Keywords: *ANP method, Submarine, Alternative priority.*

1. INTRODUCTION

Figure 1. The geographical constellation of Indonesian State

Geography is a fundamental factor in the formulation of a national defence strategy (geostrategy). The basis of this philosophy has been juridically affirmed through Article 3 paragraph 2 of the Republic of Indonesia Law No.3 of 2002 concerning National Defense, namely that "State defence is prepared by taking into account the geographical conditions of Indonesia as an archipelago". Indonesian waters consist of two types of waters, namely shallow waters and oceanic waters. There are two shallow waters, namely the Sunda Shelf in western Indonesian waters and the Sahul Shelf in eastern Indonesian waters. In the blueprint for the development of the Navy force 2005-2024, it is stated that for shallow waters a mining strategy is implemented, while for deep waters with a defence pattern using submarines (Long-term Navy Force Development Plan, 2005-2024). This philosophical and juridical basis should become the rationale for further consistent and systematic translation into the technical field of the military, to obtain the form of an essential strategy to defend an area. The basic strategy must be able to provide a real picture of the kind of defence strategy referred to on the map so that it can be applied primarily if it is oriented towards wartime.

Selection of truly appropriate submarine alternatives requires analysis of information and identification of various essential requirements regarding data from submarine alternatives which broadly include operational requirements, namely: geographical conditions of Indonesian waters, threats, neighbour power state, and interoperability; as well as the technical requirements of the submarine which includes several primary considerations that support operational requirements. Besides, the government's desire to selecting the type of submarine is also the primary data in choosing the submarine alternative.

In this paper, the Multi-Criteria Decision Making (MCDM) approach will be completed. One method that is widely known and compatible with this kind of conflict is the Analytic Network Process (ANP). The use of ANP is expected to be able to overcome if there is an interdependence between the existing criteria.

In this study, several types of references are used to support research :

a. The research review, for example paper titled Application of Fuzzy AHP for Improving the Accuracy and Effectiveness of Employee Performance Apppraisal (Wiji Setyaningsih, 2018), Fuzzy AHP method is used for Employee performance appraisal by PT Kimora Surabaya in order to obtain the accuracy of determination, the final result is increased, and the effectiveness of assessment process also increases. The fundamental weaknesses of the AHP method, namely only in accordance with the hierarchical relationship model between criteria and not in accordance with the relationship model between criteria and subcriteria which are networked and cross-criteria. Even though in reality, the relationship between criteria is dominated by network relationship.

b. Submarine. The essential functions carried out by submarines include: Surveillance and Reconnaissance, Organizing Anti-Surface Ship Warfare, Conducting Underwater Warfare including Anti-Submarine Warfare, Infiltration Facilities (Infiltration of Special Forces, activities spying, sabotage, Limited Mine Deployment, and Combat SAR). Currently, many modern diesel-electric submarines are capable of nearly matching the capabilities of nuclear submarines, with the development of weaponry technology, modern submarines are increasingly silent with longer endurance and high impact power (nuclear and conventional cruise missiles, long-range torpedoes, mines. and anti-ship surface and air missiles).

c. Multi-Criteria Decision Making (MCDM)

In this life, humans are always faced with various problems and problems. One of the definite problems experienced by humans is how to make the right decisions against multiple options (alternatives) and existing criteria. Therefore, to solve this problem various methods and solutions were made. One of these methods that are most often used is the Multi-Criteria Decision Making (MCDM).

d. Analytic Network Process (ANP)

Analytic Network Process (ANP) is a method that produces a framework for overcoming the problems of decision-makers without involving assumptions related to independence between higher and weak levels of elements and independence from items in one level.

- *Feedback Network*

  Many decision problems cannot be arranged hierarchically because they involve the interactions and dependencies of elements at a higher level with elements at a lower level. This feedback structure does not have a straight form from top to bottom as in a hierarchy but is more like a network with cycles that connect the components inside to the elements themselves.

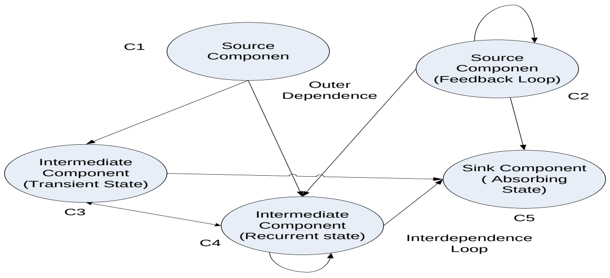


Figure 2. Structure of the feedback network

2. MATERIAL AND METHODS

2.1 Stage of Research

a. Identification Stage

1) Initial observations. The first time an observation was made of the submarine that would be the object of research to investigate the suitability of the research theme being held, the characteristics of the submarine and the criteria for the submarine to get an initial picture of the system being observed. From this step, information and the emergence of the theme raised will be obtained. The research was conducted on 5 (five) types of submarines: K-*Class* made in R-state, G-*Class* made in S-state, C-*Class* made in K-state, R-Class made in T-state and S-*Class* made in P-state.

2) Identification of the problem and research objectives. In this step, the problem to be discussed is formulated, accompanied by the determination of research objectives. This step is useful so that the issues discussed can be more focused, making it easier to carry out research, and there is no deviation from all the original problems to be discussed.

3) Literature study. A literature study is carried out to gather information and obtain supporting theories related to the problems under investigation. This can be obtained from literature or journals that discuss the methods used, or it can be obtained from studies that have been carried out and have almost the same topic.

4) System overview. This step is carried out in conjunction with literature studies to get a clearer picture of the characteristics of the observed system. Discussions with those who study the system are needed to find out in more detail the real problems in the system. By observing and describing the system to be reviewed, the boundaries and scope of the research can be determined.

MATERIAL AND METHOD

5) Identification of the methods and data required. From the steps that have been taken, then the appropriate method and information are determined about what data is needed for research. These data will be processed further at later stages.

b. Data collection stage

1) Model making. The next step is to create a model. Here we will identify the existing relationships between criteria and alternatives, as well as the interplay between current criteria.

2) Making a questionnaire. This questionnaire is based on a model of interplay that occurs from the results of discussions and is distributed to experts in their fields. The filled out questionnaires were then withdrawn for processing the questionnaire.

c. Data Processing Stage.

In this study, the data obtained will be processed using the ANP method.

d. Data Analysis Stage.

1) Sensitivity analysis. Used to find changes to the selected alternatives by making changes to the existing criteria weights. If the weights of one or more criteria are increased or decreased, there will be a possibility of changing the alternative priority arrangement.

It can also be used to determine the criteria that have significance to the system formula.

2) Analysis and Interpretation. This stage analyzes the results of data processing that has been done to obtain alternative priorities in accordance with the established criteria.

e. Conclusion Stage.

Is the final result of all the processes that have been carried out. In this conclusion, suggestions are also added for decision-makers as input as well as for other researchers who want to focus on similar fields so that there is a continuous increase in research.

2.2 Research Flowchart

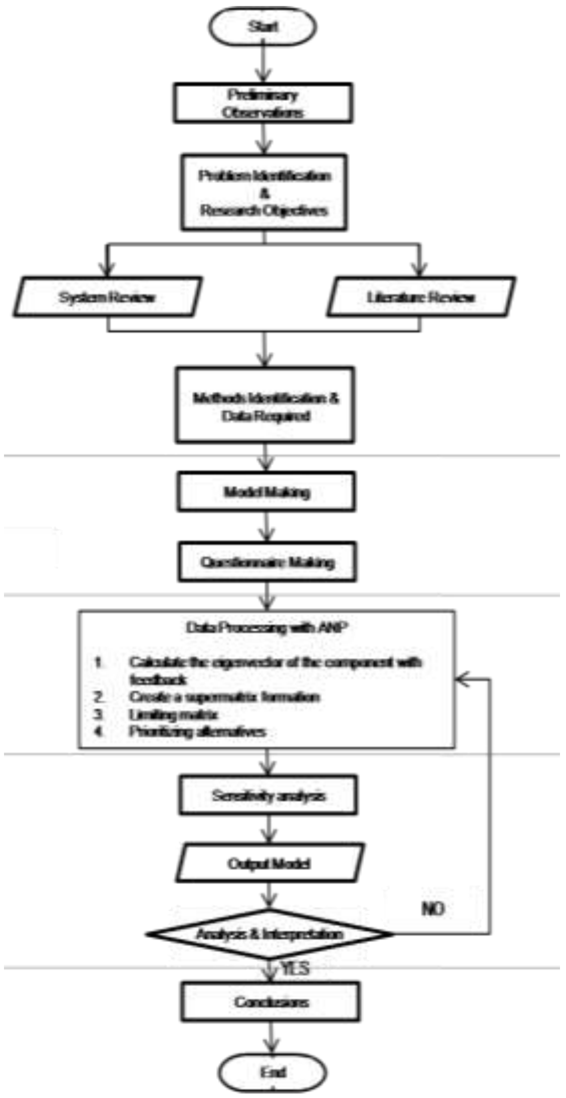


Figure 3. Research Flowchart

3. RESULT AND DISCUSSION

3.1 Data collection

a. Determination of Criteria and Alternative

Table 1. Criteria and Sub-Criteria for Submarine Selection

No.	Subcriteria	Criteria
1	Threat	***Operational Requirements (Opsreq)***
2	*Interoperability*	
3	Neighbour Power State	
4	Geographic Conditions	
5	Navigation	***Technical Requirements (Techreq)***
6	Machinery	
7	Weaponry	
8	*Platform*	
9	Sensor	

Table 2. Alternatives Used

No.	Persyaratan	K-Class	G-Class	C-Class	R-Class	S-Class
I	***Operational Requirements (Opsreq)***					
1	Threat	√	√	√	√	√
2	Interoperability	√	√	√	√	√
3	Neighbour Power State	√	√	√	√	√
4	Geographic Conditions	√	√	√	√	√
II	***Technical Requirements (Techreq)***					
1	Navigation	√	√	√	√	√
2	Machinery	√	√	√	√	√
3	Weaponry	√	√	√	√	√
4	*Platform*	√	√	√	√	√
5	Sensor	√	√	√	√	√

note: √ Fulfill the requirements

b. ANP Network Model Making

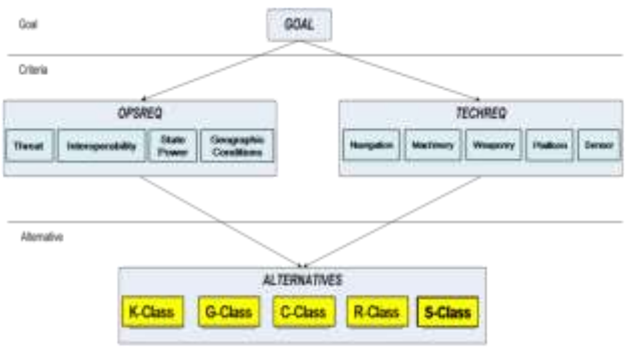


Figure 4. ANP Hierarchy Model

c. Innerdependence and Outerdependence relationship

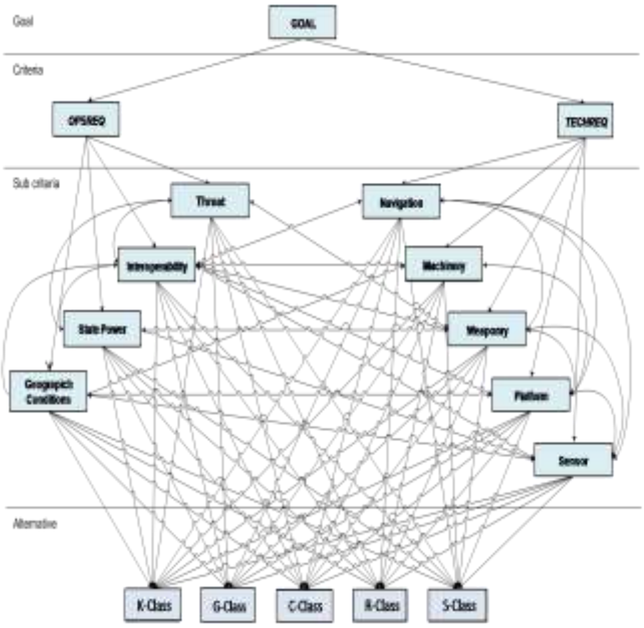


Figure 5. ANP Network Model with Innerdependence and Outerdependence Relationships

3.2 Data processing.

Data processing is done through the help of Super Decisions software. The data processed is questionnaire data which is the perception of the respondents regarding the selection of submarines.

a. Pairwise Comparison Matrix.

After the network model is created, the pairwise comparison value can be determined between criteria and between alternatives for each sub-criteria. The pairwise comparison values were obtained using a questionnaire. The priority weight values for each category obtained based on pairwise comparison values will be compared to get the final priority weight value.

b. Processing with Super Decisions Software.

After entering all geometric means into the questionnaire format in the Super Decisions software, the software performs all stages of the ANP method by running Synthesize, which contains, among others, the alternative weight values.

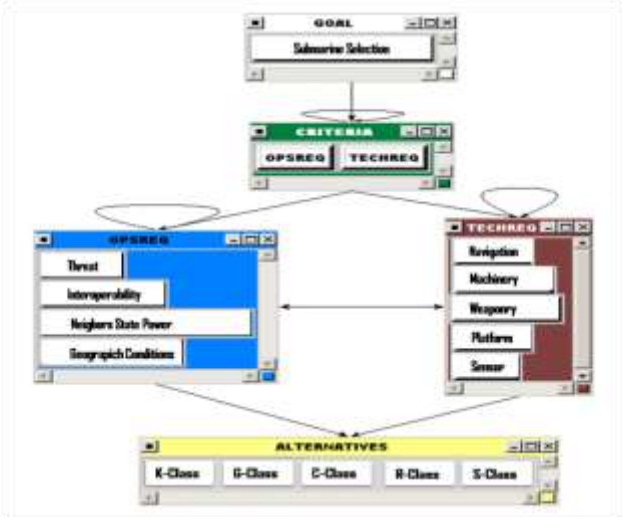


Figure 6. ANP Network Model Using Super Decisions Software

c. Analysis and Interpretation of Data Processing Results.

At this stage, the results of data processing will be analyzed and interpreted in the previous chapter.

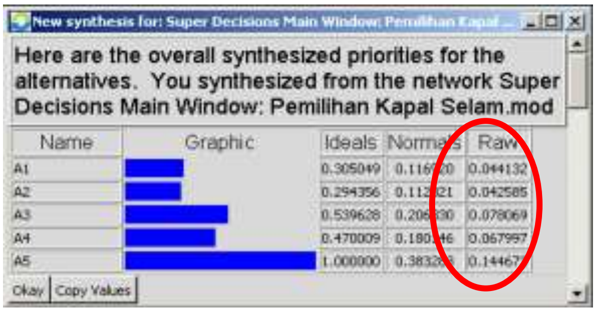
d. Consistency Ratio analysis.

From the results of processing the data in the form of a questionnaire, it can be obtained Consistency Ratio (consistency ratio), where all consistency ratio values are below 10% (0.1), so that according to what Saaty (1990) stated, this scoring system can be called consistent.

e. Alternative Priority Analysis.

In the results of data processing using Super Decisions software, alternative priorities can be seen by looking at the weight value of each alternative obtained from the calculation of the Limiting Supermatrix.

Table 3. Alternative Weight Values



New synthesis for: Super Decisions Main Window: Pemilihan Kapal ...

Here are the overall synthesized priorities for the alternatives. You synthesized from the network Super Decisions Main Window: Pemilihan Kapal Selam.mod

Name	Graphic	Ideals	Normals	Raw
A1		0.305049	0.116[illegible]20	0.044132
A2		0.294356	0.112[illegible]21	0.042585
A3		0.539628	0.206[illegible]30	0.078069
A4		0.470009	0.180[illegible]46	0.067997
A5		1.000000	0.3832[illegible]	0.14467[illegible]

Okay Copy Values

From Table 3., the alternative priority order is obtained based on the weight value of each alternative as follows:

- Priority 1 is alternative 5 (A5) with a weight value of 0.383283.
- Priority 2 is alternative 3 (A3) with a weight value of 0.206830.
- Priority 3 is alternative 4 (A4) with a weight value of 0.180146.
- Priority 4 is alternative 1 (A1) with a weight value of 0.116920.
- Priority 5 is alternative 2 (A2) with a weight value of 0.112821.

In priority 3 (alternative 4 / A4), priority 4 (alternative 1 / A1) and priority 5 (alternative 2 / A2) have a not so big difference in weight values, namely 0.180146; 0.116920; 0.112821, this shows that the results of filling out all respondents in assessing each criterion and each sub-criterion both give a small assessment of alternative 4 / A4, alternative 2 / A2 and alternative 1 / A1.

f. Criteria Priority Analysis

In addition to alternative priorities, the results of data processing using Super Decisions software also contain priority criteria which can be determined by looking at the weight value of each criterion obtained from the calculation of the Limiting Supermatrix.

Table 4. Alternative Weight Values and Criteria

Super Decisions Main Window: Pemilihan Kapal Selam.mod: ...

Here are the priorities.

Icon	Name	Normalized by Cluster	Limiting
No Icon	A1	0.11692	0.044132
No Icon	A2	0.11282	0.042585
No Icon	A3	0.20683	0.078069
No Icon	A4	0.18015	0.067997
No Icon	A5	0.38328	0.144673
No Icon	O	0.00000	0.000000
No Icon	T	0.00000	0.000000
No Icon	G	0.00000	0.000000
No Icon	O1	0.28133	0.089076
No Icon	O2	0.22634	0.071664
No Icon	O3	0.25315	0.080153
No Icon	O4	0.23919	0.075735
No Icon	T1	0.15462	0.047301
No Icon	T2	0.06727	0.020580
No Icon	T3	0.22448	0.068672
No Icon	T4	0.14460	0.044235
No Icon	T5	0.40903	0.125127

Okay Copy Values

As shown in Table 4. The priority order of criteria is based on the weight value of each alternative as follows:

- Priority 1 is the criteria T5 with a weight value of 0.125127.
- Priority 2 is the O1 criterion with a weight value of 0.089076.
- Priority 3 is the O3 criterion with a weight value of 0.080153.
- Priority 4 is the O4 criterion with a weight value of 0.075735.
- Priority 5 is the O2 criterion with a weight value of 0.071664.
- Priority 6 is the T3 criterion with a weight value of 0.068672.
- Priority 7 is the T1 criterion with a weight value of 0.047301.
- Priority 8 is the T4 criterion with a weight value of 0.044235.
- Priority 9 is the T2 criterion with a weight value of 0.020580.

g. Sensitivity Analysis

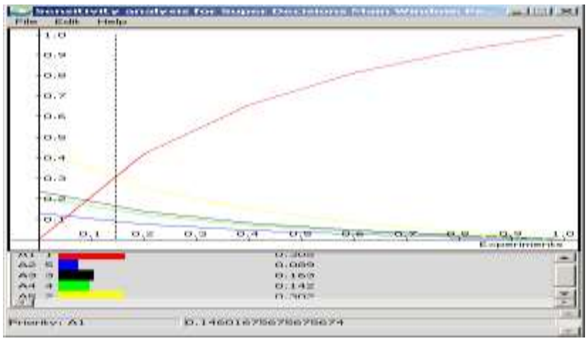


Figure 7. Sensitivity Analysis of Alternative 1

If the sensitivity test is carried out on alternative 1 by increasing the weight value to 0.305, there will be a change in the weight value for the other alternatives. Alternative 2 ranks in priority 5 with a weight value of 0.089, Alternative 3 ranks as priority 3 with a weight value of 0.163, Alternative 4 ranks in priority 4 with a weight value of 0.142, Alternative 5 ranks as priority 2 with a weight value of 0.302

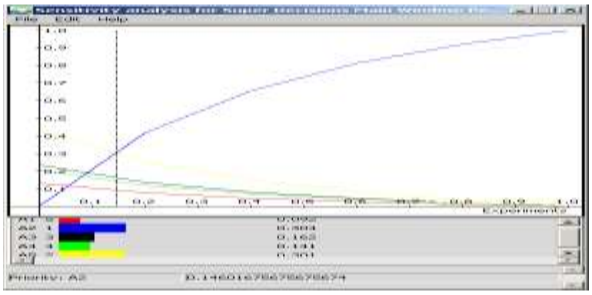


Figure 8. Sensitivity Analysis of Alternative 2

If the sensitivity test is carried out on alternative 2 by increasing the weight value to 0.304, there will be a change in the weight value for the other alternatives. Alternative 1 ranks in priority 5 with a weight value of 0.092, Alternative 3 ranks as priority 3 with a weight value of 0.162, Alternative 4 ranks as priority 4 with a weight value of 0.141, Alternative 5 ranks as priority 2 with a weight value of 0.301.

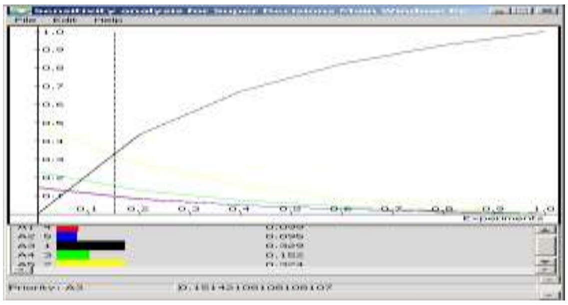


Figure 9. Sensitivity Analysis of Alternative 3

If the sensitivity test is carried out on alternative 3 by increasing the weight value to 0.329, there will be a change in the weight value for the other alternatives. Alternative 1 ranks priority 4 with a weight value of 0.099, Alternative 2 ranks priority 5 with a weight value of 0.095, Alternative 4 ranks priority 3 with a weight value of 0.152, Alternative 5 ranks priority 2 with a weight value of 0.324.

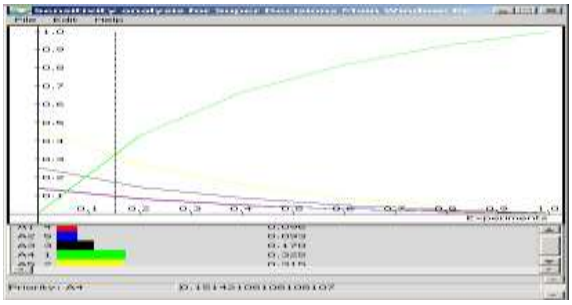


Figure 10. Sensitivity Analysis of Alternatives 4

If the sensitivity test is carried out on alternative 4 by increasing the weight value to 0.325, there will be a change in the weight value for the other alternatives. Alternative 1 ranks priority 4 with a weight value of 0.096, Alternative 2 ranks priority 5 with a weight value of 0.093, Alternative 3 ranks priority 3 with a weight value of 0.170, Alternative 5 ranks priority 2 with a weight value of 0.315.

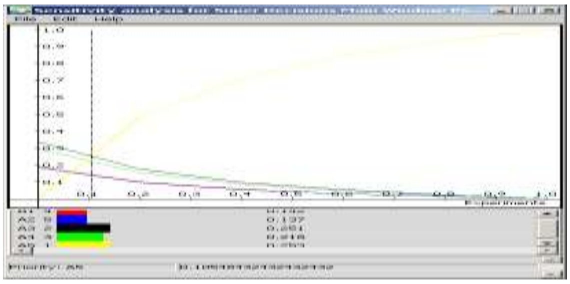


Figure 11. Sensitivity Analysis of Alternatives 5

If the sensitivity test is carried out on alternative 5 by increasing the weight value to 0.253, there will be a change in the weight value for the other alternatives. Alternative 1 ranks priority 4 with a weight value of 0.142, Alternative 2 ranks priority 5 with a weight value of 0.137, Alternative 3 ranks as priority 2 with a weight value of 0.251, Alternative 4 ranks priority 3 with a weight value of 0.218.

4. CONCLUSIONS

From the processing and data analysis above, conclusions can be drawn as follows:

a. The submarine alternative chosen is the one that gets the highest priority weight value, namely the S-Class submarine made in P-state with a priority weight value of 0.383283. In order of priority alternatives in the selection of submarines are S-Class made in P-state, C-Class made in K-state, R-Class made in T-state, G-Class made in S-state and as the last priority of the five alternatives is the K-Class made in R-state.

b. The criterion that gets the highest priority weight in selecting submarine alternatives is the Sensor criterion with a priority weight value of 0.125127. In order, the criteria for selecting submarines are sensors, threats, neighbour state power, geographic conditions, interoperability, weaponry, navigation, platform and then as a priority, the last criterion of the nine existing criteria is machinery.

ACKNOWLEDGEMENTS

The authors greatly the Support from Indonesia Naval Technology College (STTAL) for providing the necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board from their many insightful comments, which have significantly improved this article.

REFERENCE

Buyukyazici, M. dan Sucu, M. (2003), The Analytic Hierarchy and Analytic Network Processes, *Hacettepe Journal of Mathematics and Statistics*, Vol. 32, hal. 65-73.

Ciptomulyono, U., & Henry. (2000). Model Fuzzy goal programming untuk penetapan pembobotan prioritas dalam metode analisis hirarki proses (AHP). *Jurnal IPTEK*, 19-29

Ciptomulyono, U. dan Herlina. (2008), Aplikasi Metode MCDM-Analytic Network Process (ANP) dan Balanced Score Card untuk Pengukuran Kinerja, *Jurnal Teknologi Technoscientia,* Vol. 1 No. 1.

Da Silva, A.S., Nascimento, L.P., Ribeiro, J.R. dan Belderrain, M.C.N. (2009), ANP and Ratings Model Applied to Supplier Selection Problem, *Proceedings ISHAP 2009*, Sao Paulo, Brazil.

Figuera, J., Greco, S. dan Ehrgott, M. (2005), *Multiple Criteria Decision Analysis: State of the Art Surveys*, Springer Science+Business Media Inc., Boston.

Haryanto (2018). Model Strategi dan Alokasi Sumber Daya TNI Angkatan Laut dalam Menghadapi Peperangan Kepulauan, Surabaya: STTAL.

Hussey, J. & Hussey, R. (1997), *Business Research*. Macmilan Press Ltd., London.

Kemenhan. (2012). *UU RI Nomor 16 tentang Industri Pertahanan.* Jakarta: Kementerian Pertahanan Republik Indonesia.

Lin, Y.H., Shiang, W.J., dan Lin, C.T. (2002), *Applying ANP Modelto Dynamic Evaluationof Dispatching Rulesfor Semiconductor Manufacturing*, Department of Industrial Engineering and Management, Ming-Hsin University of Science and Technology, Taiwan.

Mabesal (2010), *Kajian Pengadaan Kapal Selam 2010*. Mabesal, Jakarta.

Ozuer, Ali (2007), *ANP Model for Predicting The Best Performing Biotech Stock*, Katz Graduate School of Business, University of Pittsburgh.

Saaty, Zhao, et al. (2004), ANP applies and analyzes a super matrix for weight synthesis.

Saaty, T.L. (2005), *Theory and Applications of the Analytic Network Process: Decfision making with Benefits, Opportunities, Costs, and Risks.* RWS Publications, ISBN 1-888603-06-2.

Setyaningsih, W. (2018), Penerapan Fussy AHP untuk Peningkatan Ketepatan dan Efejtifitas Penilaian Kinerja Karyawan, *Jurnal Teknologi Informasi dan industri*, Vol. I (1)

THE ANALYSIS OF ADAPTIVE LEADERSHIP FACTORS FOR IMPROVING THE PERFORMANCE OF COMPANY ORGANIZATION

Sukmo Hadi Nugroho[1], Heru Kreshna Reza[2]

[1,2] *Esa Unggul University Jakarta Indonesia*

ABSTRACT

Adaptive Leadership will always be an important factor in determining the back and forth of a company. The leader must be able to provide direction for the vision of the future, then bring all employees to understand the vision, so that the company as a whole has the readiness to face any obstacles that stand in their way. This is what will then bring the company to the optimum point, where all the company's potential can be utilized for the progress of the company. Leaders with all the leadership factors inherent in themselves are related to the performance of their employees. This is very easy for anyone to understand. A leader who has a good leadership spirit will be able to create a good teamwork. The existence of good teamwork will greatly support the creation of a good and significant increase in employee performance. This study aims to determine the extent of employee performance and the role of leadership behavior on employee performance in organization companies. From the research results it is known that there is a significant relationship between the adaptive leadership factor and employee performance, with a correlation test result. The amount of influence exerted by the leadership factor on improving employee performance in organization companies.

KEYWORDS: *Adaptive Leadership, Improving, Organization Performance.*

1. INTRODUCTION

Leadership is a trait that can be possessed by every human being. Everyone is born with a natural disposition to be a leader, at least for himself. So that this can be immediately applied in everyday life. Furthermore, having a good leadership attitude in a person will make that person accustomed to managing the activities of his daily life systematically and regularly.

As with any company, a great company almost always has great leaders. According to Malayu Hasibuan (2005) "Leadership is a person who uses authority and directs his subordinates to do some of their work in achieving organizational goals".

Leadership will always be an important factor in determining the back and forth of a company. The leader must be able to provide direction for the vision of the future, then bring all employees to understand the vision, so that the company as a whole has the readiness to face any obstacles that stand in their way. This is what will then bring the company to the optimum point, where all the company's potential can be utilized for the progress of the company. However, it is not easy to have a good leadership spirit, as well as being a leader. It takes a lot of input (input) to make someone a leader with a good leadership spirit. For example, a good company leader must be able to be firm with his employees and be able to provide penalties according to the mistakes he made. The sanctions given should be able to provide a deterrent effect, so that these mistakes are not repeated and are not emulated by other employees.

In addition, a company leader must be able to pay attention to the behavior and nature of his employees in carrying out daily activities in the world of work. This needs to be done to see their performance level. Because the abilities of each employee must be different, and surely this will affect their performance level. Uniting all employees who have different visions and missions in a company is not an easy task. A leader must be able to direct the individual employee's vision and mission to be fully utilized for the benefit of the company. This means that the vision and mission of the company is more important than the vision and mission of the individual employees who work at the company.

This is where the leader must be able to communicate everything in order to run in a balanced manner. With this communication teamwork can be created that will realize the company's vision and mission in a simpler practical order. With strong teamwork, it will encourage and motivate all employees to continue to improve their respective performance in order to advance the company.

Furthermore, as executing control functions, company leaders must be able to measure employee performance in every area or system in the company. With this performance measurement, company leaders will get the focus of attention and follow-up on its completion. If a company leader cannot measure employee productivity, it means that he cannot carry out the control function. If the control function does not work, company leaders will not be able to carry out further employee management processes. Thus, it is almost impossible to grow the company to achieve success in the future.

Many companies think that they are good at performing as part of the implementation of the control function. Even some companies have developed and demonstrated employee performance measurement systems that other companies should emulate and emulate. But unfortunately there are still company leaders who don't realize the importance of this function. So that company leaders do not see this activity as a major concern in the company.

Leaders with all the leadership factors inherent in themselves are related to the performance of their employees. This is very easy for anyone to understand. A leader who has a good leadership spirit will be able to create good teamwork. The existence of good teamwork will greatly support the creation of a good and significant increase in employee performance.

Given the importance of leadership factors in building the character of a leader in an effort to improve employee performance, the authors are interested in conducting a study related to this issue. The authors hope that from this research, the author can present a scientific study that shows a positive relationship between these two variables. Therefore, the authors took the research title "The Analysis of Adaptive Leadership Factors for Improving The Performance of a Company Organization".

1.1 Framework

The role of a leader is needed with all the dimensions that influence it, in order to improve the performance of its subordinates. So that employee morale remains high and can produce quality products. This is what then requires the stability of employee performance levels.

A leader must be able to perform all these functions. That is, it is in the hands of a leader that the responsibility rests entirely, to maintain the performance of its employees. So that with all its dimensions it can be achieved to achieve the stated company goals.

In this study the authors try to focus on the discussion of leadership on the part that is influential with improving employee performance. A good leader will show good patterns and behavior both inside and outside the company, including in terms of regulating and evaluating the actions he takes. The relationship between leadership and employee performance can be seen in the chart in Figure 1 below.

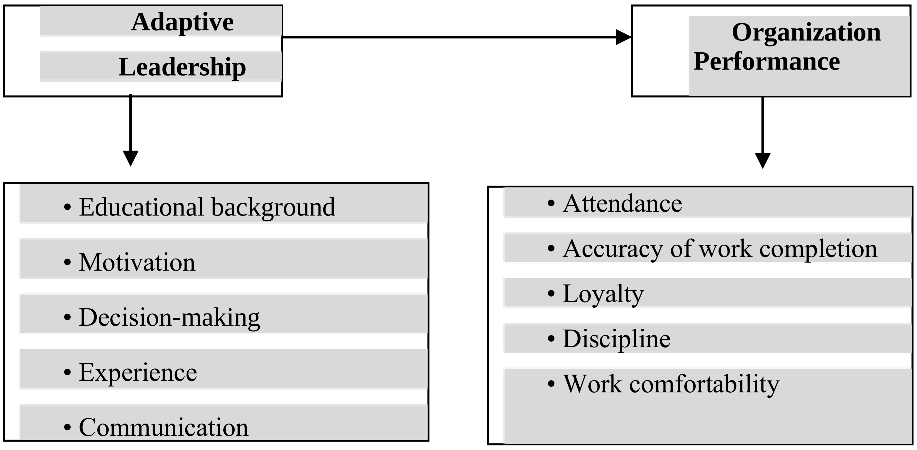


FIGURE 1. FRAMEWORK

2. MATERIALS AND METHODS

2.1 HUMAN RESOURCE MANAGEMENT

Management is an instrument used to achieve goals in an organization (company). With a good management pattern, of course, it will make it easier for the organization to realize its goals for the company, both for employees and for the community. According to Malayu S.P. Hasibuan (2003) "Management is the science and art that regulates the process of utilizing human resources and other sources effectively and efficiently to achieve certain goals".

Meanwhile, according to Yayat M Herujito (2001) "management is the management of a goal to obtain results in order to achieve goals that have been determined by moving other people to work".

From the three definitions put forward by the experts above, it can be concluded that management is a combination of science and art to manage the resources owned by the company in order to achieve predetermined goals.

Management is absolutely necessary in all companies, with the management, usability and results of the resource elements being optimally improved. The resource elements consist of Man, Money, Method, Machines, Materials, and Market, which is briefly 6 M.

One element that is important to note is "Man" (Human Resources). This is because with the right development pattern of human resources, it can overcome the obstacles that may arise in the company. For that, it is necessary to understand the definitions related to human resource management.

According to T. Hani Handoko (2003) quoting from Flippo, “Human resource management is planning, organization, direction, compensation, integration, maintenance and release of human resources in order to achieve several individual, organizational and community goals”.

Malayu S.P. Hasibuan (2003) states that "human resource management is" the science and art that regulates the relationships and roles of labor in order to be effective and efficient in shaping the realization of company, employee, and community goals. "

From the two definitions above, it can be concluded that human resource management activities are a science and art of how to plan, organize, and at the same time supervise the procurement and maintenance of human resources within the company so that company goals can be achieved. Thus human resource management must provide full contribution in the effort to achieve goals and objectives company, including to increase efficiency, efficiency with the aim of improving employee performance effectively and efficiently.

According to Malayu Hasibuan (2001) the functions of human resource management include:

a. Planning

Planning (human resource planning) is the process of planning the workforce effectively and efficiently to suit the company's needs in helping the realization of goals. Planning is done by setting a staffing program. The staffing program includes organizing, directing, controlling, procuring, developing, compensating, integrating, maintaining, disciplining and dismissing employees. A good staffing program will help achieve company, employee and community goals.

b. Organizing

Organizing is an activity to organize all employees by determining the division of labor, working relationships, delegation of authority, integration and coordination within an organizational body (organization chart).

c. Briefing

Directing is the activity of directing all employees to cooperate and work effectively and efficiently in helping achieve the goals of the company, employees and society. The direction is carried out by the leadership by assigning subordinates to do all their duties properly.

d. Control

Controlling (controlling) is the activity of controlling all employees to obey company regulations and work according to plan. If there are deviations or errors, corrective actions and improvements to the plan are taken. Employee control includes attendance, behavior, cooperation, work implementation and maintaining the work environment.

Apart from the basic functions mentioned above, there are also operational functions which include:

a. Recruitment
b. Development
c. Compensation
d. Integration
e. Maintenance
f. Discipline
g. Separation

2.2. The Role of Adaptive Leadership

The problem of leadership has existed since humans live in groups, so this is a social problem, but the understanding of the leader itself is very limited. Many definitions of leadership put forward by experts, but actually the main problem is the relationship between a person or group of people who are called superiors and another group called subordinates.

Definition of leadership according to Malayu S.P Hasibuan (2005: 42) "Leadership is a person who uses authority and directs his subordinates to do some of their work in achieving organizational goals".

Meanwhile, according to J. Salusu (2008: 191) who quotes from Robert Sculler (1988) "leadership is a force that drives your struggle or activities towards success".

Every leader has a very important role in an organization. For this reason, according to J. Salusu (2008: 199) a leader must carry out Adaptive Leadership Roles as follows:

a. Role as Adaptive Catalyst

A leader must foster understanding and awareness of the people he leads so that he believes that the actions he takes are for the benefit of all members of the organization. Organizational members should feel that the results of their leadership work are not only beneficial to themselves, but benefit all members of the organization as a whole. Therefore, leaders have the following tasks:

1. Identify problems faced by the organization, both internal and external problems.
2. Formulate the most important problems and problems that very often occur or are faced by members of the organization.
3. Formulate the factors that cause problems and look for various alternative solutions.

b. Role as Adaptive Facilitator

A leader must try to encourage and raise awareness of the members of the organization he leads in order to make changes that are expected to improve the organization. Leaders do not only act as initiators, but actively provide various facilities for their members, namely:

1. Shows ways of obtaining assistance from parties related to the program that is being or will be implemented.
2. Organizing the activities of the members to facilitate the organization in achieving its goals.
3. Making decisions that refer to the prioritization of tasks that the organization and its members want to do.

c. Role as Adaptive Problem Solver

A leader must be able to act quickly, accurately and responsively to the problems faced by the organization, and try to solve these problems. He must be able to determine the time and form of assistance to members or groups, so that they can adjust to every step taken to solve existing problems.

d. Role as Adaptive Source Liaison

A leader must try to find resources with regard to the conditions and needs of the organization. With these resources, leaders can help organizations to find ways to approach them to get the help they need in order to solve the problem at hand.

e. Role as Adaptive Communicator

A leader must be able to communicate his ideas to others, who then pass them on to others on an ongoing basis. The form of communication that must be carried out is two-way so that the ideas conveyed can be discussed broadly, including the implementers and the target audience need to master effective communication techniques.

2.3. Leadership Style

Oemar Hamalik (2005) classifies the types of leadership styles as follows:

a. Directive-Authoritative Leadership

This leadership style provides very broad opportunities for leaders to exercise their authority, while the freedom of their subordinates to express their opinions is very limited. The leader is the command center, the command center for subordinates, while the role of subordinates in expressing their opinions is very limited.

b. Persuasive Leadership

Leaders exercise authority and control, especially in the process of problem solving and decision making. Leaders pay attention to input from subordinates, subordinates get limited freedom to express their opinions. They are included in the collection decision. In this case, the leadership's decision is a joint decision even though the portion of input from subordinates is very small.

c. Consultative Leadership

Leaders provide ample opportunities for subordinates to participate in making decisions, the way to be taken is by submitting a tentative draft decision. The draft decision is offered to subordinates who are still open to changes. In this way the leader also has the opportunity to test his ideas against his subordinates through the consultation process. Another way, the leader throws the problem to his subordinates then the subordinates submit suggestions for solutions then the leader makes certain decisions that may be in accordance with the suggestions of his subordinates.

d. Participatory Leadership

Leaders provide the widest opportunity and freedom to subordinates to express their opinions in making decisions. The leader and subordinates cooperate fully as a team. Alternatively, the leader and subordinates cooperate fully, but the leader does not directly participate, he delegates it to one of his senior staff. This delegation shows the existence of freedom of action to a certain extent even though the freedom of the subordinates is very dominant, but the responsibility for decision making remains with the leader.

e. Deliberative Leadership

Leadership based on the shared values embodied in the form of kinship and mutual cooperation, the actions of the leader are characterized by a sense of helping, helping to help and working together based on compassion, while still adhering to the principles of effectiveness and efficiency. Actions taken by the leader are decision making following the procedure for determining the problem, collecting data, analyzing data and drawing conclusions.

f. Integrated Leadership

Leadership style is based on the principle of vertical integration, integration is seen from the management level, namely macro (multidisciplinary thinking), structural (involving between institutions), micro (consistent in all aspects of the program), and individual (integration between superiors and subordinates through communication interaction.). Horizontally the integrated leadership style is seen based on a systemic approach where there are input components, processes and products, so that the leadership process works systematically. Diagonally, integrated leadership is implemented based on existing situations within and outside the organization.

Oemar Hamalik (2005) states that there are two leadership theories that explain leadership. These two theories have different concepts in explaining leadership, but in reality they can be combined into one leadership concept.

a. The Harismatic Man Theory

Leadership is an individual quality. Certain individuals have a personality and intelligence that can automatically place them as leaders of groups or organizations. And is personal magnetism and hypnotic performance. This harismatic personality causes everyone to acknowledge and voluntarily follow him as a leader. Personal appearance seemed to be mystical, so that he was seen as the leader of his era.

b. Group Theory

Leadership is determined by the group. A person becomes a leader because he is able to meet the needs of the group thanks to the ability of knowledge and equipment. When the needs of the group change, the leader must also change. This means, leadership is determined by the situation within the group / organization concerned.

Both of these theories each have their own weaknesses and strengths. However, in fact the two theories can be combined in order to achieve optimal results.

Leadership is a process of giving direction and influence to members of a group or organization in carrying out tasks. According to Oemar Hamalik (2005) there are three factors that need to be considered, including:

a. The position of the people who interact with the leader.

b. The nature of the relationship between people involved in a group or in an organization that is led.

c. The number of positions of the leader, whether single or double in occupying a task and position.

Thus, it can be interpreted that what is meant by the leadership factor is a position that interacts with subordinates by ordering or influencing through good organized communication in order to achieve a goal that has been set by the leader or company or organization.

2.4. Performance

According to Anwar Prabu Mangkunegara (2001) regarding the definition of performance, namely: "Performance is a result in quality and quantity achieved by an employee in carrying out his duties in accordance with the responsibilities given to him".

Meanwhile, according to the old Marihot Efendi Hariandja (2002) performance is the result of work produced by employees or real behavior that is displayed in accordance with their role in the organization "

Based on the definitions above, it can be concluded that employee performance is very decisive in achieving company goals where each employee's work performance will be seen in quality and quantity according to their role in an organization or company.

There are two factors that are considered important in influencing performance achievement according to Anwar Prabu Mangkunegara (2001) who quotes from Keith Davis, namely:

a. Ability factor

Psychologically, the ability of employees consists of potential abilities and reality abilities or knowledge and expertise, meaning that employees who have above average potential with adequate education for their positions and are skilled in doing daily work will find it easier to achieve the expected performance.

b. The motivational factor

Motivation is formed from an attitude or attitude of an employee in dealing with work situations, motivation is a condition that moves employees who are directed to achieve organizational goals.

The mental attitude must have a mental attitude that is ready mentally, physically, goals and situations. This means that an employee must be ready to understand the goals and work targets that will be achieved, be able to take advantage of and create a conducive work situation within the company. According to Marihot Effendi Hariandja (2002) the determination of work research methods is divided into four steps, namely as follows:

a. Goal Setting

The determination of targets as mentioned must be specific, measurable, challenging and based on a certain time. Besides that, it is also necessary to pay attention to the process of determining these goals, namely that it is hoped that individual task objectives are formulated jointly between superiors and subordinates.

b. Determination of Performance Standards

The conduct of the appraisal must reflect the actual performance of the work or evaluate the behavior that reflects the successful execution of the work. By using three systems, namely, having a standard, having a measure that can be trusted and easy to use by the appraiser and the one that is assessed.

c. Determining the Method and Implementation of the Assessment

This method is an approach or means and equipment that is used such as forms and their implementation. The method is like the comparison method, test and others.

d. Evaluation Assessment

Assessment evaluation is providing feedback to employees regarding aspects of performance that must be changed and maintained as well as various actions that must be taken, both by organizations and employees in an effort to improve performance in the future.

2.5. Research Methodology

a. Variables and their Measurements

The variables and measurements used in this study for more details can be seen in Table 1 below.

Table 1. Variable Operationalization

Variable	No	Indicator	Measuring way	Scale Measurement
Adaptive Leadership as an Independent Variable	1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	Problem Solving. Level of confidence. Formal Power. Policy Determinants. Have Intelligence and Expertise. Task Orientation. Communication. Loyalty. Creative and Proactive. Got the Confession	Subordinates' perceptions of the behavior of their leaders	Ordinal Scale
Performance as Dependent Variable	1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	Understanding Work. Working time. Completion of Work. Accuracy of Job Objectives. Quality Ability Quality Quantity. Spirit at work. Self Development. Efficiency. Cooperation.	Perception Leader of subordinates performance	Scale of Ordinal

The variables used in this study are the leadership variable as the independent variable and the performance variable as the dependent variable which operationally can be seen in Table 1 above.

b. Sampling Procedure

In this study using simple random sampling (done randomly) so that each member of the population has the same possibility of being selected as a respondent. Respondents were randomly selected with 40 respondents from a total of 60 employees. Samples were taken from all employee representatives from each department or each division. Respondents were asked questions about employee leadership and performance.

c. Data collection technique

The methods used in data collection to support and strengthen research analysis are:

1) Primary sources

a) Interview

Interviews are a process of interaction and communication to obtain data directly from resource persons related to the research theme raised.

b) Questionnaire

The questionnaire is a data collection technique by distributing questionnaires to the research object selected as the sample. In this questionnaire, several questions are distributed regarding the factors of leadership and employee performance. List of questions or questionnaire

Which the author suggests uses a Likert scale and has the following intervals:

(1) Always/Very Good/Very high) = score 5
(2) Often / Good / High) = score 4
(3) Sometimes / Moderate) = score 3
(4) Rarely / Less / Low) = score 2
(5) Never / Very Poor / Low) = score 1

c) Field Observation

Field observation is a process where researchers go directly to the field to see and examine the actual situation and conditions that occur in the field. This is done so that researchers get data that is in accordance with the reality in the field.

2) Secondary Sources

Secondary sources, namely a way to obtain data through literature related to the problems under study, as a consideration in research.

d. Data Analysis Method

1) Descriptive Analysis

Conducting theoretical analysis of the problem in order to find solutions to problems that are in accordance with the theory with the conditions in the field.

2) Regression Analysis

Is a mathematical equation that allows us to predict the value of the value or dependent variable from the value of one or more independent variables.

3) Correlation analysis

This analysis is to determine how strong the relationship between these variables occurs, in other words, it is necessary to determine the degree of the relationship between one variable and another.

4) The coefficient of determination

Used to find out how much influence is given by variable X on changes in variable Y.

5) Hypothesis testing

This hypothesis test is used to determine the significance of the relationship between leadership and employee performance.

3. DISCUSSION

3.1. The Influence Analysis of Leadership Factors on Employee Performance

To determine the effect of leadership factors on employee performance based on the results of questionnaires that have been distributed to respondents, it was carried out using statistical analysis tests in the form of regression analysis, correlation and coefficient of determination. In analyzing the data obtained, the Software Statistical Product and Service Solution 16.0 for Windows (SPSS) program was used.

A. Correlation Analysis and Determination Coefficient

Table 2

Out put results of correlation and coefficient of determination

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.723 a	.522	.539	1.113

a. Predictors: (Constant), total leadership

The output of data processing using SPSS analysis, correlation test and coefficient of determination is presented in table 33 above. The value of the correlation coefficient (r) between the leadership variable (X) and the variable (Y) is 0.723. It means that it can be said that the influence of leadership factors on employee performance is quite strong. This means that the increased response of employees to leadership factors that are carried out in the company will be able to increase employee performance.

The amount of the contribution of the leadership variable (X) to the performance variable (Y) can be seen from the coefficient of determination, namely $r^2 = 0.522$ or 52.2%, the remaining 47.8% is influenced by other variables which are not discussed in this study.

Table 3.
The Output Regression Result

ANOVA[b]

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	50.880	1	50.880	48.136	.000 a
Residual	40.180	38	1.054		
Total	91.060	39			

a. Predictors: (Constant), total of leader

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		Std. Error	Beta		
(Constant)	13.605	2.194		6.657	.000
Totalx	.623	.082	.723	7.034	.000

a. Dependent Variable: total performance

B. Regression Analysis

Based on the results of the regression value with the SPSS 16.0 program in table 34, the linear regression equation between the leadership adaptive variable (X) and the variable (Y) is as follows:

Y = 13.605 +0.623 X

The interpretation of the equation is:

If there is an increase in the value of the leadership response score by one unit, the employee performance score will increase by 0, 623 units.

C. Hypothesis Testing

To test the significance of the effect of the variable X on Y, the t-hypothesis test is used as follows:

Ho = Leadership adaptive factor has no effect on performance.

Ha= Leadership adaptive factors affect performance.

The guidelines used to accept or reject the hypothesis are as follows:

1) Ho is accepted if t - count <t - table.

2). Ho is rejected if t - count> t - table.

3). Ha is accepted if t - count> t - table.

4). Ha is rejected if t - count <t - table.

TABLE 4.
The Output of Hipotesis Result Test
Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	14.605	2.194		6.657	.000
Total x	.623	.082	.728	7.034	.000

a. Dependent Variable: total performance

From the results of SPSS Table 4, it can be seen that the t-count value is 7,034.

The t-table values at the 99% confidence level are as follows:

t table = ½ α ⁄ db

= ½ (0.01) = 0.005

2 db = 40 - 2 = 38

t table = 0.005 ⁄ 38 = 2.576

Based on the hypothesis test at the 99% confidence level by comparing the t-count and t-table, the t-count is 7.034 while the t-table is 2.576.

Because the t-count is greater than the t-table, it means that Ho is rejected and Ha is accepted. Thus, the influence of the leadership variable on performance is significant. Based on the results of the t-test, it is known that the t-count is greater than the t-table (located in the area of reject Ho and accept Ha). Which means that 7,034> 2,576. This means that the hypothesis test results in the conclusion Ho reject and accept Ha, it can be concluded that there is a significant relationship between leadership factors and efforts to improve employee performance.

4. CONCLUSIONS AND SUGGESTIONS

4.1 Conclusion

From the results and discussion of research based on questionnaire data obtained during the study, regarding the influence of leadership adaptive factors on improving employee performance, several conclusions can be drawn, namely:

a. From the research results, the leadership adaptive variable on average is quite good at a score of 3.56, on a scale of 1 to 5 with the lowest average score of 3.1 and the highest score 3.8. From several leadership indicators, there is an average score below 3, namely indicator no.9 concerning leader's creativity with a score (2.7) while the highest is indicator no.6 concerning task-oriented leaders with a score of (4.57).

b. Based on research on performance variables, the average score is quite good with a score of 3.38 on a scale of 1 to 5 with the lowest average score of 2.5 and the highest score of 4.4.From several indicators there is the lowest score of 2.87 on indicator no.2 about employees on work time, while for the highest score on indicator no.3 regarding the completion of work according to the target, namely 4.55.

c. From the correlation analysis, the correlation coefficient value was obtained r = 0.723. This shows that there is a strong and positive relationship between leadership adaptive factors and employee performance.

From the analysis of the coefficient of determination, the value of r2 = 0.522 or 52.0% was obtained. This shows that the contribution of the leadership factor to performance is 52.2%.

The result of the hypothesis test, it is known that the t-table value is greater than the t-count value (t-count 7,034> t-table 2,576). It can be concluded that there is a significant relationship between leadership factors and employee performance improvement at the 99% confidence level.

d. The regression equation of the influence of leadership factors on performance: Y = 13.605 + 0.623 shows that if there is an increase in the leadership factor (X) by 1 (unit) it will increase employee performance (Y) by 0.623.

4.2. Suggestions

From the above conclusions, several suggestions can be made as follows:

a. In accordance with their functions, company leaders should constantly increase their creativity in carrying out company activities and proactively provide direction and guidance to their subordinates as well as increase their expertise and intelligence in carrying out their duties as leaders.

b. Employees should always try to complete their work both in quality and quantity in order to produce output in accordance with expectations.

ACKNOWLEDGEMENT

The authors greatly acknowledge the support from Esa Unggul University Jakarta Indonesia for providing the necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

REFERENCES

Ahmadi, & Herdiawan, D. The application of CBA and SUG model for improving the quality of Indonesian navy human resources. *International Journal of Recent Technology and Engineering*, vol. 8 no. 3, pp. 393–399, 2019.

Bandono, A. D. I., Suharyo, O. S., & Riono. Applied fuzzy and NASA tlx method to measure of the mental workload. *Journal of Theoretical and Applied Information Technology*, vol, 97, no. 2, pp. 476–489, 2019.

Badan Nasional Penempatan dan Perlindungan Tenaga Kerja Indonesia. *Laporan Kinerja BNP2TKI* (Accountability report of NAPPIOW 2016). Jakarta: BNP2TKI. 2016.

Herdiawan, D., & Ahmadi. Development strategy of national food sovereignty to encounter radicalism threat. *International Journal of Innovative Technology and Exploring Engineering*, vol 8, no. 11, pp. 544–553, 2019.

Heru Kreshna Reza, Sukmo Hadi Nugroho. The Assessment of Work Performance, Education, and Self Motivation on Organizational Citizenship Behavior. *International Journal of Advanced Science and Technology*, vol. 29, no. 3, pp. 8019 – 8030, 2020.

Hikmat, H. *Strategy of Social Empowerment*. Bandung: Humaniora, 2004.

International Labour Organization, ILO. *Preventing discrimination, exploitation, abuse of women migrant workers*, Jakarta: Press, 2004.

LAN & BPKP. *Accountability and Good Governance*. Jakarta: Modul AKIP, 2000.

Mardiasmo. *Local autonomy and financial management*. Yogyakarta: PT Andi, 2002.

Miles, H. S. *Qualitative Data Analysis*. United State of America: Sage Publication, 2014.

Ministry of Manpower Decree Number 22, Year 2014 about *Implementation of Placement and Protection of Indonesian Overseas Workers*, 2014.

Nugroho, S. H., Madhakomala, R., & Gunawan, K. The system dynamic model for policy evaluation of navy personnel on the state-duty aspect. *International Journal of Scientific and Technology Research*, vol 8, no. 12, pp.228–236, 2019.

Nugroho, S. H., Madhakomala, R., & Gunawan, K. Analysis and scenario of navy performance allowance policy using system dynamic model. *International Journal of Scientific and Technology Research*, vol 8, no. 12, pp. 1140–1147, 2019.

Nugroho, S. H., Sukandari, B., Suharyo, O. S., & Bandono, A. The application of Nasa-Tlx methods to the analysis of Mtf navy personnel allocation. *International Journal of Scientific and Technology Research*, vol. 9, no. 3, pp. 6172–6179, 2020.

Reza, H. K., & Nugroho, S. H. Relationship analysis of motivation and customer satisfaction on services quality aspect for online transportation. *International Journal of Scientific and Technology Research*, vol. 9, no. 4, pp. 1101–1108, 2020.

Regulation of Head of National Agency of Placement and Protection of Indonesian Overseas Workers Number 4 Year 2017 about *Empowerment of Indonesian Overseas Workers,* Post-Indonesian Overseas Workers, and Their Family, 2017.

Setiadji, A., Marsetio, & Ahmadi. The assessment of strategic planning and strategic change management to improve organizational performance. *International Journal of Advanced Science and Technology*, vol. 29, no. 5, pp. 682–698, 2019.

Sugiyono. *Quantitative and Qualitative Research Methods And R & D.* Alfabeta Bandung, 2012.

Syahyuti. *Main concept Village and Agriculture Development*. Jakarta:Gramedia, 2006.

The Constitution Number 39 Year 2004 about *Placement and Protection of Indonesian Overseas Workers*, 2004.

The World Bank. *Building Blocks for Good Forest Outcomes: An Analytical Framework for Governance Reform*, ESW prepared by the Forest Team, Agriculture and Rural Development Departemen. The World Bank: Washington D.C, 2009.

UNDP. UNDP and Governance: *Experiences and Lesson Learned*. New York: MDG Division-UNDP, 2006.

FIELD III

POLICY AND STRATEGY

ANALYSIS OF THE ACCELERATION TIME AND OPTIMAL COSTS OF THE SHIPBUILDING PROJECT SPECIFIED IN THE ELECTRICAL SYSTEM WITH THE CRITICAL PATH METHOD

Agung Tresnadi[1], Suparno[2], Sutrisno[3]

[1,3]Indonesian Naval Technology College, STTAL, Surabaya, Indonesia
[2]Industrial Engineering Department, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
e-mail: agung.tresnadiasro@gmail.com

ABSTRACT

PT PAL Indonesia (Persero) is one of the strategic defense industries that produces Main Weapon Systems (Alutista) especially for the Indonesian Navy, and has a strategic role in supporting the development of the national marine industry. One of the benchmarks for the success of a new shipbuilding project is the length of time to complete both the stages of the production process and the entire project in addition to cost and quality of work. Therefore, research was conducted to optimize the planning of the production process time for a new shipbuilding project by creating a project network, looking for critical activities, and calculating the project duration. The method used to analyze costs and time is the critical path method, by accelerating the duration of activities that are on the critical path, then calculating changes in project costs that occur due to acceleration. The research objective with this critical path method is to determine the time and cost of the project and what activities are included in critical activities. In addition, it is also to control and coordinate various activities so that the project can meet the right timeframe and can also help companies plan and control projects in a more efficient time and cost. From the results of the analysis of project calculations during the initial conditions with normal working days without using overtime the company spent Rp. 1,963,108,000. Critical activities in initial conditions with 870 days for completion time conditions are accelerated by 710 days (total acceleration 160 days) with 16 critical trajectories covering 34 work activities where all activities enter critical trajectories. The difference between the initial working conditions and the accelerated conditions was 160 days. The new ship building project in the electrical system can be accelerated for 160 days at an additional cost of Rp. 3,525,214,127.

Keywords: *Shipbuilding project, Critical Path Method, Acceleration of time, and costs.*

1. INTRODUCTION.

Indonesia, the largest archipelagic state in the world, consists of oceans covering two-thirds of Indonesia's territory. Also, Indonesia is one of the countries with the longest coastline in the world. As a maritime country, Indonesia's geographical position lies in the tropics, in a crossing between two continents (Asia and Australia) and two oceans (Indian and the Pacific Ocean), and it has the potential and opportunities for the development of the marine industry to become national economic strength. Indonesia as a maritime country continues to develop and upgrade the fleet sea with good additions the number and type of combat fleet as well supporting fleet. This is confirmed through Law Number 34 of 2004 about the roles and duties of the Indonesian Navy in Article 9 that the TNI has duties and responsibility to build and develop the strength of the marine dimension aims to enforce the law and maintain security and territorial sovereignty sea following national laws and laws which has been ratified.

The construction of this ship takes a long time in one part of the shipbuilding project. The difficulties are in the electrical system which was going to be combined in erections, so planning is essential to control the work so that time efficiency occurs. PT. PAL Indonesia (Persero) as an international standard shipbuilding company is required to be able to meet the effective completion time in building new ships to be able to complete the next project with better results than the previous project. Cases of project delays at shipyard companies are usually caused by various factors, such as delays in materials, human resources, and equipment facilities. If there are material obstacles or human resources problems in the production process, each activity is less effective and it could cause delay of the completion, resulting in the emergence of a critical trajectory on the activities in the ship's electrical system. If those problems happen, there will be a lot of excess in some parts of the production. This in turn will cause an increase in production expenditures or delay in completion of production, consequently results in large losses to the shipyard industry. To support its activity, the implementation of project management is very helpful in dealing with problems that often arise in a project. Several methods have been developed to overcome this problem, including the Network Planning method.

There are two basic methods commonly used in Network Planning, namely the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT). Scheduling is the basic technique commonly used in Network Planning is the CPM (Critical Path Method) method intended to analyze the critical path of work,. CPM or the critical path method is a project management technique that uses only one factor of time per activity and is the fastest path to working on a project. Every project included in this pathway is not given a rest period for its work, assuming that the estimated time for the project activity stages and its dependencies are logically correct. The critical path concentrates on time and cost tradeoffs. This activity is a project activity model described in the form of a network used for planning, scheduling, and controlling the project. Optimal duration in project implementation can be obtained by using a supporting application that can be used in planning and scheduling the activities of a project, all of which aim to optimize the work of a project so that there will be efficiency in terms of cost and execution time of the ship being built.

Project delays are a common problem. This delay is very detrimental to the parties involved, both the contractor and the project owner itself (Soeharto, 2010). Speeding up the time to complete the project is an attempt to complete the project earlier than the completion time in normal circumstances. There are times when the project schedule must be accelerated with various considerations from the project owner. The process of speeding up this time is called a program crash by accelerating the duration of activities located on the critical path and has the lowest cost slope, then calculating the changes in project costs that occur due to acceleration. This method is carried out continuously until the network with a critical path reaches a saturated condition, which means that it is no longer possible to reduce the implementation time (optimal point) on the critical path. Construction projects need to be carried out with proper planning and control so the acceleration of project implementation with the least additional cost could be done.

By using the Critical Path Method (CPM) the planning process all activities that must be completed in the project will be easier. CPM will include the entire list of activities required to complete the project, the time or duration required of each activity, and HR planning. From this process, the critical path from a network diagram, in which some activities can be found the manufacturing time can be shortened to obtain project work the most efficiently.

2. MATERIAL & METHODOLOGY

2.1 Project Management

Project management determines the success of a project's work. One of the problems commonly faced in projects is the problem of delay in work. Delays in a project that can be caused due to certain reasons, such as problems with labor availability, weather problems, and other problems so that good management is needed to overcome these delays. (Soeharto, 2001).

2.2. Project Scheduling

According to (Lawrence, 2001), many project scheduling objectives are covering:

a. Determine the earliest and last schedule of start and end times for each activity leading to the earliest completion time for the entire project.

b. Calculates the likelihood that the project will be completed within a certain time frame.

c. Look for the minimum cost schedule that will complete a project by a specific date.

d. Investigate how delays for specific activities affect the overall turnaround time of the project.

e. Monitoring a project to determine whether it is running on time and within budget.

f. Look for a schedule of activities that will smooth the allocation of resources throughout the project.

2.3 Network Planning

According to (Herjanto, 2003), Network Planning is defined as a model that is widely used in project implementation, the product of which is information about the activities contained in the network diagram concerned. It can be concluded that network planning is a planning and controlling project that describes the dependency relationship between each job depicted in the network diagram.

2.4 Optimization Analysis

Optimization analysis is defined as a process of decomposing project duration to obtain the best (optimal) duration acceleration by using various alternatives in terms of cost. The process of shortening the activity time in the network to reduce the time on the critical path, so that the total completion time can be reduced is referred to as project crashing (Heizer, 2005).

2.5 CPM (Critical Path Method)

According to Schroeder in the book Project Management by Hamdan Dimyati and Kadar Nurjaman (2014:338), that is:

“Critical Path Method (CPM)” is a network-based method that uses a linear time-cost balance. Each activity can be completed faster than normal by cutting activities for a certain amount of cost. Thus, if the project completion time is not satisfactory, certain activities can be cut short to complete the project in less time ”. In operation CPM (Critical Path Method) is a method using arrow diagrams to determine the critical path so it is also called the critical path method. CPM uses a certain number of estimated activity duration.

2.6 Optimum Time Analysis of Network Planning

One of the important things in project analysis is knowing when the project can be completed. To answer this, it is necessary to know in advance the time required for each activity, its relationship to other activities, and when the activity starts and ends. After these things are known, the next step is to carry out the calculations, while the calculation method that must be done consists of two ways, namely forward computation and backward computation. So that by doing the two calculations, it can be seen the critical path and also when the project or production can be completed.

a. Forward Computation

The forward calculation is the calculation of moving from the initial event to the terminal event. The point is to calculate the time that the event occurs at the earliest and when the activities start and finish at the earliest.

b. Backward Computation

In a countdown, the calculation moves from the terminal event to the initial event. The objective is to calculate the time at the latest events occurring and the time at the latest at the start and completion of activities (TL, LS, and LF).

2.7 Calculation of Allowance Time (Float or Slack)

Activities that can be postponed or have leeway in the process of processing can be found after doing forward and backward calculations. This slack/float can be used for scheduling without causing delays in the overall completion of the project or production. There are two types of allowance in network planning, namely total float, and free float.

According to Tjutju Tarliah Dimyati and Ahmad Dimyati (2006: 186-189): "Total float is the amount of time in which the completion time of an activity can be postponed without affecting the fastest time of completion of the overall project".

The total float is calculated by finding the difference between the slowest times starts of the activity with the earliest start of the activity. If you are going to use the equation (S = LS - ES), or it can be calculated by finding the difference between the time the activity is completed at the latest and the time the activity is completed the fastest (S = LF - EF)

Formula:

S = LS – ES

Where:

S = Total float

LS = when the activity starts at the latest

ES = the fastest time the activity starts

"Free float is the amount of time during which the completion of an activity can be measured without affecting the time that other activities start at the earliest or when other events occur in the network the earliest."

Meanwhile, free slack is calculated by finding the difference between the fastest time the event occurs at the end of the activity and the fastest time the activity is completed (SF = TE - E - t)

Formula:

SF=EF – ES – t

Where:

SF = Free Sloat

EF = The fastest time the activity is completed

ES = The fastest time to start the activity

T = the time required for an activity

An activity that has no leeway (float) is called a critical activity, in other words, a critical activity has S = SF = 0

2.8 Gantt Chart

This method was first developed by Henry L. Gantt. The principle is to describe work activities in graphical form with a time scale. Here is information about the scope of the initial task that must be completed as a condition for completing the next task.

2.9 Cost Calculation

To shorten the known critical path, there are several control methods. Especially in terms of controlling project costs which include:

a. **Manpower**: After a list of jobs and tasks for each is compiled, it can be directly drawn into a Gantt chart.

b. **Crash Program**: This program is to speed up the time of the network that has a known critical path.

After knowing the time cost elements above, you can calculate how much it costs to shorten one day using the formula:

$$\text{The slope of Costs} = \frac{\text{Shortened fees - Normal fees}}{\text{Time shortened - Normal time}}$$

c. Managing change: During project implementation, it is often necessary to adjust plans and realities.

2.10 Research Methodology

To solve problems in the observed research, steps are needed and determined to describe the approach and model of the problem. The steps taken are.

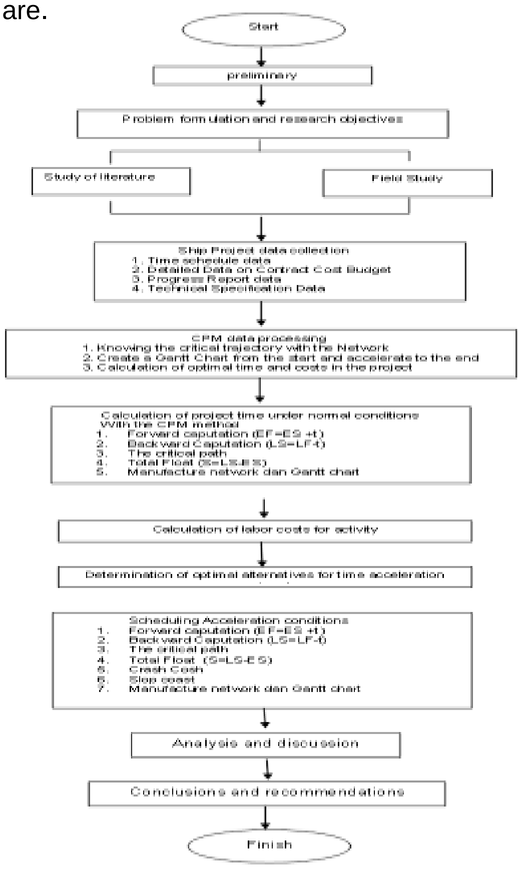


Figure 1. Research Flow Chart

3. RESULT AND DISCUSSION.

3.1 Job Description and Duration

Planning is the determination of the requirements for the project sources of the order of use in the various operations that must be carried out to achieve the desired goals. However, planning is incomplete if it is accompanied by time factors, but time should be flexible about financial, social, and other factors in planning. While the relationship between activities and duration, each activity can be seen in the tables below:

Table 1. description of activities, predecessor activities, duration of activities

No	Type of activity	Activity Predecessor	Activity	Time (day)
	PREPARATORY WORK			
1	Drawing/Design	0	A	120 day
2	Input Material	A	B	80 day
3	Material inspection	B	C	40 day
	FABRICATION			
4	Coming	D	E,F,G	82 day
5	Main Cable Way	E	H	8 day
6	Sub Cable Way	F	L	6 day
7	Seat Panel	G	P	12 day
	INSTALL			
	Main Cable Way			
8	a.1 Main Gladak	H	I,L,P	25 day
9	a.2 Gladak I	I	J,M,Q	35 day
10	a.3 Gladak II	J	K,N,R	33 day
11	a.4 Gladak II	K	S	17 day
	Sub Cable Way			
12	b.1 Main Gladak	L	M	18 day
13	b.2 Gladak I	M	N	10 day
14	b.3 Gladak II	N	O	12 day
15	b.4 Gladak III	O	P	17 day
16	Seat Panel	P	Q	12 day
	CABLING			
17	Cutting Cable	Q	R	18 day
18	Wiring Cabel	R	S	20 day
19	Peraplan Cabel	S	T	36 day
20	Connecting Cabel	T	U,V,W	168 day
21	Cek Line Cable	W	X	27 day
22	Merger Test	X	Y	17 day
23	Compound	Y	Z	42 day
24	Test Function	Z	Z1	18 day
Amount				870 day

3.2 Project Cost

Estimated project costs play an important role in the implementation of a project with the implementation of project activities starting from the planning, implementation, and control stages that will be calculated in value for money. So experience and thoroughness will be very important in preparing project forecast plans (Soeharto, 1997). There are several types of costs associated with construction project financing, namely the types of direct costs (Direct Cost) and indirect costs (Indirect Cost).

3.3 Direct Cost

Direct costs are all costs that are directly related to the implementation of construction work in the field. Direct costs can be obtained by multiplying the volume/quantity of a job by the unit cost of the work. The work unit price consists of the price of materials, labor wages, and equipment costs. In Table 2. a list of material/component prices used by the company to carry out electrical system installation work on ships

Table 2. List of Material Prices in Electrical Installations

No	Material	Harga/Unit (RP)
	POWER SUPPLY EQUIPMENT	
1	Main Switch Board :	662.500.000,00
	- Emergency switch board	Include MSB
	- Batteries	Include MSB
	- Charging and Discharging Panels for Battery	Include MSB
	- Power Supply Voltage Converter Equipment	Include MSB
2	Main Transformator	55.000.000,00
	- Distribution Panels	Include MSB
	ILLUMINATION AND NAVIGATION LIGHTING EQUIPMENT	
3	Fluorencent Lights	150.525.000,00
	- Incandescent Lights	Include above
	- Navigation light and Signal light	Include above
	COMMUNICATION,INSTRUMENTATION AND ALARM SYSTEM	
4	Ship Service Monitoring System	105.500.000,00
5	Internal Communication	8.930.712.500,00
	- Telephone Set	Include above
	- SPT System	Include above
	- PA Talk	Include above
	NAUTICAL AND RADIO EQUIPMENT	
6	Echo Sounder	3.165.608.129,00
	- Speed Log	Include above
	- ECDIS	Include above
	- GPS Receiver	Include above
	- Radar	Include above
	- EPIRB	Include above
	- Gyro & Magnetic Compass	Include above
	- Weather Facimile	Include above
	- SART	Include above
	- Radio Communication (GMDSS A-3)	Include above
7	NAUTICAL AND RADIO EQUIPMENT	3.155.609.129,00
	Echo Sounder	Include above
	- Speed Log	Include above
	- ECDIS	Include above
	- GPS Receiver	
	- Radar	Include above
	- EPIRB	Include above
	- Gyro & Magnetic Compass	Include above
	- Weather Facimile	Include above
	- SART	Include above
	- Radio Communication (GMDSS A-3)	Include above
	ELECTRICAL CABLING AND RELATED MATERIAL	
	Cable for Power	353.784.500,00
8	- Cable for Electronic	Include above
	- Cable for Control & Automation	Include above
	Tactical Communication	1.379.797.500,00
9	ELECTRICAL Outfitting	
	Raceway	376.504.900,00
10	Cable Hanger	Include above
	Cable Gland	Include above
	Terminal Lug	Include above
	Junction Box	Include above
	Cable Tie	Include above
	Amount	15.190.022.809,00

Meanwhile, direct labor costs include labor that is directly related to activities or directly working in the field. Table 3. presents a list of daily labor wages for normal hours.

Table 3. Wages / Salary of Labor / Day

No	Type of Worker	Work unit	Unit price (Rp)
1	Head of the workshop	Day	375.000,00
2	Group Leader	Day	275.000,00
3	Technician	Day	275.000,00
4	Repairman	Day	185.000,00

Overtime wages are calculated per working day which is adjusted to the job title of each worker. Overtime work can be held at any time if it is necessary, such as to catch up on a project completion time in case of a setback. Overtime is done 2 hours a day after normal working hours. The following Table 4. provides the cost of overtime pay per day for each employee position:

In a day there are 8 normal working hours, namely 08.00-12.00 WIB, 13.00-17.00 WIB, and 1 hour of rest. If there is a maximum of 3 hours of overtime a day, starting from 17.00-20.00 WIB. In 1 week there are 5 working days, Saturday and Sunday holidays, for overtime payment calculation 1/173 x Basic Salary = Tariff, this is by the Decree of the Minister of Manpower Number KEP.102 / MEN / VI / 2004 article 11, if any employees who enter that day are declared overtime for 6 hours starting from the first hour, except for employees who are all-in.

3.4 Indirect Costs

Indirect costs can be expressed as related to activities including the exploitation of equipment and machines, expenses for supervisors, field administration, supervision costs, and others. (Soeharto; 1997) costs that include indirect costs are:

a. Costs included in overhead are a component of costs including company operating expenses that are charged to the project.

b. Contingencies. The contingency is the cost reserve of an estimated cost or budget to be allocated to items that have not been determined, which according to experience and statistics show that it is always needed. The farther the project goes, the more data and information is input, so there will be many uncertain problems, as well as contingencies. In general, this cost is required between 0.5% -5% of the total project.

3.5 Calculation of Project Time with CPM

In CPM scheduling, the activities in the project are classified into critical activities and non-critical activities. In the arrangement of scheduling in project activities, there are a number of activities that must be done as soon as possible, because these activities have the longest processing time sequence. These activities are called critical activities and the path through which they are passed is the critical path or critical path. To determine the critical trajectory is calculated using forward and backward calculations.

Table 5. Foward Computation Initial Conditions

Activities	Node Start	Node Finish	Duration	ES	EF = ES + t
1	0	1	160	0	160
2	1	2	120	160	280
3	2	3	80	280	360
4	3	4	12	360	372
5	4	6	16	372	388
6	4	5	38	372	410
7	4	7	37	372	409
8	5	8	6	410	416
9	6	12	4	388	392

Table 6. Backward Computation Initial Conditions

Activities	Node Start	Node Finish	Duration	LF	LS = LF - t
1	0	1	160	160	0
2	1	2	120	280	160
3	2	3	80	360	280
4	3	4	12	372	360
5	4	6	16	430	414
6	4	5	38	410	372
7	4	7	37	463	426
8	5	8	6	416	410
9	6	12	4	434	430
10	7	16	10	473	463
11	8	12	4	434	430
12	8	9	8	424	416
13	12	13	6	440	434
14	9	13	16	440	424
15	9	10	12	440	428
16	13	14	8	448	440
17	10	14	8	448	440
18	10	11	14	501	487
19	14	15	10	458	448
20	15	16	15	473	458
21	8	16	10	473	463
22	9	17	10	483	473
23	10	18	15	498	483
24	11	19	15	516	501
25	16	17	10	483	473
26	17	18	15	498	483
27	18	19	18	516	498
28	19	20	32	548	516
29	20	21	55	683	628
30	20	22	55	683	628
31	20	23	55	603	548
32	23	24	24	617	603
33	24	25	14	631	617
34	25	26	39	670	631
35	26	27	13	683	670

3.6 Determination of the Critical Path

Total Float: calculated by finding the difference between the time the activity starts at the latest and the time at the earliest to start the activity is calculated by the equation:

Rumus :

$S = LS - ES \quad (2.12)$

Dimana :

S = Total float

LS = When the activity starts at the latest

ES = The fastest time the activity starts

Table 7. Initial Total Float Calculation

Activities	Node Start	Node Finish	Duration	ES	S = LS - ES
1	0	1	0	0	0
2	1	2	160	160	0
3	2	3	280	280	0
4	3	4	360	360	0
5	4	6	414	372	42
6	4	5	372	372	0
7	4	7	426	372	54
8	5	8	410	410	0
9	6	12	430	388	42
10	7	16	463	409	54
11	8	12	430	416	14
12	8	9	416	416	0
13	12	13	434	420	14
14	9	13	424	424	0
15	9	10	428	424	4
16	13	14	440	440	0
17	10	14	440	436	4
18	10	11	487	436	51
19	14	15	448	448	0
20	15	16	458	458	0
21	8	16	463	416	47
22	9	17	473	424	49
23	10	18	483	436	47
24	11	19	501	450	51
25	16	17	473	473	0
26	17	18	483	483	0
27	18	19	498	498	0
28	19	20	516	516	0
29	20	21	628	548	80
30	20	22	628	548	80
31	20	23	548	548	0
32	23	24	603	603	0
33	24	25	617	617	0

3.7 Labor Costs for Activities

Carrying out the calculation of labor costs requires data such as duration of activities, wages of labor per day, number and allocation of labor for activities or activities. In calculating the cost of labor in this init Duration of Activities (days) x Wages or Salary of Workers x Number of Workers

Table 8. Labor Costs for Activities in Initial Conditions

No	Tipe of activity	Duration (day)	Head of the workshop	Group Leader	Technician	Repairman	labor costs (Rp)
PREPARATORY WORK							
1	Drawing/Design	120	1	1	2		246.720.000
2	Material Input	80	1		2		108.960.000
3	Inspeksi Material	40	1	1	2		94.560.000
FABRICATION							
4	Coming	82	1	1	1	5	165.873.000
5	Main Cable Way	8		1	2	9	14.814.000
6	Sub Cable Way	6		1	1	2	3.656.000
7	Seat Panel	12			1	7	15.550.000
INSTALL							
	Main Cable Way	**112**		1	3	12	368.704.000
8	a.1 Gladak Utama	25					Include Above
9	a.2 Gladal I	35					Include Above
10	a.3 Gladak II	33					Include Above
11	a.4. Gladak III	17					Include Above
	Sub Cable Way	**46**		1	1	4	58.880.000
12	b.1 Gladak Utama	18					Include Above
13	b.2 Gladak I	10					Include Above
14	b.3 Gladak II	12					Include Above
15	b.4 Gladak II	17					Include Above
16	Seat Panel	12		1	7		15.550.000
CABLING							
17	Cutting Cable	18		1	1	3	16.455.000
18	Wiring Cable	20		1	3	20	85.608.000
19	Heat Cabel	36		1	2	9	79.008.000
20	Connecting Cable	168		1	2	15	588.555.000
21	Cek Line Cable	27		1	1	5	35.112.000
22	Mergger Test	17	1	1	1	1	15.274.000
23	Compound	42		1	1	2	35.646.000
24	Test Function	15	1	1	1	1	14.183.000
	total cost						**1-963.108.000**

3.8 Scheduling of Proposed Conditions or Acceleration

The initial condition of the project can be completed within 870 days at a cost of Rp. 1,963,108,000, - In this proposed condition a crash program will be used to speed up the project implementation time. The crash program in this study was carried out by imposing overtime hours, while the crash program used was a crash program with a maximum time limit, namely the completion of the project with a maximum time limit set by the project owner.

Table 9. Work Duration of Acceleration

No	Tipe of activity	Predecessor Activities	Activity	time (day)	time Accelarated
	PREPARATORY WORK				
1	Drawing/Design	0	A	120	60
2	Material Input	A	B	80	80
3	Inspeksi Material	B	C	40	40
	FABRICATION				
4	Coming	D	E,F,G	82	82
5	Main Cable Way	E	H	8	6
6	Sub Cable Way	F	L	6	4
7	Seat Panel	G	P	12	10
	INSTALL				
	Main Cable Way				
8	a.1 Gladak Utama	H	I,L,P	25	25
9	a.2 Gladak I	I	J,M,Q	35	25
10	a.3 Gladak II	J	K,N,R	33	33
11	a.4 Gladak II	K	S	17	17
	Sub Cable Way				
12	b.1 Gladak Utama	L	M	18	18
13	b.2 Gladak I	M	N	10	10
14	b.3 Gladak II	N	O	12	12
15	b.4 Gladak III	O	P	17	17
16	Seat Panel	P	Q	12	12
	CABLING				
17	Cutting Cable	Q	R	18	18
18	Wiring Cabel	R	S	20	20
19	Perapian Cabel	S	T	36	36
20	Connecting Cabel	T	U,V,W	168	90
21	Cek Line Cable	W	X	27	24
22	Merger Test	X	Y	17	17
23	Compound	Y	Z	42	39
24	Test Funtction	Z	Z1	15	15
	Total days accelerated			**870**	**710**

3.9 Calculation of the Critical Path for Acceleration Conditions

In determining the critical path after applying overtime, forward and backward calculations are used.

Table 10. Foward Computation in Accelerated Condition

Activities	Node start	Node finish	Duration	ES	EF = ES + t
1	0	1	100	0	100
2	1	2	80	100	180
3	2	3	50	180	230
4	3	4	12	230	242
5	4	6	16	242	258
6	4	5	38	242	280
7	4	7	37	242	279
8	5	8	6	280	286
9	6	12	4	258	262
10	7	16	10	279	289
11	8	12	4	286	290
12	8	9	8	286	294
13	12	13	6	290	296
14	9	13	16	294	310
15	9	10	12	294	306
16	13	14	8	310	318
17	10	14	8	306	314
18	10	11	14	306	320
19	14	15	10	318	328
20	15	16	15	328	343
21	8	16	10	286	296
22	9	17	10	294	304
23	10	18	15	306	321
24	11	19	15	320	335
25	16	17	10	343	353
26	17	18	15	353	368
27	18	19	18	368	386
28	19	20	32	386	418
29	20	21	30	418	473
30	20	22	30	418	473
31	20	23	30	418	473
32	23	24	20	473	493
33	24	25	14	493	507
34	25	26	30	507	537
35	26	27	13	537	550

Table 11. Backward Computation in Accelerated Conditions.

Activities	Node Start	Node Finish	Duration	LF	LS = LF - t
1	0	1	100	100	0
2	1	2	80	180	100
3	2	3	50	230	180
4	3	4	12	242	230
5	4	6	16	300	284
6	4	5	38	280	242
7	4	7	37	333	296
8	5	8	6	286	280
9	6	12	4	304	300
10	7	16	10	343	333
11	8	12	4	304	300
12	8	9	8	294	286
13	12	13	6	310	304
14	9	13	16	310	294
15	9	10	12	310	298
16	13	14	8	318	310
17	10	14	8	318	310
18	10	11	14	371	357
19	14	15	10	328	318
20	15	16	15	343	328
21	8	16	10	343	333
22	9	17	10	353	343
23	10	18	15	368	353
24	11	19	15	386	371
25	16	17	10	353	343
26	17	18	15	368	353
27	18	19	18	386	368
28	19	20	32	418	386
29	20	21	30	550	495
30	20	22	30	550	495
31	20	23	30	473	418
32	23	24	20	493	473
33	24	25	14	507	493
34	25	26	30	537	507
35	26	27	13	550	537

Table 12. Calculation of Total Float in Accelerated Condition

Activities	Node start	Node finish	LS	ES	S = LS – ES
1	0	1	0	0	0
2	1	2	100	100	0
3	2	3	180	180	0
4	3	4	230	230	0
5	4	6	284	242	42
6	4	5	242	242	0
7	4	7	296	242	54
8	5	8	280	280	0
9	6	12	300	258	42
10	7	16	333	279	54
11	8	12	300	286	14
12	8	9	286	286	0
13	12	13	304	290	14
14	9	13	294	294	0
15	9	10	298	294	4
16	13	14	310	310	0
17	10	14	310	306	4
18	10	11	357	306	51
19	14	15	318	318	0
20	15	16	328	328	47
21	8	16	333	286	49
22	9	17	343	294	47
23	10	18	353	306	51
24	11	19	371	320	0
25	16	17	343	343	0
26	17	18	353	353	0
27	18	19	368	368	0
28	19	20	386	386	77
29	20	21	495	418	77
30	20	22	495	418	0
31	20	23	418	418	0
32	23	24	473	473	0
33	24	25	493	493	0
34	25	26	507	507	0
35	26	27	537	537	0

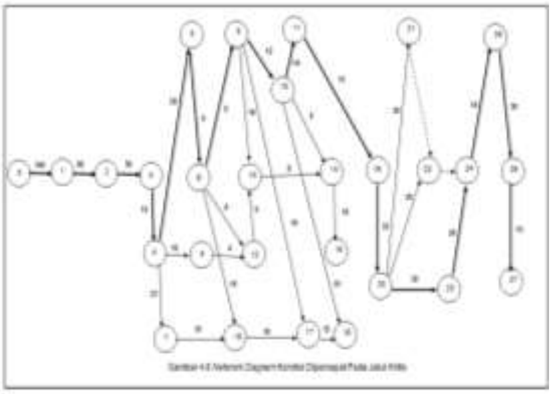


Figure 1. Network Diagram of Accelerated Conditions on a Critical Path

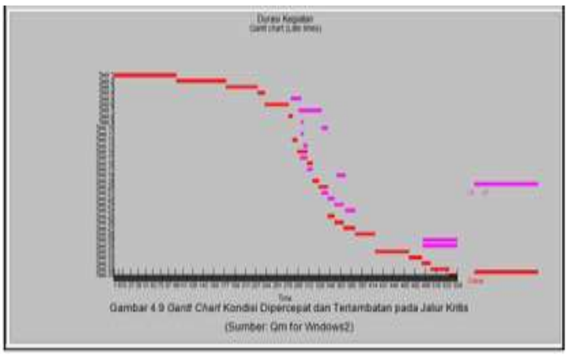


Figure 2. Gantt Chart Accelerated and Delayed Conditions on Critical Pathways

3.8 Labor Costs After Acceleration Conditions

The results of the calculation of labor costs for accelerated activities can be found activity slope which is useful for knowing the comparison to choose which critical activity will be shortened, the smaller the cost to shorten the time period of the activity, and vice versa.

Table 13. Tambulation of Normal, Accelerated and Cost Slopes

Activities	Normal Time	Normal Fee	Crash Time	Crash Fee	Slope of Costs
Drawing/Design	120	189.120.000	100	237.207.720	801.462
Material Input	80	108.960.000	80	115.080.000	153.000
Inspeksi Material	40	94.560.000	50	100.603.860	201.462
CABLING					
Conneting Cable	168	588.555.000	90	637.852.950	657.306
Cek Line Cable	27	35.112.000	20	36.182.256	267.564
Compound	42	35.646.000	30	37.132.620	164.180

4. CONCLUSIONS

After carrying out the research process, from the processing results data and calculations that have been done it can summed up as follows:

a. Critical activity in initial conditions with 870 days for an accelerated condition of completion time for 710 days (a total acceleration of 160 days) with 16 critical trajectories covering 34 work activities where all activities enter critical trajectories.

b. The difference in processing time during the initial condition and acceleration condition is 160 days.

c. Alternate acceleration applied to reduce consequences of delay, among others:

1) Additional working hours, and
2) Increase in the number of workers

d. The Shipbuilding project on the electrical system can be accelerated for 160 days at a cost an additional amount of Rp. 3.525.214.127.

ACKNOWLEDGEMENT

This research has been Supported by Indonesia Naval Technology College (STTAL).

REFERENCE

Ali, T. H. (1995). Prinsip-prinsip Network Planning. Bandung: Gramedia.

Badri, S. (1997). Dasar-dasar Network planning. Jakarta: Penerbit Rineka Cipta.

Dimyati. (2014). Manajemen Proyek. Bandung: CV Pustaka setia.

Ervianto, W. I. (2002). Manajemen Proyek Konstruks. yogyakarta: Cetakan Pertama, Andi Offset.

Heizer. (2005). Operations Management. Jakarta: Salemba Empat.

Herjanto. (2003). Manajemen Produksi dan Operasi, cetakan ketiga. Jakarta: Grasindo.

Husen, A. (2009). Manajemen Proyek (Perencanaan Penjadwalan dan Pengendalian Proyek). Yogyakarta: Penerbit: Andi.

Jay, H. d. (2008). Operation Management. Jakarta: Salemba.

Kajatmo, S. (1977). Uraian Lengkap Metode Network Planning Jilid I,II,III. Jakarta: Badan Penerbit Pekerjaan Umum.

Nazir. (1998). Metode Penelitian. Jakarta: Galia Indonesia.

PMBOK. (2004). A Guide to Project Management Body of Knowledge,.

Reksohadiprodjo. (1987). Manajemen Proyek. Yogyakarta: BPFE.

Siswojo. (2000). GMD, Jilid II. Jakarta: Erlangga.

Soeharto. (2001). Manajemen Proyek. Jakarta: Erlangga.

Soeharto. (2010). Manajemen Proyek. Jakarta: Erlangga.

THE DEVELOPMENT STRATEGY OF INDONESIAN NAVAL HUMAN RESOURCES UNIT (LAPETAL) USING SWOT ANALYSIS

Cahyanto[1], Suparno[2], Adi Bandono[3]

[1,3]Indonesian Naval Technology College, STTAL, Surabaya, Indonesia
[2]Industrial Engineering Department, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
e-mail: cahyaafkar@gmail.com

ABSTRACT

Quality human resources who are in the Indonesian Navy organization have a very important role. Because with the Indonesian Naval Main Weapon System (Alutsista) award, which is getting more and more sophisticated and the challenges in the era of the industrial revolution 4.0, it is hoped that its human resources will be able to reliably manage the defense equipment. In looking for quality human resources, good planning is needed to achieve optimal organizational goals in the utilization of existing resources. The provision of quality human resources in the Indonesian Navy requires a qualified organization, in this case, is carried out by the Lapetal. So that we need a strategy to develop the Indonesian Naval Human Resources unit. The purpose of this study was to obtain the factors, criteria, and formulation of development strategies. This study uses the SWOT analysis method. Based on the SWOT analysis, there were 10 criteria for internal factors and 7 criteria for external factors as well as 4 alternative strategies, namely 7 SO strategy steps, 5 ST strategy steps, 6 WO strategy steps and 4 WT strategy steps, WO strategy was chosen as the first alternative with the highest weight of 4, 01.

Keywords: *The Indonesian Naval Human Resources Unit (Lapetal), SWOT Analysis.*

1. INTRUDUCTION

In supporting the implementation of its main duties, the Indonesian Navy always maintains the performance of the organization's performance to create an effective and efficient performance (Harky, 2018). This is a demand that must be considered in every organization, therefore the Indonesian Navy needs qualified and qualified Human Resources in terms of capability and professionalism.

Quality human resources who are within the Indonesian Navy have a very important role. Because with the availability of the Indonesian Naval Main Weapon System (Alutsista) which is increasingly numerous and sophisticated as well as the challenges in the era of the industrial revolution 4.0 (Mashudi, 2019), it is hoped that its human resources will be able to manning the defense equipment reliably. In looking for quality human resources, a good plan is needed to achieve optimal organizational goals in the utilization of existing resources.

The provision of quality human resources in the Indonesian Navy requires a qualified human resources organization, in this case, carried out by The Indonesian Naval Human Resources Unit (Lapetal). Faced with the expansion of the Indonesian Naval organization, namely the formation of a new unit/organization and also the addition of defense equipment, the duties, and responsibilities of the Lapetal will be heavier because it also causes the recruitment of Indonesian Naval personnel in the future. With the increasing number of duties and responsibilities of Lapetal and seeing the current condition of Lapetal, it is necessary to make efforts to develop Lapetal in the future.

Based on the current condition of Lapetal, the researcher will research Lapetal development strategies using a SWOT analysis. This study aims to obtain the factors and criteria that affect the Lapetal development strategy and to obtain the formulation of the Lapetal development strategy.

2. MATERIALS/METHODOLOGY

2.1. Concept of Organizational Development Strategy

Etymologically it is a derivative of the Greek word strategos. Strategos can be translated as "military commander" in the democratic era of Athens. Meanwhile, in terms of terminology, many experts have put forward the definition of strategy with different points of view, but basically, all of them have the same meaning or meaning, namely achieving goals effectively and efficiently.

According to (Istiqomah, 2017) strategic management can be defined as the art and science of formulating, implementing, and evaluating cross-functional decisions that enable an organization to achieve its goals. Historically, the main benefit of strategic management has been to help organizations formulate better strategies by using a more systematic, logical, and rational approach to strategy choice.

2.2 The Indonesian Naval Human Resources Unit (Lapetal).

The provision of quality human resources as crews of the Indonesian Armed Forces organization has a significant, strategic, and comprehensive influence on every activity of the organization and management to achieve the expected performance. In supporting the task of providing these soldiers at the Indonesian Navy, it is carried out by Lapetal which has an office at Jalan Yos Sudarso Malang, East Java and is headed by a Colonel Intermediate Officer. Lapetal is the front liner in the recruitment process for members of the Navy and has a strategic function in obtaining qualified human resources who meet qualifications and character standards.

Based on the TNI Commander Regulation Number 30 of 2014 concerning the Provision of Volunteer Soldiers for the Indonesian Armed Forces (Mabes TNI, 2014), what is meant by the provision are all activities carried out to process a citizen to become a Volunteer Soldier of the Indonesian Armed Forces by the specified requirements, which includes campaigns, admissions, first education, appointment, and first service ties.

2.3. SWOT Analysis Concept

SWOT analysis is the most common technique that can be used to analyze strategic cases (Hill & Westbrook, 1997). SWOT is a tool that is often used to analyze the internal and external environment to achieve a systematic approach and support for decision situations (Wheelen & Hunger, 2012). SWOT is an acronym for strength (S), weakness (W), opportunity (O), and threat (T). The first two factors (strengths and weaknesses) are related to internal organizational factors, while opportunities and threats cover the broader context or environment in which the entity operates (Collins-Kreiner & Wall, 2007).

Internal and external factors are referred to as strategic factors and are summarized in the SWOT analysis. Strengths and weaknesses are factors in the system that allow and hinder the organization from achieving its goals. Opportunities and threats are considered as external factors that facilitate and limit the organization in achieving its respective goals (Wasike, et al., 2010).

In table 1, The SWOT analysis shows the appropriate strategy in the four categories SO, ST, WO, and WT. The strategy identified as SO involves taking advantage of opportunities using existing strengths. ST is a strategy related to using force to eliminate or reduce the effects of a threat. Likewise, the WO strategy seeks to take advantage of the opportunities presented by external environmental factors by taking into account its weaknesses. The fourth and final one is WT, where an organization tries to reduce the impact of its threats by considering its weaknesses (Yuksel & Dagdeviren, 2007).

Furthermore, in this study, the SWOT analysis method is used to identify and formulate several strategies for developing the posture capability of the Indonesian Navy. The SWOT analysis method used in the development strategy is integrated with the MIDLIFE military strategy area corridor and the Naval strategy with the theoretical approaches of Alfred Thayer Mahan and Julian Stanford Corbett.

Table 1. SWOT Analysis Matrix

INTERNAL/EXTERNAL FAKTOR	STRENGTH (S) (Maximal)	WEAKNESS (W) (Minimal)
OPPORTUNITIES (O) (maximal)	S-O Strategy (Maximal-Maximal)	W-T Strategy (Minimal-Minimal)
THREATS (T) (Minimal)	S-T Strategy (Maximal-Minimal)	W-O Strategy (Minimal-Maximal)

2.4 Flow diagram

An outline of all research activities is illustrated in a flowchart as follows:

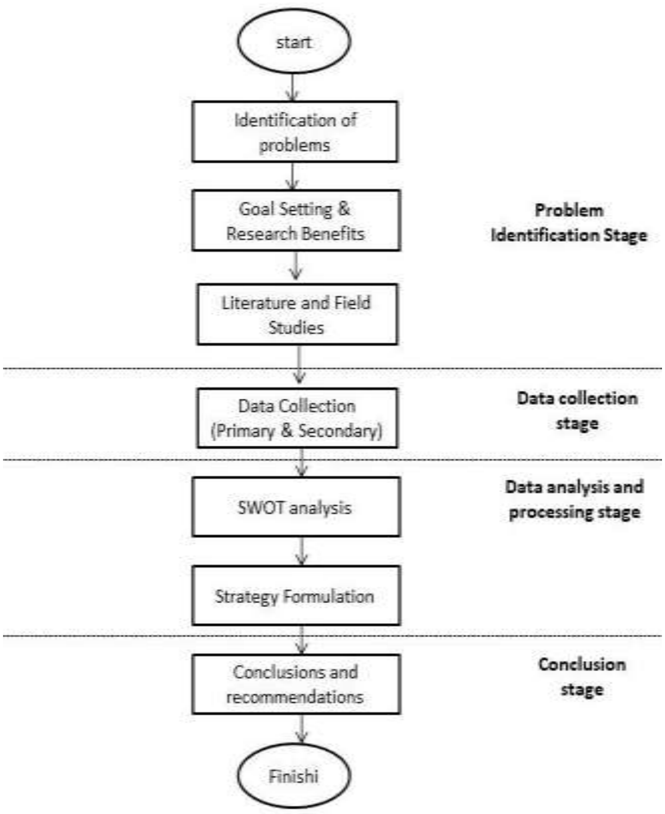


Figure 1. Flow Chart

3. RESULT AND DISCUSSION

3.1. Collection of Technical Data

In the early stages of data collection in the form of primary data and secondary data. Primary data is the process of taking data directly in the field by making observations to find out the facts or conditions. The initial stage in this data collection activity is carried out by interviewing the Chief of Lapetal and staff, to get an objective picture directly about the existing conditions as well as the fundamental factors that are part of the Lapetal. In addition to the above, a literature study was carried out through references from Indonesian Navy publications which were secondary data in this study. In addition to secondary data collection, primary data collection was also carried out by conducting interviews and distributing questionnaires to obtain data from respondents following their fields.

3.2. Existing Lapetal Conditions

The current condition of Lapetal as a human resources institution can only carry out 2 (two) stages of Provision, namely the campaign/socialization stage and the recruitment stage. Meanwhile, other stages have not been implemented (Lapetal, 2018)

This is because the organizational structure and number of personnel according to the Personnel Composition List (DSP) in the Organization and Procedures are not proportional, meaning that the main activities with the number of personnel are not appropriate so that they do not fully support the implementation of activities optimally. While the current DSP has not changed/added the number of personnel, therefore it is hoped that there will be a change in the organizational structure and an increase in the number of Lapetal personnel so that the Provision process activities can run according to their stages and optimally.

The organizational structure of Lapetal chaired by a Kalapetal with the rank of Colonel (grade 13) is a very strategic position because it is the stakeholder of Provision activities. Where the duties and responsibilities are very large. This is because the process of providing Indonesian Navy soldier candidates is only carried out by one institution which is headquartered in the city of Malang, East Java, while the process and outputs of their duties are for the Indonesian Navy organization.

Faced with the expansion of the Indonesian Navy organization, namely the formation of a new unit/organization and also the addition of defense equipment, the duties, and responsibilities of the Lapetal will be heavier because it also causes the recruitment of Indonesian Navy personnel in the future.

3.3. Internal Factor Analysis

Analysis of the internal environment aims to identify several strengths and weaknesses in the internal resources and processes that are owned. Internal activity resources and processes are said to have strength if these internal activity resources and processes have the capability that will create excellence in an organization. After the existing data is collected, which is obtained from documents, literature review, preliminary interviews with resource persons (Expert), the elements of internal factors are obtained as follows:

Table 2. Elements of Internal Factors

NO	FACTOR
1	Lapetals are only able to carry out 2 stages of provision, namely socialization and acceptance.
2	There are no detailed work instructions in carrying out the selection process for the recruitment of Indonesian Navy soldiers, especially the regional selection.
3	There is no special section that handles socialization/campaigning.
4	No division handles the security sector.
5	In terms of quantity and quality, the number of personnel is still lacking.
6	Lapetal personnel have very high motivation/performance.
7	Training for recruiting Indonesian Navy soldiers to all Lapetal personnel and representatives of all regional committees.
8	The transportation and communication system in Lapetal is quite good.
9	The availability of equipment in the socialization and selection activities is quite adequate, however, it needs to be improved, especially documentation equipment.
10	The facilities and infrastructure used for the implementation of the central selection still use those of the Malang Naval Base.

Based on the tabulation of the internal factors, the number of internal factor criteria is obtained, then the classification of the strengths and weaknesses factors. With the following formula:

$$\text{Overall average score} = \frac{\text{The average number of each factor}}{\text{Number of factors for internal criteria}} \quad (1)$$

Then we get the tabulation of internal factors as follows:

Table 3. Tabulation of Internal Factor Elements

NO	FACTOR	TOTAL	AVERAGE	CRITERIA
1	Lapetal personnel have very high motivation/performance.	29	7.25	S
2	Training for recruiting Indonesian Navy soldiers to all Lapetal personnel and representatives of all regional committees.	28	7	S
3	The transportation and communication system in Lapetal is quite good.	27	6.75	S
4	The availability of equipment in the socialization and selection activities is quite adequate, however, it needs to be improved, especially documentation equipment.	26	6.5	S
6	Lapetals are only able to carry out 2 stages of provision, namely socialization and recruitment.	17	4.25	W
6	There are no detailed work instructions in carrying out the selection process for the recruitment of Indonesian Navy soldiers, especially the regional selection.	15	3.75	W
7	The facilities and infrastructure used for the implementation of the central selection still use those of the Malang Naval Base.	15	3.75	W
8	There is no special section that handles socialization/campaigning.	14	3.5	W
9	No division handles the security sector.	12	3	W
10	In terms of quantity and quality, the number of personnel is still lacking.	12	3	W
	Overall average	195	48.75	

The calculation of the number on criterion no.1 is obtained from the total answers of 4 respondents, the total is 29. Then the average value is obtained from the total number of answers divided by the number of respondents so that the average = 29/4 = 7.25. The average value of the respondents' assessment of internal factors, it is known that the calculation of the benchmark value or the average of all internal factors = 4,875. Obtained from the sum of the average value divided by the number of criterion items 48.75 / 10 = 4.875. If the internal factors whose average score is above the benchmark value are grouped as strength, and internal factors whose average score is below the benchmark value are grouped as weaknesses.

From the results of the tabulation of internal factors, it can be seen that the strength factor which has the highest average value is Lapetal personnel who have very high motivation/performance, with an average value of 7.25. This, according to the respondents' assessment, is the main strength for Lapetal development. This means that the existence of motivation / good performance from Lapetal personnel becomes the main capital to be able to develop Lapetal. Meanwhile, the weakness factor that gets the lowest average score is the number of Lapetal personnel who are still lacking both in quality and quantity, with an average value of 3. This, according to respondents, is the biggest weakness in Lapetal development.

3.4. External Factor Analysis

After the existing data is collected, and based on document documents, literature review, preliminary interviews with resource persons (Expert), the elements of external factors are obtained as follows:

Table 4. Elements of External Factors

NO	FACTOR
1	The existence of the MEF (Minimum Essential Force) program.
2	There is a program for recruiting Indonesian Navy soldiers for special routes in the eastern region.
3	The existence of High School Taruna NALA (SMANTAR NALA), East Java.
4	Public interest to join the Indonesian Navy is high.
5	There is no maximum support in the implementation of publications from related units/stakeholders within the Indonesian Navy.

Based on the tabulation of external factors, the number of criteria for external factors is obtained, then the classification of opportunity factors (Opportunities) and threat factors (Threats). With the following formula:

$$\text{Overall average score} = \frac{\text{The average number of each factor}}{\text{Number of factors for external criteria}} \qquad (2)$$

Then we get the tabulation of external factors as in the following table:

Table 5. Tabulation of External Factor Elements

NO	FACTOR	TOTAL	AVERAGE	CRITERIA
1	The existence of the MEF (Minimum Essential Force) program.	30	7,5	O
2	Public interest to join the TNI AL is high.	29	7,25	O
3	The existence of High School Taruna NALA (SMANTAR NALA), East Java.	28	7	O
4	There is a program for recruiting Indonesian Navy soldiers for special routes in the eastern region.	27	6,75	O
5	There is no maximum support in the implementation of publications from related units/stakeholders within the Indonesian Navy.	21	5,25	T
	Overall average	135	33,75	

The calculation of the number on criterion no.1 is obtained from the total answers of 4 respondents as in the attachment, the total is 30. Then the average value is obtained from the total number of answers divided by the number of respondents, so that the average = 30/4 = 7.5. The average value of the respondents' assessment of external factors, it is known that the calculation of the benchmark value or the average of all external factors = 33.75 / 5 = 6.75. If external factors whose average value is above the benchmark value are grouped as opportunities, and external factors whose average value is below the benchmark value are classified as threats.

The opportunity factor that has the highest average score is the existence of the MEF (Minimum Essential Force) program, with an average score of 7.5. According to the respondent, this is the greatest opportunity, because it provides an opportunity for Lapetal to develop into a professional human research organization. Meanwhile, the threat factor that has the lowest average value is the absence of maximum support in the implementation of publications from related units/stakeholders within the Indonesian Navy, with an average score of 5.25. According to respondents, this is the biggest threat in Lapetal development.

3.5. SWOT data processing

The following will be weighted internal strategic factors, external strategic factors, and a summary of the results.

3.5.1. Weighting of Internal Strategy Factors (IFAS). After determining the strengths and weaknesses of internal factors, then weighting the IFAS can be seen in the following table:

Table 6. Weighting of IFAS

FACTOR	TOTAL	WEIGHT	RATING	WEIGHT x RATING
STRENGHT				
1. Lapetal personnel have very high motivation/performance.	29	0.1487	1.75	0,26
2. Training for recruiting Indonesian Navy soldiers to all Lapetal personnel and representatives of all regional committees.	28	0.1436	1.75	0.25
3. The transportation and communication system in Lapetal is quite good.	27	0,1385	2.25	0.31
4. The availability of equipment in the socialization and selection activities is quite adequate, however, it needs to be improved, especially documentation equipment	26	0.1333	2.5	0.33
STRENGHT TOTAL				1,16
WEAKNESS				
1. Lapetals are only able to carry out 2 stages of provision, namely socialization and recruitment	17	0.0872	2	0.17
2. There are no detailed work instructions in carrying out the selection process for the recruitment of Indonesian Navy soldiers, especially the regional selection.	15	0.0769	3.5	0.27
3. The facilities and infrastructure used for the implementation of the central selection still use those of the Malang Naval Base	15	0.0769	3	0.23
4. There is no special section that handles socialization/campaigning	14	0.0718	3.25	0.23
5. no division handles the security sector	12	0.0615	3	0.18
6. In terms of quantity and quality, the number of personnel is still lacking.	12	0.0615	3.75	0,23
WEAKNESS TOTAL				1,11
TOTAL				2,46

The calculation of the amount for the strength factor on no.1 is obtained from the total answers of 4 respondents, namely 29. Then the total number of answers to 4 respondents from the strength and weakness factors is 195. The calculation of the weight of the strength factor on no.1 is obtained from the total answers of 4 respondents divided by the total number answer, namely as follows: weight = 29/195 = 0.1487.

Based on the IFAS matrix table above, it can be seen that the weighting of the internal factor rating, where the weighting is done to know how much the factors influence or have an impact on the strategic factor itself. The weighting of the strategic factors in the table is obtained from the total strength score of 1,15 and the total weakness score of 1,31 so that the overall total of internal factors is 2.46. The purpose of this rating is to provide a scale ranging from 4 to 1 based on these factors for Lapetal development. The overall score shows how Lapetal development reacts to its internal strategy factors.

3.5.2. Weighting of External Strategy Factors *(EFAS).* After determining the strengths and weaknesses of internal factors, then weighting the IFAS can be seen in the following table:

Table 7. Weighting of EFAS

FACTOR	TOTAL	WEIGHT	RATING	WEIGHT * RATING
OPPORTUNITY				
1. The existence of the MEF (Minimum Essential Force) program.	30	0,2222	3,26	0,72
2. Public interest to join the TNI AL is high.	29	0,2148	3,75	0,81
3. The existence of High School Taruna NALA (SMANTAR NALA), East Java.	28	0,2074	2,76	0,57
4. There is a program for recruiting Indonesian Navy soldiers for special routes in the eastern region.	27	0,2	3	0,6
OPPORTUNITY TOTAL				2,7
THREAT				
There is no maximum support in the implementation of publications from related units/stakeholders within the Indonesian Navy.	21	0,1686	3,26	0,5[illegible]
THREAT TOTAL				0,51
TOTAL				3,21

The calculation of the number for the opportunity factor on no.1 is obtained from the total answers of 4 respondents, namely 30. Then the total number of answers to 4 respondents from the opportunity and threat factors is 135. The calculation of the weight of the opportunity factor on no.1 is obtained from the total answers of 4 respondents divided by the total number answer, namely as follows: weight = 30/135 = 0.2222. Based on the table above, it shows that the weighting of the external strategy factor rating for Lapetal development, where the weighting is done to know how much the factors influence or have an impact on the strategy factor itself. The weighting of the strategic factors in the table is obtained from the total opportunity score of 2.7 and the total threat score of 0.51 so that the overall total of external factors is 3.21. The purpose of this rating is to provide a scale from 4 to 1 based on these factors for Lapetal Development. The overall total score shows how Lapetal development factors against external factors.

3.5.3. Recapitulation of the calculation of strengths, weaknesses, opportunities, and threats.

Based on the results of calculations that have been carried out through the SWOT analysis, the final value of internal factors, namely strengths and weaknesses, as well as external factors, namely opportunities and threats, and the weighting results of the SWOT matrix, can be briefly seen in the following table:

Table 8. Comparison of IFAS and EFAS

IFAS / EFAS	S = 1,15	W = 1,31
O = 2,7	3,85	4,01
T = 0,51	1,66	1,82

The results of the IFAS-EFAS interaction resulted in an alternative strategy that received the highest weight, namely Weaknesses - Opportunities (WO), which can be translated as a strategy that takes advantage of opportunities by maximizing the weaknesses they have. This condition is favorable for Lapetal because, from the external factor side, the existing opportunities are much greater than the threats in the framework of Lapetal development. The strategy formulation is obtained through a combination of elemental factors, S, W, O, and T, resulting in several strategic combinations as follows.

The WO strategy has the highest weight (4.01) so it is the first alternative in the Lapetal development strategy. The WO strategy consists of 6 (six) sub-strategies, including:

a. To study the organizational structure of Lapetal to be proposed to the leadership element in the framework of developing (organizational validation) of Lapetal, so that the special parts that have not been handled can be included in the larger organizational structure, including; Socialization/campaign, security, Taruna Nala High School, etc.

b. Making detailed work instructions regarding the implementation of the selection of candidates for the recruitment of Indonesian Navy soldiers, both at the regional and central levels.

c. Make suggestions to the leadership regarding the improvement/transfer of rights to use existing facilities and infrastructure in the Malang Navy Base.

d. With the increase in the size of the Lapetal organizational structure, it is necessary to increase the number of personnel, this is due to the increasing number of duties and responsibilities that are carried out by Lapetal.

e. Conducting training to improve the quality of Lapetal personnel, including; computer training, training on checking the completeness and validity of documents, training on medical examinations, physical testing training, and other training regarding the implementation of recruiting Indonesian Navy soldiers.

f. Coordinate and cooperate with relevant stakeholders within the Indonesian Navy to carry out socialization and publication to the maximum regarding the recruitment of prospective Indonesian Navy soldiers to increase public knowledge and interest in the Indonesian Navy.

4. CONCLUSION

This research has several stages to achieve the expected goals. Starting from the problem identification stage and data collection taken from journals, books, field studies, and questionnaires to selected experts. The next stage is to continue with the identification and formulation of strategies. In this study, the SWOT analysis method was used to identify and formulate several Lapetal development strategies. The SWOT analysis method used in this development strategy integrates with the existing conditions of the Lapetal, the corridor of the MEF military strategy area, the Navy strategy and government policies on the World Maritime Axis. This stage consists of (1) determining the external opportunity factors of Lapetal; (2) Determining threat factors; (3) Determining the strength factors; (4) Determining the weakness factors; (5) Determining the Strategy I SO (Strength-Opportunity); (6) Determining the II WO (Weakness-Opportunity) Strategy; (7) Strategy III ST (strength-threat); (8) Determine the WT strategy IV (weakness-threat).

In the formulation of the Lapetal development strategy, (four) alternative strategies were obtained, namely the SO strategy, the WO strategy, the ST strategy, the WT strategy. SO strategy consists of 7 (seven) strategic steps. ST strategy consists of 5 (five) strategy steps. The WO strategy consists of 6 (six) strategy steps and the WT strategy consists of 4 (four) strategic steps. In the next step, all the strategic steps will be determined the priority weight so that the main strategy chosen can be found. Based on the results of the weight calculation, it is known that the WO Strategy has the highest weight (4.01) so that it becomes the first alternative in the Lapetal development strategy. The WO strategy consists of 6 (six) sub-strategies.

ACKNOWLEDGEMENT

This research has been Supported by Indonesia Naval Technology College (STTAL).

REFERENCES

Collins- Kreiner, N. &. (2007). Evaluating tourism potential: A SWOT analysis of the Western Negev. Israel, Tourism. *55*, 51 - 63.

Harky, Y. F. (2018). The Significance of Recruitment and Selection on Organizational Performance: The Case of Private owned Organizations in Erbil, North of Iraq. *International Journal of Contemporary Research and Review*, 20393-20401.

Hill, T. &. (1997). SWOT Planning (30 ed.).

Istiqomah, A. (2017). Strategi pengembangan Sumber Daya Manusia sebagai upaya untuk meningkatkan kinerja aparatur desa dengan menggunakan analisis SWOT. *Jurnal Universitas Negeri.*

Lapetal. (2018). *Materi Hand Book Lapetal.* Malang: Lapetal.

Mabes TNI. (2014). *Peraturan Panglima TNI Nomor 30 tahun 2014 tentang Penyediaan Prajurit Sukarela Tentara Nasional Indonesia.* Jakarta: Mabes TNI.

Mabes TNI AL. (2001). *Surat Keputusan Kepala Staf Angkatan Laut (Kasal) Nomor Kep/05/II/2001 tanggal 8 Februari 2001 tentang Organisasi dan Prosedur Dinas Administrasi Personel TNI AL.* Jakarta: Mabes TNI AL.

Mabes TNI AL. (2013). *Surat Keputusan Kepala Staf Angkatan Laut Nomor Kep/1178/IX/2013 Tanggal 12 September 2013 tentang Daftar Susunan Personel Lapetal.* Jakarta: Mabes TNI AL.

Mashudi, A. (2019). STTAL Development Strategy to Produce Human Resources that Acknowledge Technology Facing The Industrial Revolution Era 4.0. *International Journal of ASRO STTAL*, 27-33.

Wasike, C. B. (2010). Factors that influence the efficiency of beef and dairy cattle recording system in Kenya: A SWOT - AHP analysis. . *Trop Anim Health Prod.*

Wheelen, T. L. (2012). *Strategic Management and Business Policy: Toward Global Sustainability (13th ed.)* (13th ed.). New Jersey: Pearson Education.

Yuksel, I. &. (2007). *Using the Analytic Network Process (ANP) in a SWOT Analysis – A Case Study for a Textile Firm.*

THE INFLUENCE OF COMPETENCY FACTORS, CAREER DEVELOPMENT AND MOTIVATION ON PERSONNEL PERFORMANCE

Eko Kurniawan[1], Adi Bandono[2], As'ad Aris M[3]

[1,2,3]Indonesian Naval Technology College, STTAL
Bumimoro-Moro Krembangan, Surabaya, 60178, Indonesia

ABSTRACT

Organizational goals will be achieved through positive employee performance, otherwise the organization will face obstacles in achieving goals when employee performance is ineffective, so that the success of an organization will be greatly influenced by the performance of its employees. The problem in this study is how to determine the effect of motivation, competence and career development of a person on employee performance. While the purpose of this study was the method used in this research is quantitative method using Structural Equation Modelling (SEM) analysis techniques, to find out the influence relationship between the variables studied. The results showed that the competence of employees on employee performance is significant. This means that the more competent an employee is, the more positive his performance will be, as well as career development for employees has a positive effect on improving employee performance. Competency level and employee career development have a positive effect on employee motivation and also affect employee performance improvement.

Keywords : *Competence, Career Development, Motivation, Employee Performance, Structural Equation Modelling (SEM)*

1. INTRODUCTION

An organization, whether for profit or non-profit, private or government, requires good management practices in several aspects, including strategic management, human resource management, production, marketing and other management. Organizational goals will be achieved through positive performance from employees, otherwise the organization will face obstacles in achieving goals when the performance of employees is ineffective in the sense that they cannot meet the demands of the job that the organization wants (Ahmad, 2009). Therefore, organizational success is greatly influenced by the performance of its employees. In improving employee performance, adequate competence is required. Competence has a very important role, because in general competence involves a person's basic ability to do a job (Moeheriono, 2012). To achieve maximum and satisfying work results, an employee's competence is needed in carrying out his work duties so that employee performance can increase.

Competence can be linked to performance and simply intention, action and outcome. Competence itself can affect performance management as stated by Armstrong that performance management is related to inputs and processes (goals and competencies). Likewise, with motivation and its relation to performance, Robbins and Judge also define motivation as a process that explains the intensity, direction and persistence of efforts to achieve a goal. Furthermore, according to Samsudin, it provides an understanding of motivation as a process of influencing or encouraging from outside a person or work group so that they want to carry out something that has been determined. Motivation can also be interpreted as impulse which is meant as a natural urge to satisfy and sustain life.

Motivation is formed from the attitude of employees in dealing with work situations in the company. Motivation is a condition or energy that moves employees who are directed or aimed at achieving company organizational goals. Thus, the mental attitude of employees who are pro and positive about work situations is what strengthens their work motivation to achieve maximum performance. Based on the above understanding, motivation is the employee's response to a number of statements regarding the overall effort that arises from within the employee so that the motivation to work grows so that the goals desired by the employees are achieved.

In his theory, McClelland's Achievement Motivation Theory or achievement motivation theory, McClelland argues that individuals have reserves of potential energy, how this energy is released and developed depends on the strength or motivation of the individual and the situations and opportunities available. This theory focuses on three needs, namely the need for achievement, the need for power, and the need for affiliation.

Personnel career development in a large range of personnel coaching for organizational needs. The simple mechanism is; First, the supervisor directly has the authority to provide an assessment and the results of the assessment are submitted to the superior from the direct supervisor. Furthermore, the supervisor from the direct superior continues to the corp coach and personnel staff and then from the corp coach and staff personnel who will determine the next employee career path according to the needs of the organization. However, promotion is not based solely on the assessment of the direct superior but also other aspects determined or determined by the leadership and top management. These qualifications and career opportunity policies are not known to the individual personnel directly.

This paper has many literatures to support the research, such as literature with title (Kiran, Shanmugam, & Srivastava, 2017), Application of Structural Equation Modelling (SEM) for Analysis of the Effect of Perception on Professionality Knowledge and Motivation of Nurseson the Implementation of Patients Safety Programs (Syahfirin, Kholil, & Agung, 2019), Entrepreneurial Action, Innovation, and Business Performance : The Small Independent Business (Georgellis, Joyce, & Woods, 2000), Social capital of Entrepreneurs and small firm perfomance: A meta-analysis of contextual and methodological moderators (Stam, Arzlanian, & Elfring, 2014), Motivation and Limitations in Implementating Halal Food Certification; a Pareto Analysis (Talib & Syazwan, 2015), Factors Affecting Purchase Intention of Organic Food in Malaysia’s Kedah State (Shaharudin & Rizaimy, 2010), Impact of Customer Perceived Value and Customer’s Perception of Public Relation on Customer Loyalty with Moderating Role of Brand Image (Rahi, 2016), Impact of Customer Value, Public Relations Perception and Brand Image on Customer Loyalty in Services Sector of Pakistan (Rahi, Impact of Customer Value, Public Relations Perception and Brand., 2016).

This research is organized as follows, chapter 1 introduction, chapter 2 shows material and methodology, chapter 3 shows the results of data and discussion, chapter 4 conclusion.

2. MATERIAL AND METHODOLOGY

2.1. Strategic Human Resource Management.

According to Hasibuan, the definition of human resource management is the science and art of regulating the process of using human resources and other resources effectively to achieve a certain goal in which there are six elements, namely men, money, method, materials, machine and market. As an element of HRM, Humans play a very critical and strategic role. Human resource management has a strategic role because it is expected to be able to carry out all functions in the organization in such a way that the support given to various functional areas and other work units actually enables the realization of an increase in the efficiency, effectiveness and productivity of the organization.

Strategic Human Resource Management views the Human Resources function as an integral part of all company functions such as marketing, production, financing, law and so on (Alaeldeen & Darun, 2017). Strategic Human Resource Management has advantages in terms of workforce development, costs and planning. In workforce development, organizations can focus on developing the types of skills / personnel required (Hamid, 2013). In terms of costs, organizations can make efficiency. Meanwhile, in planning, organizations can cope with and overcome environmental uncertainty. Strategic Human Resource Management enables the organization to improve its performance, satisfy employees and employees and add some value (Barney, 1998).

2.2. Competence.

The terms competencies, 'competence' and 'competent' which in Indonesian are translated as competence, proficiency, and empowerment which refer to a state of capable and appropriate quality (Hendriani, 2014). The English dictionary defines the word 'competence' as being appropriate, adequate, or appropriate. The definition of competence in the workplace refers to the understanding of a person's suitability for his job. However, in the context of his work, competence has two different meanings, depend on the organizational frame of reference.

Competence can be defined as the basic characteristics of a person who has a causal relationship with the reference criteria for effectiveness and / or excellence in certain jobs or situations (Ngo, 2014). Competency is a basic character of a person that indicates how to behave or think, which applies in a very wide range of situations and lasts for a long time. Yudistira and Siwantara stated that competence has a positive and significant effect directly on employee performance. This is supported by research from Sulistyaningsih which states that competence has a significant positive effect on employee performance.

According to Spencer, the relationship between employee competence and performance is very close and very important, has relevance and is strong, accurate, even if employees want to improve their performance, they should have competencies that are in accordance with their job duties. Competence can cause or be used to predict a person's performance, meaning that if he has high competence, he will also have high performance.

2.3. Career development.

According to Robbins, career development is a process of increasing the work ability of an individual in order to achieve the desired success. The aim of all career development programs is to match the needs and goals of employees with job opportunities available in the company at present and in the future. The definition of career development is a formal approach in an effort to increase or improve, growth, job satisfaction, employee knowledge and abilities, to ensure that people with the right qualifications and experience are available when needed (Zin, 2013). Thus, a clear career planning and development will help employees and the organization to be successful.

Winda Anissa Putri in her research, said that career development is a normal approach that companies can use to be able to manage employees in the company who have the appropriate self-qualifications, abilities, and experience when needed by the company. According to Napitupulu, et al., Career development is an increase in the position of employees in companies in a predetermined professional path to improve their performance. With the ever-changing standard of living, employees are always unsatisfied with their position and always want to get a promotion which of course will affect the salary / wages they receive.

Career development is very important for an organization, because a career is a need that must be continuously developed in an employee so that it is able to motivate employees to improve their performance (Hüttges, 2015). Career development includes any activity to prepare a person for a specific career path. A career plan that has been made by a worker must be accompanied by a realistic career goal. Thus, an employee needs to take certain steps in order to realize the plan. The various steps that need to be taken can be taken at the employee's own wishes, but can also be in the form of activities scheduled by the organization, or a combination of both. This is one of the most fundamental principles of career development.

2.4. Motivation.

According to Henry, scientific opinion from researchers revealed that motivation is a psychological drive that directs a person towards a goal. Furthermore, it was stated that: "motivation of people depends on the strength of their motives". In this case, a person's motivation depends on the strength of his motive or need. Thus, a person's needs can be used to estimate his motivation. In addition, it was stated that. Motivation can be interpreted as a condition for exerting a high level of effort towards organizational goals (Ghafari & Shah, 2017). So, motivation is conditioned by the ability of a strong effort to meet something individual needs. Motivation is also defined as follows: "Motivation as the set of processes that arouse, direct, and maintain human behavior toward attaining a goal". Motivation is a series of actions that can move, direct, and organize human behavior to achieve goals.

From some of these definitions of motivation, it can be interpreted that motivation is an impetus for a person to act in achieving goals (Gachengo & Wekesa, 2017). In this case, a motivation can be felt in the presence of this need which is a stimulus or impetus for the emergence of motivation to take certain actions.

Theories concerning work motivation, namely theories relating to human needs. One such need theory is the hierarchy of needs theory. The hierarchy of needs theory states that humans have five levels of needs, namely as follows: "According to Abraham Maslow, human shares a concern for five levels of need satisfaction from their life experiences: physiological, safety, social, esteem and self - actualization". The five levels of needs are (1) physiological, including: eating, drinking, clothing, and sex, (2) security, including: safety and protection, (3) social, including: affection, belonging, acceptance. well, and friendship, (4) appreciation, including: self-esteem, achievement, recognition and attention, and (5) self-actualization, including: achieving potential and self-fulfillment.

From some of these definitions of motivation, it can be interpreted that motivation is an impetus for a person to act in achieving goals. In this case, a motivation can be felt with the needs to be achieved. These needs are a stimulus or motivation for the emergence of certain actions. The work motivation is the work impulse that arises in a person to behave in achieving predetermined goals. In this case, human behavior is seen as a series of activities oriented towards achieving a certain goal. A person will do a job diligently if he has strong enough motivation. Conversely, someone will leave or are less enthusiastic about doing work if he does not have a strong motivation to do it. The impulses that exist in a person produce varied behaviors according to the needs and the required achievements. A person's needs can be used to estimate his motivation.

2.5 Personnel Performance.

Whitmore simply stated that performance is the implementation of the functions that are required of a person (Muda, Rafiki, & Harahap, 2013). The definition according to Whitmore is one that demands the least amount of need to succeed. Therefore, Whitmore put forward the notion of performance which he considered representative, so that it illustrates the large responsibility of one's job.

According to Frank Hertle, the definition of performance is a process of creating a shared understanding of what must be achieved and how it must be achieved, as well as how to organize people in a way that increases the likelihood of achieving that goal. According to Indra Bastian stated that performance is a description of the level of achievement of the implementation of an activity or program or policy in realizing the goals, objectives, mission and vision of the organization which are stated in the formulation of a strategic scheme (strategic planning) of an organization's performance is the result of work that has a strong relationship with the objectives. organization strategic, customer satisfaction, and contribute to the economy.

There are two main factors that affect individual performance, namely ability and work motivation of the individual (Madlock, 2008). Individual ability depends on the level of knowledge they have, educational background, and skills mastered. Meanwhile, individual work motivation depends on the attitude as the basic motivation and the environment that influences that motivation.

Gibson argues that, "the ability is an innate or learned trait that allows a person to complete his job". Based on this understanding, it can be concluded that a person's ability is none other than the potential possessed by a person to do and complete a job. This potential is not only innate but also can be learned and therefore it is possible to be further developed or enhanced.

This motivation questions how to encourage the enthusiasm of subordinates so that they are willing to work hard by giving all their abilities and skills to realize organizational goals. Basically, organizations not only expect capable, capable and skilled employees but most importantly they are willing to work hard and are willing to achieve optimal work results. According to Hasibuan's opinion, "Motivation is the provision of a driving force that creates enthusiasm for someone's work so that they are willing to cooperate, work effectively, and are integrated with all their efforts to achieve satisfaction".

2.6. Structural Equation Modeling

Structural Equation Modeling or what is commonly called SEM is one of the multivariate analysis techniques (Babin, Hair, Jr, & Boles, 2008). The analysis allows testing a series of relationships from several independent variables with several dependent variables. By using SEM, researchers can find out the structural relationships expressed by a set of equations.

The SEM method uses two kinds of components, namely:

a. Latent variables Latent variables are key variables of concern. Latent variables cannot be observed so they cannot be measured directly. Latent variables are grouped into two types, namely endogenous variables and exogenous variables. Endogenous variables are variables that can be influenced by other variables while exogenous variables are variables that cannot be influenced by other variables (exogenous variables are called independent variables in the regression equation).

b. Observed variables, Observed Variables or indicators are variables that can be observed or can be measured empirically. The mathematical notation for the observed variable which is the measure of the exogenous variable is Y, while the effect of the endogenous latent variable is X.

Exogenous variables include knowledge, skills, motivation, self-characteristics and self-concept, while endogenous variables include employee internal factors, internal organizational factors and organizational external factors.

2.7. Research Methodology

To solve problems in the observed research, steps are needed and determined to describe the approach and model of the problem. The steps taken are:

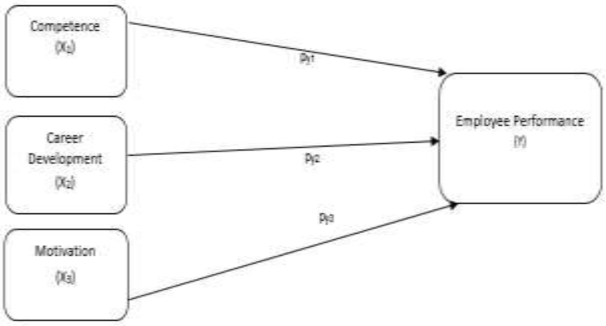


Figure 1: Research Methodology Flowchart.

Competency Model, this model is a CFA model which has one latent variable, namely employee competence. This variable is an exogenous variable that has four indicators or observable variables.

Career development model, this model is the CFA which has one latent variable, namely the personnel career development variable. This variable is an exogenous variable that has four indicators, namely the unobserved variable.

Motivation model, this model is a CFA model which has one latent variable, namely the Personnel motivation variable. This variable is an exogenous variable that has four indicators or observable variables.

The structural model analysis in this study consists of 3 (three) hypotheses, which must be tested for significance.

H1: The higher the competence of personnel, the higher the personnel's performance.

H2: The higher the personnel's career development, the higher the personnel's performance.

H3: The higher the personnel's motivation, the higher it will be also the personnel's performance.

Target: Analyze and understand the magnitude of the influence of Competency Factors on personnel performance, Analyze and understand the influence of Career Development on personnel performance, Analyze and understand the influence of motivation on personnel performance, Analyze and understand the influence of competency factors on motivation, Analyze and understand the influence of Career Development on Motivation.

Steps: The step of this research is: step 1 determine the variable criteria make the influence analysis model using SEM, step 2 determine variable indicators and disseminate questionnaires to all officers who have been determined to be sampled, step 3 analyzing system and model, step 4 giving suggestions for improvement and conclusions.

3. RESULT AND DISCUSSION

3.1. Exogen and Endogen Variables.

Table 1: Operational variables

Variables	Indicators
Exogen	
1. Competence	The level of formal education it has
	Technical training that he has attended
	Ability to master work
	Accuracy in completing work
2. Career Developments	Recruitment and selection
	Allocation of human resources
	Assessment and evaluation
	Training and development
3. Motivations	Develop creativity
	Enthusiastic to achieve high
	Sense of Achievement
	Sense of Participation
Endogen	
4. Personnel Performance	Quality
	Quantity
	Punctuality
	Effectiveness

3.2. Model fit test

Some of the goodness of fit test results can be seen in the table below, and the summary of the goodness of fit test results contains 2 (two) GOF measures that indicate a good fit, and 8 GOF measures that indicate a good fit, so it can be concluded that a good fit the overall model is good, therefore the model can be accepted because of the suitability between the model and the data. Thus, the path coefficient of each relationship between variables used in the study is presented to test the hypothesis.

Table 2: Model fit test results

GOF	Estimation	Match Level
Chi-Square P	$X^2 = 50.61$ (p = 0.41)	Good
NCP Interval	1.61 (0.0 ; 22.71)	Good
RMSEA P (close fit)	0.024 p= 0.67	Good
ECVI	M = 108.61 S = 156.00 I = 814.63	Good
NFI	0.94	Good
CFI	1.00	Good
IFI	1.00	Good
RFI	0.91	Good
GFI	0.82	Very Good
AGFI	0.72	Very Good

In this study, because of the additional matrix, namely the asymptotic covariance matrix, the satora-bentler scaled chi-square used in assessing the chi-square was 50.61. The chi-square probability is insignificant p = 0.41, which means that the model is fit, which indicates the empirical data fits the model.

The model produces a GFI (Goodness of Fit Index) value of 0.82. This value is smaller than the recommended value, namely> 0.90, so the model can be said to be quite fit. The model produces a GFI (Goodness of Fit Index) value of 0.82. This value is smaller than the recommended value, namely> 0.90, so the model is said to be quite fit.

H1: It is assumed that the higher the personnel's competence in an organization, the higher the personnel's performance in that organization.

H2: It is assumed that the higher the personnel's career development in an organization, the higher the personnel's performance in that organization.

H3: It is assumed that the higher the motivation of personnel in an organization, the higher the performance of personnel in that organization.

3.3. Measurement Model Analysis

Table 3: Validity test

Var. Let → Var. observed	Performance		Competence		Career develop		Motivation		
	SLF	Value -t	SLF	Value -t	SLF	Value -t	SLF	Value -t	Validity
KREDIBL	0.63	*							Valid
KPEDULI	0.85	6.51							Valid
ANDAL	0.77	6.10							Valid
SKP			0.55						Valid
SPN			0.72	4.59					Valid
CR PAKAI			0.88	5.50					Valid
KOM 2AR					0.76				Valid
KOM FORM					0.86	9.16			Valid
KOM TNTK					0.74	7.06			Valid
WJD KOMIT							0.78		Valid
KONSIST							0.70	6.51	Valid
TK OPORT							0.62	5.81	Valid

Table 4: Reliability test

Variable	CR	VE	Reliability
Performance	0.80	0.57	Good
Competence	0.77	0.53	Good
Career development	0.83	0.62	Good
Motivation	0.74	0.50	Good

3.4. Structural Model Analysis

Structural model analysis deals with the evaluation of coefficients or parameters that show a causal relationship between latent variables and other latent variables. The aim in assessing the structural model is to ascertain whether the hypothesized relationships in the conceptualized model are supported by empirical data obtained through the survey.

The structural model analysis in this study consists of 3 (three) hypotheses, which must be tested for significance.

a. T-value of the coefficient / parameter
   1) Competence → Personnel Performance = -2.03; absolute (-2.03)> 2 or 1.96 → significant coefficient.
   2) Career development → Personnel Performance = 1.11 <2 or 1.96 → the coefficient is not significant.
   3) Motivation → Personnel Performance = 3.12> 2 or 1.96 → significant coefficient.

b. Coefficient / parameter values

1) Competence → Personnel Performance = -0.55
2) Career development → Personnel Performance = 0.36
3) Motivation → Personnel Performance = 1.00

Table 5: Evaluation of Structural Model Coefficients and Relation to Research Hypotheses

Hypothesis	Path	Estimation	t-value	Conclusion
1	Competence → Personel Perfrmance	-0.55	-2.03	Significant (Hypothesis 1 is accepted)
2	Career Developmnt → Personel Perfrmance	0.36	1.11	Not Significant (Hypothesis 2 is rejected)
3	Motivations → Personel Performanc	1.00	3.12	Significant (Hypothesis 3 is accepted)

a) Hypothesis 1

The test results with the LISREL 8.8 program show that the influence of personnel competence on personnel performance is significant, but competence has a negative effect on personnel performance. This is indicated by the regression coefficient of -0.55 and the t-value of -2.03, this means that the higher the personnel's competence, the lower the personnel's performance.

The possibility that underlies this is because personnel performance is not only seen from the personnel's competence. Basically, the attitudes and behaviors that are owned will affect performance, the higher the competence they have, the less the personnel's performance will be, because the competence shown by personnel's is only the ability to be highlighted, meaning that these competencies are not followed by ethics that arise from conscience. They personnel just want to do their job not because they love their job.

b) Hypothesis 2

The results of testing with the LISREL 8.8 program regarding the effect of career development on personnel performance indicate that career development does not have a significant effect on personnel performance. It can be seen from the regression coefficient which is positive for 0.36 and the t-value is 1.11. Thus, the hypothesis which states that the higher the personnel's career development, the higher the personnel performance is rejected.

c) Hypothesis 3

The test results with the LISREL 8.8 program show that personnel motivation on personnel performance has a significant effect. This is shown from the results of data processing which has a regression coefficient of 1.00 and a t-value = 3.12, this means that the research hypothesis which states that the higher the personnel's motivation, the higher the personnel's performance in the organization is accepted.

This positive relationship occurs because the organization will always realize its commitment, through solving some of the problems faced by personnel's in earnest by always holding its consistency in organizational development.

4. CONCLUSION

Based on the results of the analysis and discussion, the following conclusions can be drawn:

a. The results show that the influence of personnel competence on personnel performance is significant, but competence has a negative effect on personnel performance, this means that the higher the personnel's competence, the lower the personnel's performance.

b. The results show that career development does not have a significant effect on personnel performance, this means that the research hypothesis which states that the higher the personnel's career development, the higher the personnel's performance is rejected.

c. The results show that the effect of personnel motivation on personnel performance is significant, this means that the research hypothesis which states that the higher the personnel's motivation, the higher the personnel's performance will be accepted.

ACKNOWLEDGEMENTS

The authors greatly acknowledge the support from Naval Technology College, STTAL Surabaya Indonesia for providing the necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

REFERENCE

Ahmad. (2009). *Relationship between Emotional Intelligence and Peer Interaction, Social Adjusment for Class VIII Students of the Acceleration Program at State Junior High School 9.* Surakarta: Sebelas Maret University.

Alaeldeen, & Darun, R. (2017). Determining relationship between strategic human resource management practices and organizational commitment. *International Journal of Engineering and Business Management*, 105-120.

Babin, B. J., Hair, J. F., Jr, & Boles, J. S. (2008). Publishing Research in Marketing Journals Using Structural Equation Modeling. *Journal of Marketing Theory and Practice*, 279-285.

Barney, J. &. (1998). On Becoming a Strategic Partner: The role of Human Resource in Gaining Competitive Advantage. *HumanResources Management* , 31-46.

Gachengo, V., & Wekesa, S. (2017). Influence of motivation on employee performance: a case of national bank of Kenya. *Journal of Business, Management and Social Research*, 179-185.

Georgellis, Joyce, & Woods. (2000). Entrepreneurial Action, Innovation, and Business Performance : The Small Independent Business. *Journal of Small Business and Enterprise Development*, 7-17.

Ghafari, & Shah. (2017). The Influenceof Motivation on Job Performance: A Case Study at University Teknology Malaysia. *Australian Journal ofBasic and Applied Sciences*, 92-99.

Hamid, J. ,. (2013). Strategic Human Resource Management and Performance:The Universalistic Approach – Case of Tunisia. *Journal of Business Studies Quarterly*, 1556-1567.

Hendriani, S. E. (2014). Contribution of Motivation and Competence to the Change of Organization Effectiveness. *Journal of Applied Sciences*, 2994 – 3000.

Hüttges, A. &. (2015). Gender influences on career development: A brief review [Editorial]. *Journal of Personnel Psychology,*, 113-120.

Kiran, Shanmugam, & Srivastava. (2017). SEM Modeling Approach for Studying the Social Impact of Whatsapp Usage. *Indian Journal of Public Health Research & Development*, 268-279.

Madlock, P. (2008). The Link Between Leadership Style, Communicator Competence and Employee Satisfaction. . *Journal of Business Communication* , 61-78.

Moeheriono. (2012). *Competency Based Performance Measurement.* Jakarta: King.

Muda, Rafiki, & Harahap. (2013). Factors influencing Employees' Performance: A Study on the islamic Banks in Indonesia. *Journal of Aplication Management*, 169-180.

Ngo, H. a. (2014). Linking HRM Competency to Firm Performance: An Empirical Investigation of Chinese Firms. . *Personnel Review* , 898-914.

Rahi, S. (2016). Impact of Customer Perceived Value and Customer's Perception. *Journal of Internet Banking and Commerce* , 111-122.

Rahi, S. (2016). Impact of Customer Value, Public Relations Perception and Brand. *Arabian Journal Bus Manag*, 49-60.

Shaharudin, & Rizaimy. (2010). Factors Affecting Purchase Intention of Organic Food in Malaysia's Kedah State. *Malaysia: Cross-Cultural Communication.*, 11-20.

Stam, Arzlanian, & Elfring. (2014). Social capital of Entrepreneurs and small firm perfomance: A meta-analysis of contextual and methodological moderators. . *Journal of Business Venturing* , 152-173.

Syahfirin, Kholil, & Agung. (2019). Application of StructuralEquation Modelling (SEM) for Analysis of the Effect of Perception on Professionality Knowledge and Motivation of Nurseson the Implementation of Patients Safety Programs. *Asian Journal of Research in Nursing and Health*, 1-12.

Talib, A., & Syazwan, M. (2015). Motivation and Limitations in Implementating Halal Food Certification; a Pareto Analysis. *British Food Journal*, 2664-2705.

Zin, M. (2013). Investigating the influenceof job rotation on careerdevelopment among production workers in Japanese companies. *International journal of Busness ang Society*, 102-113.

THE DEVELOPMENT STRATEGY OF FASHARKAN LANTAMAL IX XYZ FROM CLASS C FASHARKAN TYPE TO FASHARKAN CLASS A KOARMADA III WITH SWOT AND ISM APPROACH

R. Fajar[1], Abdul Rahman[2], Anton Nugroho[3]

[1,2,3]Indonesian Naval Technology College, Bumimoro-Morokrembangan, Surabaya 60187, Indonesia Email : fajarantariksa01@gmail.com

ABSTRACT

The formation of Koarmada III resulted in a shift and an increase in the number the KRI in its working area, so it must be balanced with the ability of maintenance and repair facilities (fasharkan). Fasharkan XYZ is a fasharkan with class C status so it needs to be upgraded to class A in order to support its main task. The purpose of this research is to determine the alternative development strategy of Fasharkan XYZ. This study uses an integrated SWOT analysis and Interpretative Structural Modeling (ISM). SWOT analysis to formulate alternative strategies developed, namely the SO strategy consisting of 6 (six) strategic steps, the ST Strategy consisting of 6 (six) strategic steps, the WO Strategy consisting of 9 (nine) strategic steps and the WT strategy consisting of 4 (four) strategy move. From the weighting of the EFAS and IFAS matrices the WO strategy was selected. By using ISM, it is obtained 5 (five) levels of hierarchical structure from the classification of elements in the WO strategy, including the strategy (WO5) at level V. Then the sub strategies (WO1) and (WO4) are at level IV. At level III it consists of 4 (four) sub strategies, namely (WO2); (WO6); (WO7); (WO8). At level II, namely the sub strategy (WO3). At level I sub strategy (WO9).

Keywords: *Fasharkan XYZ, development strategy, SWOT, ISM.*

1. INTRODUCTION

As a maritime country, most of its territories are islands separated by the ocean. The Indonesian Navy (TNI AL) as an integral part of the Indonesian National Army (TNI) has a main task that focuses on defense and security at sea. This is part of the trinity of the universal role of the Navy as put forward by Ken Booth, a British maritime thinker (Marsetio, 2014). In accordance with what is mandated in the doctrine of the Indonesian National Armed Forces Tridarma Eka Karma (tridek) in the roles, functions and main tasks of the Navy, among others:

a. Carry out TNI duties in the marine sector in the defense sector.

b. Upholding the law and maintaining security in the marine area of national jurisdiction in accordance with the provisions of national law and international law that has been ratified.

c. Carry out the diplomatic duties of the Navy in order to support the foreign policy set by the government.

d. Carry out TNI duties in the development and development of the strength of the marine dimension.

e. Implementing the empowerment of marine defense areas.

The formation of Koarmada III based on the Presidential Decree of the Republic of Indonesia Number 12 of 2018 concerning the formation of Koarmada III and Pasmar 3 in Sorong will have an impact on shifting the operational area and adding combat units according to the operating sector, especially towards East Indonesia. So that we need a balanced process between the Motion Exercise Schedule (JOG) and the Maintenance Exercise Schedule (JOP).Koarmada III currently only has 2 (two) Ship Maintenance and Repair Facilities (Fasharkan) namely, class C Fasharkan at Lantamal

IX XYZ and Fasharkan class A at Lantamal X Manokwari.

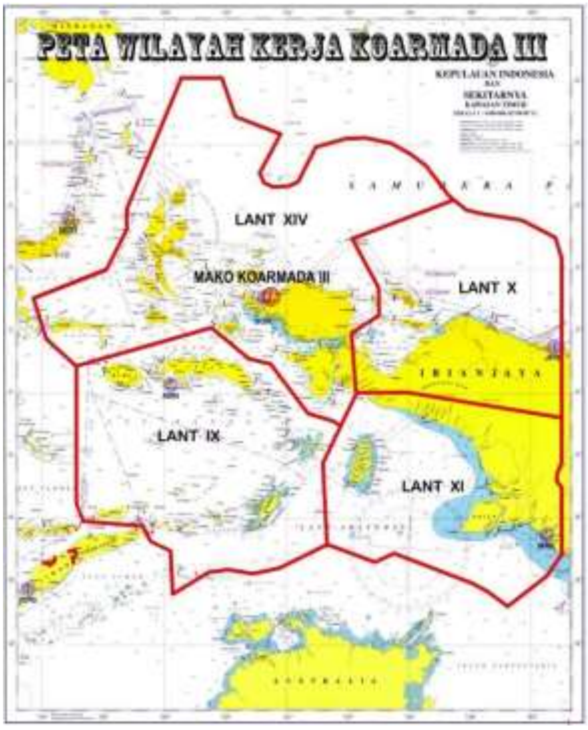


Figure 1. Map of the Working Area of Koarmada III

Fasharkan Lantamal IX XYZ, which currently still has a class C level, is very important to upgrade its grade to Fasharkan class A. Some considerations on the importance of developing XYZese Fasharkan include:

a. Formation of Koarmada III in Sorong. Based on the Regulation of the Chief of Naval Staff Number 17 of 2018, dated 9 May 2018 concerning the Establishment of Fleet Command III.

b. Geographically, fasharkan XYZ is very strategic because it has the closest position to Mako Koarmada III

c. Based on the data, many KRIs who are carrying out operational tasks in the eastern region will carry out provisions and stabilization of technical conditions at Fasharkan Lantamal IX XYZ compared to Lantamal X Manokwari fasharkan.

Table 1. KRI recapitulation visited in Lantamal IX XYZ and Lantamal X OPQ

No	Period Of Time	Total Visit
	LANTAMAL IX XYZ	
	2018	
1	Three Months I	4
2	Three Months II	4
3	Three Months III	5
4	Three Months IV	5
	2019	
1	Three Months I	9
2	Three Months II	18
3	Three Months III	18
4	Three Months IV	4
	2020	
1	Three Months I	10
2	Three Months II	18
	Total	**95**
	LANTAMAL X OPQ	
	2018	
1	Three Months I	1
2	Three Months II	-
3	Three Months III	3
4	Three Months IV	2
	2019	
1	Three Months I	3
2	Three Months II	1
3	Three Months III	8
4	Three Months IV	5
	2020	
1	Three Months I	-
2	Three Months II	3
	Total	**26**

d. Regional issues in the region of Southeast Asian (ASEAN) countries are so complex and dynamic that Indonesia's strategic defense planning policies in the 2015 - 2020 period must be able to adopt this phenomenon within the existing timeframe. The maritime sector development program by the government is an opportunity for the Indonesian Navy to develop its capabilities. Indonesia needs to strengthen its defense capability among Southeast Asian countries by strengthening the base posture and defense structure that is linked to the vision of the world's maritime axis.

e. The current priority for handling state threats is the issue of terrorism and radicalism, separatism and armed rebellion, natural and environmental disasters, drug abuse and threats to the mindset. The change in the threat dimension is one of the basic considerations in defense force development planning in addition to the limited capacity and budget support that can be provided by the state.

f. The development of the strategic environment around the Fasharkan XYZ work area shows that the existing ship maintenance facility is PT. Doc and Shipping Wayame XYZ, PT. Doc and Shipping

Tawiri and PT. Perikanan Nusantara Maluku cannot accommodate ship maintenance work due to overcapacity and limited shipyard capabilities of vessels under 500 GT (Gross Tonnage) due to limited shipyard facilities (Haikal Marasabessy, Kompas, 2011). Thus, around 76 percent or 380 ships out of 500 units in Maluku are forced to carry out repairs and maintenance in Papua and Sulawesi.

Currently, Fasharkan XYZ is only able to carry out intermediate maintenance but its nature is still limited, such as carrying out repair / servicing of pump motors and not being able to maintain and repair KRI up to the depot level or to repair docking or maintenance of ships under the Water Line (BGA). This is not in accordance with the repair provisions needed by KRI in terms of maintenance, namely the existence of type 'A' fasharkan.

Based on these problems, it is an inevitable need for the development of XYZese fashion in order to improve the ability to repair and maintain KRI. This study aims to determine what factors influence the development of Fasharkan XYZ, as well as formulate several strategies to meet the minimum or same abilities as class 'A' Fasharkan for example Lantamal V Surabaya fasharkan and Lantamal VI Makassar fasharkan.

There are several methods that can be used in planning development strategies to improve abilities or capabilities such as (Ragil Sudaryanto, 2016) Integration of Threats Opportunities Weaknesses Strength (TOWS), Analityc Hierarchy Process (AHP) and Simple Additive Weighting (SAW) in Strategy Formulation (Case Study PT. XYZ). (Lumaksono, 2014) using the SWOT-AHP method as a strategy for developing the shipyard industry in Sumenep. (Aam Slamet Rusydiana et al, 2018) using the Interpretative Structural Modeling (ISM) approach method in the development of cooperatives with a Sharia background in Indonesia.

The integration of SWOT and ISM analysis is used in this study to formulate a development strategy for Fasharkan XYZ. SWOT analysis is used to formulate alternative strategies. While the ISM method is used to determine priorities in the preparation of a road map for the chosen strategy.

Research Objectives. From the description of the problem formulation above, this research is carried out by aiming at the objectives to be achieved, namely:

a. To get the factors and criteria that influence the development strategy of Fasharkan XYZ.

b. To formulate a development strategy for Fasharkan XYZ.

c. To determine priorities and strategic roadmaps that can be applied in the development of Fasharkan XYZ.

2. MATERIALS AND METHOD

2.1 Literatur Review

In this study, the aim of this research is to formulate a strategy for the development of Fasharkan Lantamal IX XYZ through the SWOT analysis approach by identifying factors that influence both internal and external factors based on current conditions to obtain alternative strategies and then using the Interpretative Structural Modeling (ISM) approach to determine alternatives and priorities as well as strategic steps for the development of Fasharkan Lantamal IX XYZ.

2.2 Fleet Command III

Fleet Command (Koarmada) III as the Main Operational Command (Kotama Ops) is directly under the TNI Commander and as the Main Development Command (Kotama Bin) is directly under Kasal. This is stated in the Regulation of the Chief of Naval Staff (Perkasal) Number 17 of 2018 concerning Formation of Fleet Command III.

2.3 Main Base of the Indonesian Navy

In general, the Navy Main Base (Lantamal) has the main duties and functions in accordance with the Indonesian Navy Base, which is based on the Decree of the Chief of Naval Staff Number Kep / 1771 / XII / 2013 concerning the Guidebook for Standardization Administration of the Indonesian Navy Base (Pum-7.03), is as follows :

a. Main tasks. The Navy Base has the main task of carrying out administration and logistics for elements of the Navy (ships, aircraft and Marines) and carrying out maritime potential development by utilizing the facilities and infrastructure owned by the Pangkalan itself and those associated with it.

b. Function. The base as a place to dock, provision, operation and maintenance as well as repairing operational elements of the Indonesian Navy and personnel maintenance. This is known as the "5R" function namely Rebase, Replenishment, Repair, Rest and Recreation.

2.4 Maintenance and Repair Facilities (Fasharkan)

One of the work units under Lantamal was Fasharkan. Fasharkan is a ship maintenance and repair facility owned by the Indonesian Navy, which is part of the maritime service industry (injasmar) to support combat readiness of elements of the Indonesian Navy. Based on the Decree of the Chief of Naval Staff Number Kep / 1771 / XII / 2013 concerning the Guidebook for Standardization Administration of the Indonesian Navy Base (Pum-7.03), in general, the main functions and duties of fasharkan are to provide maintenance and repair support for Indonesian Navy ships at medium maintenance levels, Depo level as well as emergency maintenance for KRI or KAL that are homebase in their working area and also those operating in that area and have development capabilities, in this case the production of a certain scale ship.

2.5 Development Strategy

Strategic management is a managerial action in making decisions in determining the direction of performance in the long term of an organization which includes observations of environmental influences, formulation or planning of a strategy, implementation of evaluation and implementation of the strategy itself (J. David Hunger, 2003).

2.6 SWOT analysis

SWOT is a tool commonly used in analyzing the internal and external environment in obtaining a systematic approach and support for decision makers (Rangkuti., 2012). SWOT is an abbreviation in English of strength (S), weakness (W), opportunity (O) and threat (T). Internal organizational factors are represented by the first two factors (strengths and weaknesses), while external factors from the words opportunities and threats cover the broader environmental context in which the entity operates (Rangkuti, 2018).

In the SWOT analysis (Rangkuti., 2012), several key questions are as follows:

a. Strengths, which is an internal variable in an organization that has positive values whose conditions can be controlled and in planning can be strengthened.

b. Weaknesses, which is a negative internal variable in the organization that can be controlled and in planning, can be improved.

c. Opportunities, which is an external condition of an organization that has a positive value that cannot be controlled and its benefits can be utilized.

d. Threats, which is an external condition with negative values that cannot be controlled and its impact may be minimized.

e. What obstacles are being faced. In determining the strategy based on the potential factual conditions and problems as described above, the technique used is to find a cross strategy of the four SWOT factors above, namely:

1) S-O strategy: The strategy is formulated by utilizing all components of the strength and taking as many opportunities as there are.

2) S-T Strategy: Strategies that are taken to take advantage of existing strengths in dealing with emerging threats.

3) W-O Strategy: A strategy to take full advantage of opportunities to deal with the weaknesses of the organization.

4) W-T Strategy: Strategies to overcome weaknesses and eliminate threats that arise.

Table 2. Matrix SWOT

INTERNAL/EXTERNAL FAKTOR	STRENGTH (S) (Maximal)	WEAKNESS (W) (Minimal)
OPPORTUNITIES (O) (maximal)	S-O Strategy (Maximal-Maximal)	W-T Strategy (Minimal-Minimal)
THREATS (T) (Minimal)	S-T Strategy (Maximal-Minimal)	W-O Strategy (Minimal-Maximal)

2.7 Interpretative Structural Modelling (ISM)

ISM was first introduced by J. Warfield in 1973, by defining ISM as a computer-assisted learning process that allows individuals or groups to develop a map of complex relationships between various elements involved in a complex situation (Warfield, 1974). ISM is a sophisticated planning methodology used to identify and infer various kinds of relationships between factors in a particular problem or issue (Sage, 1977).

ISM is a sophisticated interactive planning methodology that allows a group of people, working as a team, to develop a structure that defines the relationships among the elements in a set. Structure is obtained by answering simple questions. (Bhattacharya and Momaya, 2009). ISM is a method of making decisions from complex situations by connecting and organizing ideas in a visual map. ISM is a model that describes the specific relationship between variables, the overall structure and has an output in the form of a graphical model in the form of quadrants and variable levels (Li & Yang, 2014)

.

ISM begins with the identification of elements that are relevant to the problem or problem and extends to group problem solving techniques. A structural self-interaction matrix (SSIM) was developed based on the comparison of the paired elements. There are procedures or stages in using the ISM method, these stages include (Firoz & Rajesh, 2012) :

a. Parameter identification. The elements to be considered for identification of relationships were obtained through literature surveyors by conducting surveys.

b. Development of Structural Self Interaction Matrix (SSIM). The development of the interpretive structural model begins with the construction of a structural self-interaction matrix, which shows the direction of the contextual relationship among the elements.

c. Reachability Matrix. From the self-interaction matrix (SSIM), relational indicators are converted into binary numbers 0 and 1 to obtain a square matrix, which is called the reachability matrix (Hussain, 2011).

1) If (i, j) the value in SSIM is V, (i, j) the value in the reachability matrix will be 1 and (j, i) the value will be 0.

2) If (i, j) the value in SSIM is A, (i, j) the value in the reachability matrix will be 0 and (j, i) the value will be 1.

3) If (i, j) the value in SSIM is X, (i, j) the value in the reachability matrix will be 1 and (j, i) the value will also be 1.

4) If (i, j) the value in SSIM is the value of O, (i, j) in the reachability matrix will be 0 and (j, i) will also be 0.

d. Partition level. From the reachability matrix, for each parameter, the reachability set and the antecedent set are derived. Variables, which are common in reachability sets and antecedent sets, are allocated to intersection sets. The top-level element for each hierarchy is one where theantecedent set and the intersection set are the same in the ISM hierarchy. Once the upper level barrier is identified, it is removed from consideration and other upper level barriers are found (Firoz & Rajesh, 2012). This process will continue until all levels of each barrier are found.

e. Interpretive structural modeling (ISM) constructs. From the partitioned parameters and reachability matrix, a structured model is derived, showing the parameters at each level and arrows showing the direction of the relationship. Such a graphical representation of the model is called a diagraph.

f. MICMAC analysis. MICMAC analysis refers to the Matrice d'Impacts Croisés Multiplication Appliquée á un Classement (Hussain, 2011) and involves developing a graph to classify various enablers based on driving power and dependence power. MICMAC is also used to check driving power and power dependencies. Variable is a concept that contains a variation of values consisting of at least two variations (Suharjo, 2013). The variables have been classified into four categories referred to as Autonomous, Linkage, Dependent and Driving / independent.

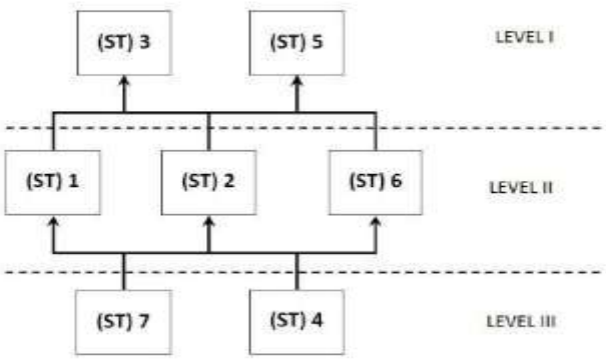


Figure 2. Hierarchy Level Determination in the Selected Strategy

2.8 Research Procedures

By using the SWOT and ISM analysis methods in this study, systematically and sequentially based on the problems raised, a research analysis can be compiled through several process steps, including:

a. The process of identifying the factors that influence the organization's internal (internal factors) which at the same time is in the form of determining the existing variables of the strengths and weaknesses. Furthermore, the identification of external factors (external factors) in the form of determining factors of opportunities (Opportinities) and Threats (Threats).

b. Formulation of a questionnaire as a means of obtaining an assessment from respondents on the factors that have been formulated. The rating of the factors is given a scale between 1 (very very bad) to 9 (very very good).

c. Through a questionnaire, expert views or perceptions of internal and external factors are obtained. Then these factors are grouped into internal factors (strengths and weaknesses), as well as external factors (opportunities and threats) which are then carried out weighting.

d. Multiplies the weight of each internal factor by its rating to determine the weight score, as well as the external factor.

e. Add up the average score for each variable to determine the total weight score.

f. The output of the SWOT analysis is a strategy formulation.

g. The results of the SWOT analysis were made a questionnaire to determine the relationship or interest between one sub strategy and another by using the ISM method approach to determine strategic priorities and the road map for the development strategy of Fasharkan Lantamal IX XYZ.

In general, all processes and sequences of activities carried out in the study are depicted in a flowchart as shown in Figure 3.

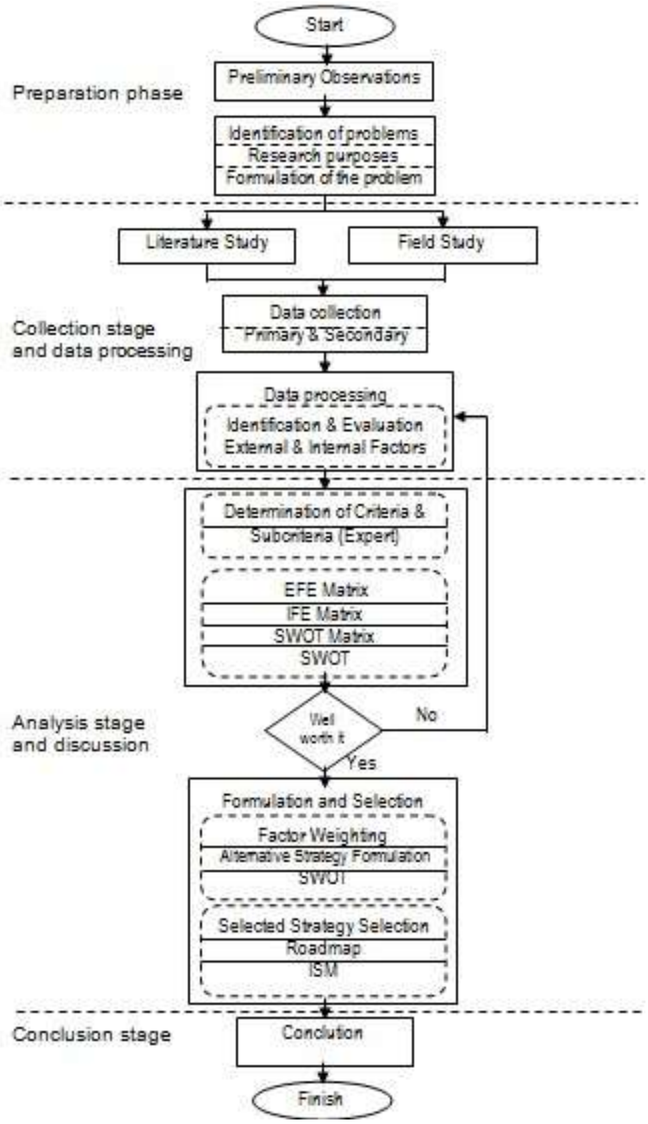


Figure 3. Flowchart Mapping

3. RESULT AND DISCUSSION

3.1 Strategy Formulation

Data collection through literature studies, documents and interviews with competent parties or experts, namely six personnel (E1; E2; E3; E4; E5; E6;) related and observation in obtaining the formulation of internal and external factors. Based on the analysis of internal factors, it was obtained 8 strength factors and 8 weakness factors. Meanwhile, the analysis of external factors obtained 9 (nine) opportunity factors and 7 (seven) threat factors. This section discusses the analysis of the results of weighting criteria and alternative strategies for the development of Fasharkan XYZ by using weighting from EFAS and IFAS through the use of questionnaires given to stakeholders in XYZ's fasharkan development strategy.

3.2 Weighting of Internal Factors / Internal Factors Analysis Summary (IFAS)

After the strengths and weaknesses of the internal factors in the development of Fasaharkan XYZ are known, then the IFAS weighting is carried out as in the following table:

Table 3. Internal Factor Weighting

Internal Factor Criteria	Assessment	Weight (W)	Rating (R)	W x R
Strengths (S)				
Well commitment	7,67	0,07	2,83	0,19
Has a dock	7,17	0,06	2,83	0,17
Competent human resources	7,33	0,06	2,67	0,17
Computer operator well	7,50	0,06	2,67	0,17
Transfer of Technology chance	7	0,06	2,67	0,16
Good managerial	7,17	0,06	3,33	0,21
Budget availability	7,33	0,06	3,17	0,20
Strategic location	7,33	0,06	3,17	0,20
Total Strength	**58,50**	**0,50**	**23,33**	**1,47**
Weaknesses (W)				
Old workshop equipment	7	0,06	3,5	0,21
No docking facility	7,50	0,06	3,33	0,21
Less equipment operator	7,67	0,07	3	0,20
No professional certification	7	0,06	3,33	0,20
Unable to repair KRI to depot level	7,33	0,06	3,33	0,21
Manually equipments	6,67	0,06	3,33	0,19
Welding less technology	7,17	0,06	3,5	0,22
Focused budget employee spending	7,50	0,06	3,33	0,21
Total Weaknesses	**57,83**	**0,50**	**26,67**	**1,66**
Total	**116,33**	**1**	**50,00**	**3,12**

Weighting is done to find out how much influence or impact these factors have on the strategy itself. Strength sub-criteria assessment no.
1 (7.67) is obtained from the total answers of 6 respondents (46) divided by the number of respondents (6), namely (value = 46/6 = 7.67). The total assessment of each strength and weakness factor was 116.33. The weight of the sub-criteria strength no.1 (0.07) is obtained from the value in column 1 (7.67), divided by the total

number of assessments (116.33), namely (weight = 7.67 /
116.33 = 0.07). It is known that the weighted score for strength is 1.47 and weaknesses is 1.66. The rating aims to provide a scale ranging from 4 to 1 based on these factors that affect the development of Fasharkan XYZ**3.3 Weighting of External Factors / External**

Factors Analysis Summary (EFAS)

After the opportunities and threats to external factors in the development of Fasaharkan XYZ are known, then the EFAS weighting is carried out as in the following table:

Table 4. External Factor Weighting

External Factor Criteria	Assessment	Weight (W)	Rating (R)	W x R
Opportunities (O)				
Goverment Policy	7,33	0,06	3,17	0,20
Procurement of domestic vessels	7,50	0,06	2,83	0,18
An increase in the number of ships	7,00	0,06	2,50	0,15
Additional defense budget	7,17	0,06	2,67	0,16
The number of productive age	7,50	0,06	2,50	0,16
Limited shipyards	7,50	0,06	3,17	0,20
Strict regulations for new shipyards	7,00	0,06	3,50	0,21
Increase in the defense industry	7,50	0,07	3,33	0,23
Transfer of Technology adopted	7,17	0,07	3,00	0,18
Total Opportunities	**65,,67**	**0,56**	**26,67**	**1,67**
Threats (T)				
High interest rates	7,17	0,06	3,50	0,22
Low defense budget (1.5% GNP)	7,33	0,06	3,17	0,20
High budget for new technology	7,33	0,06	2,67	0,17
Less integrity of each shipyards	7,17	0,07	3,50	0,22
Dependence on foreign technology	7,50	0,07	3,50	0,23
Limitations of technology transfer	6,83	0,06	3,50	0,21
Rpid development of technology	7,50	0,07	3,50	0,23
Total Threats	**50,83**	**0,44**	**23,33**	**1,45**
Total	**116,50**	**1,00**	**50,00**	**3,12**

Weighting is done to find out how much influence or impact these factors have on the strategy itself. Opportunities sub-criteria assessment no.1 (7.33) is obtained from the total answers of 6 respondents (44) divided by the number of respondents (6), namely (value = 44/6 = 7.33). The total assessment of each opportunities and threats factor was 116.50. The weight of the sub-criteria opportunities no.1 (0.07) is obtained from the value in column 1 (7.67), divided by the total number of assessments (116.33), namely (weight = 7.67 /
116.33 = 0.07). It is known that the weighted score for opportunities is 1.67 and threats is 1.45. The rating aims to provide a scale ranging from 4 to 1 based on these factors that affect the development of Fasharkan XYZ

3.4 SWOT matrix and the determination of the chosen strategy

Based on the results of calculations that have been carried out through the IFAS and EFAS analysis, the final value of internal factors (strengths and weaknesses) and external factors (opportunities and threats) is obtained. The results of the weighting of the influencing factors above are arranged in a cross strategy between factors or a SWOT matrix to determine the chosen strategy, so that we can analyze what strategy is appropriate to use in problem solving. In summary, it can be seen in the following table.

IFAS / EFAS	Strengths (S = 1,47)	Weaknesses (W = 1,66)
Opportunities (O = 1,67)	Strategy S-O = 3,14	Strategy W-O = 3,33
Threats (T = 1,45)	Strategy S-T = 2,92	Strategy W-T = 3,11

The combination of the crossover strategy of the IFAS and EFAS factors or the SWOT matrix produces several strategic formulations with certain weights. Based on the final score obtained, strategic priorities are arranged starting from the strategy with the highest score to the lowest, as shown in the figure below:

Figure 4. Strategy Weights

Based on the IFAS-EFAS interaction process through a cross strategy / combination of elements of S, W, O, and T elements, the strategy alternative with the highest weight is the Weaknesses - Opportunities (WO) strategy. This can be interpreted as a chosen substrategy to solve the problems faced by maximizing the opportunities available to deal with organizational weaknesses / shortcomings. This condition is favorable for XYZese fasharkan because in terms of external factors, the existingopportunities are greater than threats in the context of developing XYZese fasharkan into class 'A' fasharkan types.

3.5 Prioritization of Sub-strategies based on ISM

Based on the analysis results, the selected sub-strategy is the W-O strategy as an alternative development strategy for Fasharkan XYZ. Where these elements are obtained from the results of determining the strategy in the SWOT analysis. In the next step, in order to prioritize the organizational development sub-strategy, the Interpretative structural modeling approach is used.

Table 6. Results of Determination of Sub Strategies

Code	Sub-Strategy W-O
WO1	New procurement and updating of equipment for each workshop
WO2	Construction of slipway shipyard facilities and complete infrastructure
WO3	Construction of a graving dock with a capacity of up to 5000 DWT
WO4	Increased capability of renewable welding technology
WO5	Charging personnel according to their needs and competencies
WO6	Implementation of education and training and courses according to assignments
WO7	Integration of cooperation with related stakeholders in order to align common goals
WO8	Increased cooperation in transfer of technology in all fields
WO9	The new KRI procurement policy is in line with the development of KRI's fasharkan

After obtaining several alternatives from the W-O selected sub-strategy, from the WO1 to WO9 alternatives, then the ISM questionnaire was taken from the selected sub-strategies to the validator / expert of the position holder for further data processing using ISM. The results from processing the ISM questionnaire data obtained the following binary calculation formations:

Table 7. Reachability Matrix

Code	Sub-Strategy W-O	Sub-Strategy									Driven Power
		1	2	3	4	5	6	7	8	9	
WO1	New procurement and updating of equipement for each workshop	1	1	0	0	0	1	1	1	0	5
WO2	Construction of slipway shipyard facilities and complete infrastructure	0	1	0	0	1	1	0	0	1	4
WO3	Construction of a graving dock with a capacity of up to 5000 DWT	0	1	1	0	0	0	0	0	1	3
WO4	Increased capability of renewable welding technology	1	0	0	1	0	0	0	0	1	3
WO5	Charging personnel according to their needs and competencies	1	1	1	1	1	1	0	0	1	7
WO6	Implementation of education and training and courses according to assignments	0	0	1	1	0	1	1	1	1	6
WO7	Integration of cooperation with related stakeholders in order to align common goals	0	0	1	0	0	0	1	1	1	4
WO8	Increased cooperation in transfer of technology in all fields	0	0	0	0	0	0	0	1	1	2
WO9	The new KRI procurement policy is in line with the development of KRI's fasharkan	0	0	1	0	0	0	1	0	1	3
Dependence		3	4	5	3	2	4	4	4	8	

Based on further data processing and analysis on RM, the Driven Power and Dependence values are obtained which are then mapped or classified into the sub-strategy elements based on Driven Power (DP) as the abscissa (X) axis and Dependence (D) as the ordinate axis (Y) in the graphic description /picture. The classification of existing elements can be classified into 4 sectors, namely:

a. Sector I. As Weak Driver - weak dependence variables (Autonomous). In terms of changes in this sector with the system, it is relatively small or irrelevant.

b. Sector II. As Weak Driver - Strongly Dependence Variables (Dependent). Changes in this sector depend on the input and actions taken on the system, especially those that come from linkage changes.

c. Sector III. As Strong Driver - Strongly Dependence Variables (Linkage). In this sector, the relationship between variables is not stable. Every action taken will affect other changes.

d. Sector IV. As Strong Driver - Weak Dependent Variables (independent), the changes in this sector are called independent variables, where this sub strategy is considered a key factor in the system.

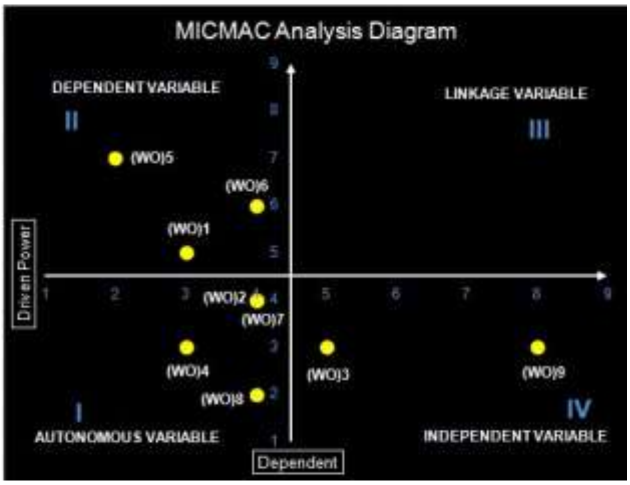


Figure 5. MICMAC Analysis Diagram

Through the influence of driven power and dependence on the MICMAC Analysis Diagram it is known that the autonomous variables (sector I) consist of four variables, namely (WO2), (WO4), (WO7) and (WO8). This sub strategy has a relatively small driving power and has little dependence on other elements.

Sector II (Dependent Variable), there are two elements of the sub strategy, namely building a graving dock up to 5000 DWT (WO3) capability and a new KRI procurement policy in line with the development of KRI (WO9) fasharkan. these elements have a relatively small driving power but are heavily dependent on other elements as triggers in the development of Fasharkan. Sector III (variable linkage) has no variables.

Sector IV (Independent variable) has three variables, namely new procurement and updating of equipment for each workshop (WO1), filling of personnel according to their needs and competencies (WO5) and implementation of education and training and courses according to assignments (WO6) has an effect strong against the success of fasharkan development. Where (WO5) as the strongest driver in driving other variables. Then sequentially followed by the (WO1) and (WO6) sub-strategies as driving other variables in the XYZese fasharkan development process.

In accordance with Figure 5. The micmac analysis diagram can be arranged from each element and can be obtained 5 (five) hierarchical levels of each variable as shown below.

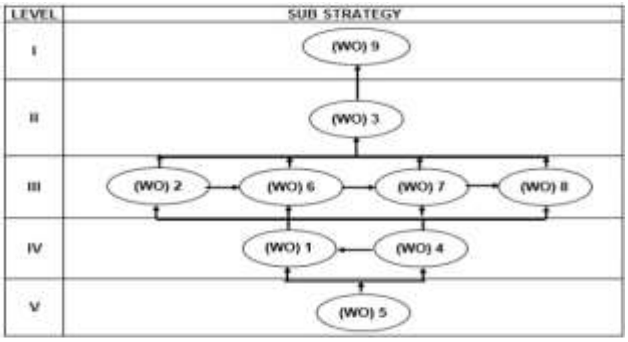


Figure 6. Strategic Structure Level

From the picture above, it is obtained 5 (five) levels of the hierarchical structure, namely the variables (WO5) are at level V. The sub-strategy (WO1) and (WO4) are at level IV. At level III it consists of 3 (three) sub strategies, namely (WO2), (WO6) and (WO7) and (WO8). At level II there is a strategy (WO3) and at level I a strategy element (WO9).

4. DISCUSSION

The research starts from the problem identification stage and data collection from literature, field studies, interviews and questionnaires to selected experts. The next stage is identifying and formulating strategies. With the SWOT analysis method, the W-O sub-strategy was selected. In order to solve the problems faced by maximizing the opportunities available to deal with organizational weaknesses / shortcomings. This condition is favorable for XYZese fasharkan because in terms of external factors, the existing opportunities are greater than threats in the context of developing XYZese fasharkan into class 'A' fasharkan types.

The SWOT analysis method integrates external and internal factors in formulating a legal development strategy. weighting of each factor iscarried out with an EFAS / IFAS analysis which is then carried out a cross combination of each of these factors in the form of an SO strategy (6 strategy steps), WO strategy (9 strategy steps), ST strategy (6 strategy steps) and WT strategy (4 strategy steps) where the selected strategy with the highest weight is the sub-strategy WO = 3.33

After taking the ISM questionnaire from the selected sub-strategies (WO1) - (WO9) to the occupational expert, a binary calculation formation is obtained to determine the relationship / position of each strategy in the reachability matrix to determine the function of each variable as a driven power or as a the dependence factor (dependence / linkage). From Figure 5, it can be classified into 4 (four) sectors, namely the autonomous variable (sector I), there are 4 (four) sub strategy variables (WO2, WO4, WO7, WO8). In sector II (Dependent Variable) there are 3 (three) sub strategies (WO1, WO5, WO6), Sector III (variable linkage) has no variables and sector IV (Independent variable) has 2 (two) sub strategy variables (WO3, WO9)).

The next step is to map the relationship between the sub strategies of the selected strategy in the hierarchical level structure in order to identify the linkages between the sub strategy elements. Based on the results of the classification of elements in the WO strategy, there are 5 (five) levels of hierarchical structure. It can be described briefly from the hierarchical structure that the filling of personnel according to their needs and competencies (WO5) is at level V. Then the sub-strategies of new procurement and equipment updating for each workshop (WO1) and increasing the capability of renewable welding technology (WO4) are at level IV. . At level III it consists of 4 (four) sub strategies, namely the construction of slipway shipyard facilities and completing the infrastructure (WO2); Implementation of education and training as well as courses according to assignments (WO6); Integration of cooperation with related stakeholders in order to align common goals (WO7); Increased cooperation in transfer of technology in all fields (WO8). At level II, namely the construction of a graving dock with a capacity of up to 5000 DWT (WO3). At level I, the new KRI procurement policy is in line with the formal development of KRI (WO9).

5. CONCLUSION

The conclusion that can be made are:

a. The formation of Koarmada III in Sorong had an effect on changes in the operating sector and the addition of KRI elements, especially in the eastern region. This has implications for increasing workloads and readiness of bases in order to increase capabilities in the process of maintaining and repairing KRI so that they are always ready to carry out operational tasks at sea, with the existence of a strategy for developing fasharkan Lantamal IX XYZ from class C to class A.

b. By paying attention to the external and internal factors of the organization which are then processed and analyzed using the SWOT approach, several formulations are obtained, namely the strategy strengths(S) - Opportunities(O) (SO1-SO6), Strategies of Weaknesses(W) - Opportunities(O) (WO1-WO9), strategy strengths(S) - Threats(T) (ST1-ST6) and strategy weaknesses(W) - Threats(T) (WT1-WT4) where the selected strategy with the highest weight is the WO sub-strategy with a score of 3.33

c. Using the ISM method, the WO strategy is further processed into the reachability matrix and the weight of each sub-strategy WO is obtained in the value of driven power and dependence, then entered in the micmac analysis diagram, the position of each variable element is obtained to determine the effect (driven power) and dependence. (dependence) one variable on another variable.

d. Mapping of each variable in the relationship between the sub-strategies of the selected strategy into the hierarchical level structure in order toidentify the relationship between the elements of the sub strategy, there are 5 (five) levels of the hierarchical structure, namely the sub-strategy (WO5) is at level V. sub-strategy (WO1) and (WO4) is at level IV. At level III it consists of 4 (four) sub strategies (WO2); (WO6); (WO7); and (WO8). At level II there is a strategy (WO3). At level I strategy (WO9).

ACKNOWLEDGEMENTS

XYZ's fasharkan development strategy is a form of response to the validation of organizational development. This investigation is expected to be one of the considerations and inputs in the decision making process. The subject of research studies is expressed in variables to represent the place of the organization with the aim of not causing negative perceptions. Acknowledgments to agencies that have provided support and opportunities to researchers to provide support for their thoughts and to honorable officials and supervisors so that this paper can be compiled.

REFERENCE

Aam Slamet Rusydiana, A. D. (2018). Mengembangkan Koperasi Syariah di Indonesia: Pendekatan Interpretative Structural Modelling (ISM). *Jurnal Ekonomi Islam* , 1-23.

Bhattacharya,S. And Momaya,K. (2009),"Interpretive structural modeling of growth enablers in construction companies", Singapore Management Review, Vol. 31

Creswell, J. W. (1992). *Research Design : Qualitative, Quantitative and Mixed Methods Approaches.* Chicago: University of Chicago Press.

Firoz, N., & Rajesh, R. (2012). Relationship among Supplier Selection Criteria using Interpretative Structural Modeling for Manufacturing Organization in Kerala . *International Journal of Engineering Science Invention, 3*(8), 60-70.

Hunger, J. D., & Wheelen, T. L. (2010). *Essentials Of Strategic Management 5th edition.* United States of Amerika: Prentice Hall.

Hussain, M. (2011). *Modelling the Enablers and lternatives for Sustainable Supply Chain Management.* Montreal: Concordia University.

Kasal. (2013). *Peraturan Kepala Staf Angkatan Laut Nomor KEP/1771/XII/2013 tentang Buku Petunjuk teknis Standarisasi Pangkalan TNI AL.* Jakarta: Mabesal.

Kasal, (2018). Perkasal Nomor 17 Tahun 2018, Tanggal 9 Mei 2018 tentang Pembentukan Komando Armada III

Li, M., and Yang, J. (2014), “Analysis of interrelationships between critical waste factors in office building retrofit projects using interpretive structural modeling”, *International Journal of Construction Management,* Vol. 14, No. 1, pp. 15-27.

Lumaksono, H. (2014). *Implementation Of SWOT-FAHP Method To Determine The Best Strategy On Development Of Traditional Shipyard In Sumenep. Academic Research International Vol. 5(5) September 2014*, 56-67.

Marsetio, (2014). Paradigma Baru TNI Angkatan Laut Kelas Dunia. *The Indonesian Navy's New Paradigm.* Buku Petunjuk Pelaksanaan Tugas sesuai strata pembinaan di jajaran TNI Angkatan Laut. *Page* 22

Presiden R. I (2018). Keppres Republik Indonesia Nomor 12 Tahun 2018 tentang pembentukan Koarmada III dan Pasmar 3 di Sorong

Rangkuti., F. (2012). *SWOT Balanced Scorecard.* Jakarta: PT Gramedia Pustaka Utama.

Sage A P (1977), Interpretive structural modelling: methodology for large-scale systems, McGraw-Hill, New York, pp. 91-164.

Sudaryanto, Ragil (2017) *Integrasi Threats Opportunities Weaknesses Strength (Tows), Analytic Hierarchy Process (AHP) dan Simple Additive Weighting (Saw) dalam Perumusan Strategi (Studi Kasus PT.XYZ).* Masters thesis, Institut Teknologi Sepuluh Nopember.

Warfield J N (1973), "On arranging elements of hierarchy in graphical form", IEEE Transactions on Systems, Men and Cybernetics, vol. 3 no. 2, pp. 121-132.

Warfield, J.N. (1974), "Developing interconnected matrices in structural modeling", *IEEE Transactions on System, Man and Cybernetics*, Vol. SMC-4 No. 1, pp. 81-87

THE DEVELOPMENT OF STRATEGY OF INDONESIAN NAVAL REPAIRMENT AND MAINTENANCE FACILITY (FASHARKAN) TO SUPPORT THE READINESS OF BATTLESHIPS IN FIRST FLEET COMMAND BY USING TOWS METHOD (CASE STUDY FASHARKAN JAKARTA)

Kuncoro[1], Okol Sri Suharyo[2], Avando Bastari[3]

[1,2,3]*Indonesia Naval Technology College STTAL, Surabaya Indonesia*

ABSTRACT

Indonesian Naval Repairment and Maintenance Facility that has location in Jakarta is an organization which has duties and tasks to repair and maintain the KRI. To implement their complexity tasks and fulfill the developing of Naval technology, it needs equipment that requires with high technology and professional personel suitable with their fields. The purpose of this research is to determine the alternative development strategy of Indonesian Naval Repairment and Maintenance Facility Jakarta. This study uses the TOWS analysis method (Treaths Opportunities weaknesses Strengths). TOWS analysis is used to formulate and provide alternatives in the development strategy of Fasharkan Jakarta. Based on the results of the TOWS matrix analysis, the SO Strategy consists of 6 (six) strategic steps, the ST Strategy consists of 6 (six) strategic steps, the WO Strategy consists of 9 (nine) strategy steps and WT strategy consists of 4 (four) steps strategy. Based on weighting are using the EFAS and IFAS matrices, the chosen strategy is the WO Strategy, so that the WO strategy becomes the first alternative. Based on the results of the classification of elements in the WO strategy, there are 5 (five) levels of hierarchical structure. In this hierarchical structure, it can be seen that the sub-strategy (WO5) is at level V. Then the sub-strategies (WO1) and (WO4) are at level IV. At level III, it consists of 4 (four) sub strategy, they are (WO2); (WO6); (WO7); (WO8). At level II, it is named the sub strategy (WO3). At level I sub strategy is (WO9).

Keywords: *Fasharkan Jakarta, Development Strategy, TOWS.*

1. INTRODUCTION

In the report of Global Marine Technology Trends 2030, the power map of countries in the world will have the drastic changes in 2030. Asia will pass North America and Europe in terms of global power, which are grouped into types of potential technology in three major sectors, namely shipping, shipping and utilization. sea space. In this projection, Indonesia is seen as one of the countries that will have an increasing power (emerging power) in 2030. However, a note to note is that Indonesia needs to increase its maritime power, so that it is able to manage the potential and threats that may arise in their territorial waters. (Phillips, 2008).

The TNI Commander has set 11 (eleven) priority programs for 2018 in accordance with government policy commitments and the importance of synchronizing the development of the TNI force title with national development. This policy is in line with the national maritime policy through the concept of Indonesia as a World Maritime Axis which was conveyed by President Joko Widodo at the 9th East Asia Summit (EAS), 13 November 2014. Where the national development agenda will be focused on five main pillars, namely: First, rebuilding Indonesia's maritime culture; Second, protecting marine resources and creating seafood sovereignty by placing fishermen on the main pillar; Third, give priority to infrastructure development and maritime connectivity by building sea tolls, deep seaports, logistics, the shipping industry, and maritime tourism; Fourth, Implementing maritime diplomacy, through proposals to increase cooperation in the maritime sector and efforts to deal with sources of conflict, such as illegal fishing, violation of sovereignty, territorial disputes, piracy and marine pollution with an emphasis that the sea must unite various nations and countries and not separate; and Fifth, building maritime power as a form of responsibility for maintaining shipping safety and maritime security.

The implementation of the Navy's duties in defending and maintaining sovereignty at sea can be carried out with support for infrastructure and mastery of Naval Technology, especially in the Integrated Fleet Weapon System (SSAT). SSAT readiness and mastery of marine technology greatly affect the implementation of the Navy's duties in defending and maintaining the country's sovereignty, especially at sea. Thus, the readiness of the SSAT, especially the Indonesian Warship Ship (KRI), is a priority to support security at sea (Ahmadi, 2017). With the increasing number of the presence of KRI at sea, it will be able to control the sea area (sea control) and be able to minimize risks and be free from all threats that have been present so that the stability and balance and safety of the sea are maintained.

The development of the Indonesian Navy organization is consisting of three Fleet Commands (Koarmada), which are first fleet command in Jakarta, second in Surabaya and third in Sorong, West Papua. The task of the Fleet Command as an operational Kotama is to carry out maritime intelligence operations tasks in supporting the implementation of marine operations in the context of War Military Operations (OMP) and to carry out Military Operations Other Than War (OMSP) in the form of daily marine operations in its territory according to the policy of the TNI Commander (Asmoro RN, 2018). Meanwhile, as the Guidance Kotama, it has the task of fostering the capabilities and strength of the components of the Integrated Fleet Weapon System (SSAT), fostering maritime warfare, fostering operational readiness to implement OMP and OMSP and fostering maritime potentials to become a defense and security force under Kasal. The Fleet I Command has a working area covering Lantamal I Belawan, Lantamal II Padang, Lantamal III Jakarta, Lantamal IV Tanjung Pinang and Lantamal XII Pontianak. In carrying out its main duties to secure and maintain the integrity of the territorial waters under its jurisdiction. Fasharkan Jakarta has the main task is to assist the Commander of Indonesian Naval Base III in providing maintenance and repairing facilities to the KRI which will carry out repairs in the fields of ship building, docking, electronics, and weapons as well as fostering potential maritime services that are support the main task of Indonesian Naval Base III (Kasal, 2013).

In carrying out its main duties, Fasharkan Jakarta has the function of providing maintenance and repair facilities for KRI who will carry out repairs, maintaining the level of readiness of facilities and infrastructure in the Fasharkan environment so that they are able to accept the burden of maintenance and repair tasks for elements of the Navy, plan maintenance and repair activities at the depot level, medium and emergency repair of the Fleet I Commando equipment and its workshop equipment based on the plan and program of Disharkap Koarmada I in providing maintenance support for KRI. Fasharkan Jakarta is a type A Fasharkan, according to the type "A" Fasharkan has the ability to repair and maintain KRI up to the depot level. However, the current condition of Fasharkan Jakarta's ability is still limited in terms of implementing the repair and maintenance of KRI, because there are several things that still need to be improved and changes in the future, including the condition of existing human resources (HR) both in terms of quality and quantity is still not fulfilled, limited human resources who have certification, have not been able to carry out repairs up to the depot level. The current docking capability of Fasharkan Jakarta is only capable of docking up to 50 tons and a Slip Way with a capacity of 600 tons, but its current condition is damaged and cannot be used to repair

KRI and Fasharkan Jakarta currently does not have a Graving Dock (pool dock) with a capacity of 5000. ton. Besides that, the workshop facilities, safety equipment and supporting transportation equipment are old and still manual, so they are still behind the sea lift technology.

Figure 1. Slipway 50 Tons Fasharkan Jakarta.

Figure 2. Slipway 750 Tons Fasharkan Jakarta.

Fasharkan Jakarta as a supporting component for base facilities is in a strategic location, where the location is the Fleet I base / homebase, which is the berth for the completed KRI / KAL as well as a place to prepare technical conditions for ships that will carry out operations, in connection with The operational demands and main duties of the KRI, increasing the ability of Fasharkan Jakarta to be very appropriate to get attention in the effort to increase the ability to improve the Fasharkan class A standard To Support the Readiness of Battleship in First Fleet Comand Using the TOWS Method (Case Study Fasharkan Jakarta).

2. MATERIAL AND METHODS

2.1 Strategic Management Concept

Strategic management is a managerial action in making decisions in determining the direction of long-term performance of an organization which includes observations of environmental influences, formulation or planning of a strategy, implementation of evaluation and implementation of the strategy itself (J. David Hunger, 2003). Etymologically, strategy comes from Greek which is derived from the derivative of the word strategos, in the Athenian era of democracy which meant "military commander". However, from the perspective of terminology, experts have different understandings of the meaning of strategy, but basically have a similar meaning or meaning, namely a plan to achieve goals efficiently and effectively (Syahtaria, 2019). According to (Istiqomah, 2017) Strategic management can be defined as the art and science of formulating, implementing, and evaluating cross-functional decisions that enable organizations to achieve their goals. This definition implies that strategic management focuses on integrating management, marketing, finance/accounting, production/ operations, scriptwriting and development, and information systems to achieve organizational success. The term strategic management in this text is used synonymously with the term strategic planning.

2.2 TOWS Analysis Theory

According to Kertajaya, et al (Kertajaya, 2005) The TOWS analysis begins with a study of external factors by conducting a threat-opportunity analysis, followed by a review of the company's internal conditions in the form of strength-weakness. This kind of analysis sequence is based on the fact that in the 1990s environmental change and turbulence became increasingly important, far beyond changes in the internal environment, therefore we have to start from the outside, new to the inside. In other words, we are using an outside-in, not inside-out approach.

When conducting a TOWS analysis, an organization may be trapped by placing too much pressure on internal factors and limiting the identification of threats and opportunities only to those that are in line with the company's capabilities. This does not mean that a company does not need to adapt the external environment to its internal conditions, this is the most important thing that companies must do. By examining all possible threats and opportunities before examining the company's weaknesses and strengths, we will tend to be better able to formulate and carry out the company's strategic steps. The TOWS analysis will provide a future paradigm so that the strategies created can also be used for the future.

The TOWS matrix consists of eight cells. As seen, there are four key factor cells, four strategy factor cells. Four strategy cells, labeled SO, WO, ST, and WT. is developed after solving the four key factor cells, labeled S, W, O, and T. The purpose of each match is to produce an alternative strategy that can be executed, not to choose or determine which one is the best. Therefore, not all strategies developed in the TOWS matrix will be selected for implementation. The TOWS matrix explains that there are four strategies we can develop.

2.3 Research Approach

This research uses quantitative analysis research method because in its implementation it is based on measurement results based on existing variables and also uses questionnaire and interview instruments. According to Bagman and Taylor, qualitative methodology is defined as a research procedure that produces descriptive data in the form of written or spoken words from people and observed behavior. (Taylor, 1975), (whereas the quantitative approach is one that is presented with numbers. This is in accordance with the opinion(Arikunto, 2006) who argues that quantitative research is a research approach that is required to use numbers, starting from data collection, interpretation of the data, and the appearance of the results.

2.4 Research Data Sources

Researchers collect research data sources from primary data sources and secondary data sources. These two data sources are collected in order to provide various information about the data to be analyzed. Based on the research data source, the data collected was divided into 2 (two), namely:

a. Primary research data comes from data collected by the author from the first source or the place where the research object was carried out. Primary data in this study were sourced from Disharkap Koarmada I, Fasharkan Jakarta and KRI First Fleet Command**.**

b. Secondary research data comes from data that has been previously collected by other researchers, agencies or other sources that have been tested / valid. Secondary data is obtained from literature, articles, journals and sites on the internet with regard to the research conducted.

2.5 Research Subjects

Research resource persons are people who understand about Fasharkan Jakarta. The resource persons used in this research were those who were directly involved in the research, namely, Kafasharkan Jakarta, Kadisharkap Koarmada I, Kabagren/Fasharkan Jakarta Staff, Head of Jakarta Fasharkan Staff / Head of Fasharkan Jakarta, the Kabeng/Fasharkan Jakarta Staff and Chief Engineering Battleship First Fleet Command.

2.6 Data Collection Technique

Data collection is carried out to obtain the information needed in order to achieve the objectives of a study. In this research, data collection techniques were carried out through observation, interviews and documentation / literature study. Primary data is through observation and interviews (in-depth interviews. Secondary data is obtained from books, documentation and literature studies which are obtained indirectly from the subject or object of research.

2.7 Data Analysis Techniques

Data analysis is intended to find elements or sections that contain smaller categories of research data. In this study, researchers collaborated with sources to obtain patterns that match the object under study. Based on the existing problems, this research method uses the TOWS method. In the TOWS analysis, there are several stages including identifying external and internal factors, then compiling a matrix of external and internal factors and creating a questionnaire. From the results of the questionnaire, it can be concluded about the respondent's assessment of the existing indicators and compiled in a TOWS matrix. Then make an evaluation of external factors and internal factors by giving weight to strategic factors on a scale from 1 (bad) to 9 (good). Weighting of the group of factors and internal and external strategic factors through the pairwise comparison method. In developing alternative strategies, the TOWS matrix is used to help match strengths and opportunities (SO strategy), strengths and threats (ST strategy), opportunities and weaknesses (WO strategy) and weaknesses and threats (WT strategy).

2.8 Research Flowchart

An outline of all research activities is depicted in a flowchart as in Figure 3.

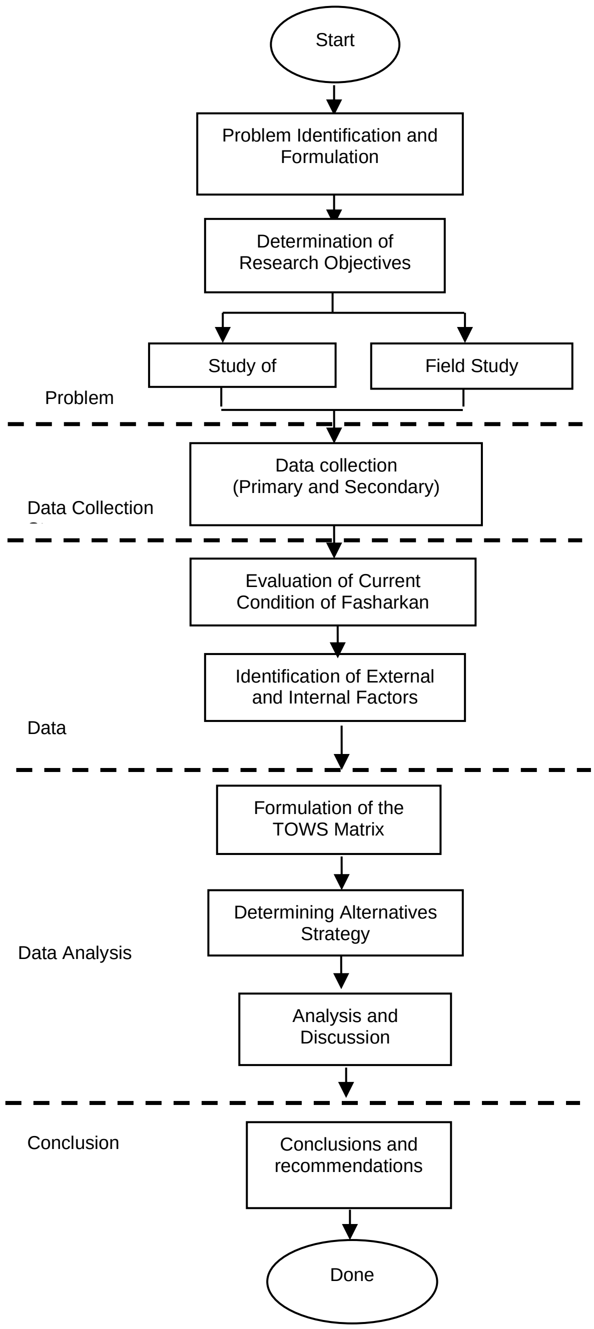


Figure 3. Research Flowchart

2.9 TOWS Matrix

From the identification of internal and external factors, the next step is to formulate strategic factors by combining internal and external factors to determine the alternative development strategy for Fassharkan Jakarta. The strategy formulation and results are obtained from the TOWS matrix. The TOWS matrix illustrates how external factors, namely the opportunities and threats faced by the organization, are aligned with internal factors, namely the strengths and weaknesses of the organization.

From this matrix, four alternative strategies for the development of Fasharkan Jakarta can be generated as shown in Figure 4.

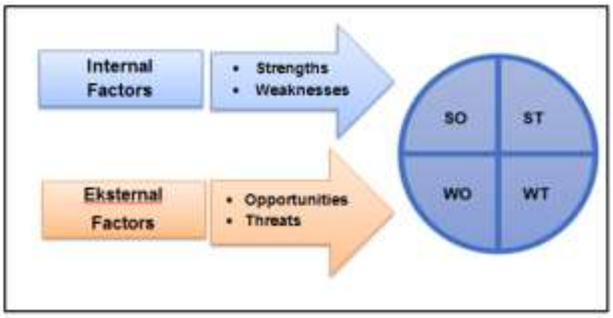


Figure 4. TOWS Matrix Analysis for Strategy Formulation

a. Identifying the factors that affect the internal research objectives of the organization which is also an activity to determine the strength factor variables Strength and weakness that exist. Then identify the external factors which are activities to determine the Opportinities and Threats.

b. Give weight to each factor external and internal they range from 0.0 (not important) to 1.0 (very important). The weight value is obtained from the weighting of the TOWS process which reflects the relative significance of an organizational factor to the research objectives.

c. Rank each factor external and internal factor to show the effectiveness of the current organizational strategy in responding to these factors.

d. Multiplies the weight of each factor external with its ranking to determine the weight score, as well as the internal factors.

e. Add up the average score for each variable to determine the total weight score.

3. RESULT AND DISCUSSION

The results of weighting the criteria and alternative strategies for the development of Fasharkan Jakarta are using weighting from EFAS and IFAS TOWS. In weighting EFAS and IFAS using a questionnaire given to stakeholders in the Jakarta fashion development strategy.

a. Weighting of Internal Factors (IFAS)

After the strengths and weaknesses of the internal factors in the development of Fasaharkan Jakarta are known, then the IFAS weighting is carried out as in the following table:

Table 1. Internal Factor Weighting Table

Internal Factor Criteria	Score	Weight (B)	Rating (R)	B x R
Able to carry out docking up to 700 tons	7.67	0.07	2.83	0.19
Has a dock	7.17	0.06	2.83	0.17
Having human resources who have skills in their fields	7.33	0.06	2.67	0.17
HR has the ability to interact with computers well	7.50	0.06	2.67	0.17
Technology transfer cooperation opens the way to mastering technology	7	0.06	2.67	0.16
The managerial of the organization is quite solid	7.17	0.06	3.33	0.21
The budget comes from APBN funds	7.33	0.06	3.17	0.20
Fasharkan's location is very strategic	7.33	0.06	3.17	0.20
Total Strength	**58.50**	**0.50**	**23.33**	**1.47**

Table 2. Weighting Table Internal Factors

Internal Factor Criteria	Score	Weigh t (B)	Ratin g (R)	B x R
Workshop equipment is old or old.	7	0.06	3.5	0.21
Slipway docking capability is limited to 700 tonnes	7.50	0.06	3.33	0.21
There is a lack of human resources at the operator level	7.67	0.07	3	0.20
HR does not have a professional certification	7	0.06	3.33	0.20
Not yet able to carry out repairs to KRI up to the depot level	7.33	0.06	3.33	0.21
The equipment used is still manual	6.67	0.06	3.33	0.19
Do not have welding technology with aluminum and computer systems	7.17	0.06	3.5	0.22
The dependence of the budget on the APBN is still mostly used for personnel expenditure	7.50	0.06	3.33	0.21

Internal Factor Criteria	Score	Weight (B)	Rating (R)	B x R
Number of Weaknesses	**57.83**	**0.50**	**26.67**	**1.66**
Total	**116.33**	**1**	**50.00**	**3.12**

Based on table 4.10 of the IFAS matrix above, it can be seen that the weight of the internal factor rating, where the weighting is carried out with the aim of knowing how much the factors influence or have an impact on the strategy factor itself. The weighting of the strategic factors in the table is obtained from the total strength score of 1.47 and the total weakness score of 1.66, so that the overall total of internal factors is 3.13. The purpose of this rating is to provide a scale ranging from 4 to 1 based on these factors towards the development of Fasharkan Jakarta to fulfill its main duties. The overall score shows how the development reacts.

b. Weighting External Factors (EFAS)

After the opportunities and threats to external factors in the development of Fasaharkan Jakarta are known, then the EFAS weighting process is carried out as in the following table:

.

Table 3. Weighting Table for External Factors

External Factor Criteria	Score	Weight (B)	Rating (R)	B x R
Government policy in developing the shipping industry as a driving force for the national economy	7.33	0.06	3.17	0.20
The new KRI Procurement Program is domestically produced	7.50	0.06	2.83	0.18
The positive trend in the growth of the national ship fleet is a lot of demand for ship repair	7.00	0.06	2.50	0.15
Economic growth supports an increase in the defense budget	7.17	0.06	2.67	0.16
Having the availability of young human resources at each level	7.50	0.06	2.50	0.16
Uneven distribution of shipyards in certain islands, eastern Indonesia 12%	7.50	0.06	3.17	0.20
The shipbuilding industry is difficult for new players to penetrate (high barrier to industry entry)	7.00	0.06	3.50	0.21
The national defense industry has gradually increased its capabilities	7.50	0.07	3.33	0.23
The existence of technology transfer from developed / friendly countries	7.17	0.07	3.00	0.18
Number of Opportunities	**65,, 67**	**0.56**	**26.67**	**1.67**

Table 4. Weighting Table for External Factors

External Factor Criteria	Score	Weight (B)	Rating (R)	B x R
The policy on banking interest rates is still high	7.17	0.06	3.50	0.22
Defense budget is still below standard (2% of GDP)	7.33	0.06	3.17	0.20
Requires a large budget for software and hardware needs	7.33	0.06	2.67	0.17
Lack of integrity between similar industries in the form of clusters in mutually beneficial cooperation, especially between BUMN and the private sector in the procurement of new vessels and platforms	7.17	0.07	3.50	0.22
Still dependent on foreign technology	7.50	0.07	3.50	0.23
Technology transfer is still at 50% scale	6.83	0.06	3.50	0.21
The demands of the development of shipping technology are growing rapidly	7.50	0.07	3.50	0.23
Number of Threats	**50.83**	**0.44**	**23.33**	**1.45**
Total	**116.50**	**1.00**	**50.00**	**3.12**

Based on table 4.11 the EFAS matrix above, it shows that the rating weighting of the external strategy factor for the development of Fasaharkan Jakarta, where the weighting is done with the aim of knowing how much the factors that influence or have an impact on the strategy factor itself. The weighting of the strategic factors in the table is obtained from the total opportunity score of 1.67 and the total threat score of 1.45 so that the overall total of external factors is 3.12. The purpose of this rating is to provide a scale from 4 to 1 based on these factors for the development of fasharkan Jakarta.

From the results of processing the IFE and EFE tables then determining the strategic quadrant position by entering into the weight score table by placing the Strength (S) and Weakness (W) values in the Internal column and the difference in values between (S) and W as the X axis. Opportunity (O) and Treats (T) are placed on the external column and the difference between O and T is the value on the Y axis. In Table 5 we can find that the X-axis value is -0.21 and the Y-axis value is 0.22.

Table 5. Quadrant Processing

Internal (X)	**Score**	**External (Y)**	**Score**
Strength *Weaksness*	1.47 1.66	*Opportunity* *Treats*	**1.67** **1.45**
Score difference	**-0.21**		**0.22**

From the difference in value in table 5 then we enter it in the strategy quadrant to determine the chosen strategy, so that we can analyze what strategy is right to use in problem solving.

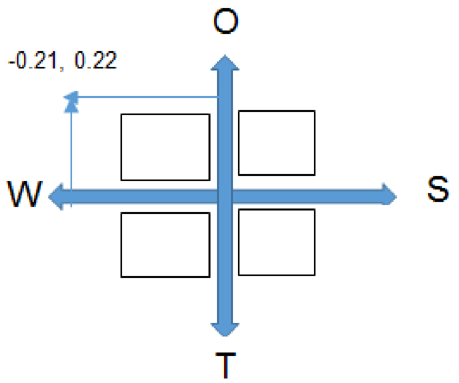


Figure 5. Quadrant strategy

Seeing from the figure, that the position of the strategy lies in the WO quadrant, this shows that the WO strategy is used to solve problems, namely by maximizing the opportunities that exist to overcome weaknesses in the organization. The WO sub-strategies include:

a. Upgrade equipment according to the latest technological advances. Currently technology has developed very rapidly along with the sophistication of today's technology. The need for technology has a huge impact on human life in various activities. Increasing the quality of life increasingly requires humans to carry out various activities needed by optimizing the resources they have.

b. increase the Slipway capability up to 700 tonnes. The existing slipway facility currently has a capacity of 700 tonnes but is in severely damaged condition.

c. Build graving docks up to 5000 DWT capability. The construction of a graving dock with a capacity of up to 5000 DWT is expected to be repaired for all ships in the Indonesian Navy.

d. Procurement of aluminum welding equipment to support the aluminum appliance procurement policy.

e. Carry out the fulfillment of human resources in accordance with the DSP and qualifications.

f. Improve human resources capabilities by carrying out training and science and technology education.

g. Cooperating with domestic shipyards in the construction and repair of KRI.

h. Carry out technology transfer in accordance with the policies of the shipping industry and marine technology.

i. The development of Fasharkan is in line with the shipping industry development policy

4. CONCLUSION

In the formulation of the development strategy of Fasharkan Jakarta, based on the SWOT analysis, 4 (four) alternative strategies were obtained, namely the SO strategy, the ST strategy, the WO strategy, the WT strategy. SO strategy consists of 6 (six) strategy steps. ST strategy consists of 6 (six) strategy steps. The WO strategy consists of 9 (nine) sub strategies and the WT strategy consists of 4 (four) strategic steps. From the 4 (four) strategies then weighting is carried out to get the main strategy selected using the EFAS and IFAS matrices. Based on the research results, it is known that the strategy chosen was a WO strategy consisting of 9 (nine) sub strategies to be the first alternative in the development strategy of Fasharkan Jakarta. From the results of the IFAS EFAS matrix on the SWOT analysis of the WO strategy which consists of 9 (nine) sub-strategies in the development of Fasharkan Jakarta.

The results of this study show that the classification of elements in the WO strategy is obtained 5 (five) levels of hierarchical structure. In this hierarchical structure, it can be seen that the sub-strategy (WO5) is at level V. Then the sub-strategies (WO1) and (WO4) are at level IV. At level III it consists of 4 (four) sub strategies, namely (WO2); (WO6); (WO7); (WO8). At level II, namely the sub strategy (WO3). At level I sub strategy (WO9).

ACKNOWLEDGMENT

This research has been Supported by Indonesia Naval Technology College (STTAL), Indonesian Navy and Ministry of Defense of the Repulic Indonesia.

REFERENCES

Ahmadi. (2017). Applied of Impressed Current Cathodic Protection Design for Fuel Pipeline. Iranian Journal of Materials Science and Engineering, 41-52.

Asmoro, R. D. (2018). Submarine Operations Degree Strategy in Support of Three Fleet Commandos to Strengthen the Archipelago's Maritime Defense Strategy. surabaya: Naval Technology College (Thesis).

Bandono, A. (2017). The Use of Value Clarification Technique-Based- Picture Story Media As An Alternative Media To Value Education In Primary School. Journal of Arts Research and Education 17 (1), 68-67.

Darmawan, D. P. (2017). Structured Decision Making with Interpretative Structural Modeling. Yogyakarta: Publisher Elmatera.

Firoz, N., & Rajesh, R. (2012). Relationship among Supplier Selection Criteria using Interpretative Structural Modeling for Manufacturing Organization in Kerala. International Journal of Engineering Science Invention, 3 (8), 60-70.

Hunger, J. D., & Wheelen, T. L. (2010). Essentials Of Strategic Management 5th edition. United States of America: Prentice Hall.

Hussain, M. (2011). Modeling the Enablers and Alternatives for Sustainable Supply Chain Management. Montreal: Concordia University.

I Made Jiwa Astika1, K. G. (2018). Measurement of Indonesian Naval Base Development in a Border Area: A Case Study. International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 3, 1560-1566.

Istiqomah, A. (2017). Human Resources development strategies as an effort to improve the performance of village officials using a SWOT analysis. Journal of the State University of Malang, 1-9.

J. David Hunger, T. L. (2003). Strategic Management. Yogyakarta: ANDI.

Kasal. (2013). Regulation of the Chief of Naval Staff Number KEP / 1771 / XII / 2013 concerning Technical Manual for Standardization of Indonesian Navy Bases. Jakarta: Headquarters.

Kasal, K. (2018). Head of Kasal Number Kep / 1111 / V / 2018 concerning the Doctrine of the Indonesian Navy Jalesveva Jayamahe. Jakarta: Headquarters.

Kertajaya, H. (2005). Markplus on Strategy 12 years of Markplus & Go's journey to build a marketing strategy. Jakarta: PT Gramedia Pustaka Utama.

Khoiroh, S. M. (2016). Formulation of a Policy Strategy Roadmap for Strengthening the Regional Innovation System (SIDa) in the Maritime Industry Sector for Small-scale Ship IKM in Lamongan. Surabaya: Faculty of Industrial Technology, Sepuluh Nopember Institute of Technology.

Lumaksono, H. (2014). Implementation Of SWOT-FAHP Method To Determine The Best Strategy On Development Of Traditional Shipyard In Sumenep. Academic Research International Vol. 5 (5) September 2014, 56-67.

Nurcahya Dwi Asmoro, B. S. (2018). Formulation of Maritime Industry Mastery Strategies to Strengthen National Defense. Journal of Industrial Systems Optimization, 162-170.

Oreski1, D. (2012). Strategy Development by Using SWOT - AHP. TEM Journal, 283-291.

Panackal, N., & Singh, A. (2016). Using Interpretative Structural Modeling to Determine the Relation between Youth and Sustainable Rural Development. Journal of Management and Research, 4 (1), 58-64.

Presidential Decree No. 16. (2017). Indonesia is the World Maritime Axis. Jakarta: Coordinating Ministry for Maritime Affairs.

Puskom. (2015). 2015-2035 National Industrial Development Master Plan. Jakarta: Ministry of Industry.

Operation. Journal of Defense Management, 1-8.

Rangkuti, F. (2018). SWOT analysis. Jakarta: PT Gramedia Pustaka Utama.

Rizal, O. (2015). Strategic feasibility of relocating the TNI AL base in supporting the main tasks of elemental operations. Surabaya: STTAL Thesis.

Singh2, N. P. (2015). Using Interpretive Structural Modeling to Determine the Relation between Youth and. IBMRD's Journal of Management and Research, 58-74.

Suastika, W. A. (2017). Analisys Development Of Green Ship-Recycling yard. National Oceanic Journal, 33-34.
Suharjo, B. (2013). Applied statistics Dissertation example Application with SPSS. Yogyakarta: Graha Science.
Suharyo, O. S. (2017). Establishing the location of naval base using fuzzy MCDM and covering technique methods: A case study. International Journal of Operations and Quantitative Management IJOQM Vol 23 Issue 1,

THE INFLUENCE OF ORGANIZATIONAL COMMUNICATION AND LEADERSHIP FACTORS ON THE PERFORMANCE OF EMPLOYEE

Heru Kreshna Reza[1], Sukmo Hadi Nugroho[2]

[1,2] *Esa Unggul University Jakarta Indonesia*

ABSTRACT

This research background of the company's efforts to improve the performance of employees is a goal to be achieved by the company. Performance is highly dependent on the awareness of each employee. To improve the performance of employees of the company must to maintain the existence of human resources one of the efforts made is to improve employee performance by creating leadership and good communication with employees.The purpose of this study are: 1) To determine the influence of leadership on employee performance 2) To determine the effect of organizational communication on employee performance and 3) To determine the influence of leadership and organizational communication together on employee performance. The population in this study were all employees of a Government Organization, amounting to 35 people. Data analysis technique used in this research is descriptive statistical analysis with multiple regression analysis methodBased on the results of research and discussion that has been done then it can be concluded as follows: 1) Leadership significant effect on employee performance of a Government Organization 2) Organizational communication significant effect on employee performance a Government Organization 3) Leadership and organizational communication significant jointly to the performance of employees of Government Organization

Keywords : *Leadership, Communication and Employee Performance.*

1. INTRODUCTION

Leadership is the process of influencing or setting an example by leaders to their subordinates in an effort to achieve organizational goals (Handoko, 2011). According to achieving maximum performance, the company must be able to create conditions that can encourage and enable employees to develop and improve their abilities and skills optimally. According to Slamet (2007) leadership is a person's strength, enthusiasm, abilities that can influence other people who follow the results of their thoughts or do what is expected as determined. Leaders need to be involved in two-way communication, so that it has a good impact on channeling employee aspirations, providing support and encouragement to employees, making it easier for employees to interact and involving employees in decision making.

An effective leader is a leader who successfully directs and mobilizes a person and group to carry out all planned activities in an effort to achieve predetermined goals (Griffin, 2004). Leaders who pay less attention to subordinates even tend to be more autocratic, namely directing and supervising employees closely to ensure that tasks are carried out as desired and leaders pay more attention to the implementation of work than the development of employees so this will cause dissatisfaction with employees who have the desire to develop (Kartini, 2002). This situation will cause a decrease in performance which results in not achieving targets that have been planned before (Robbins, 2006). If this situation is not taken immediately, then the goal of the agency to improve employee performance and agency performance cannot be achieved, and it will hinder the survival of the agency in the future (Kartini, 2002).

Besides that, besides leadership, the performance of an employee is greatly influenced by communication. Communication is the process of sending messages or information in the form of ideas, facts, thoughts, feelings between two or more individuals effectively so that they can be understood easily (Handoko, 2011). Communication in this case involves all individuals in companies and communities who respond and create good relationships in adapting to each other's environment. Good communication competence between superiors and employees and between one employee and another will be able to make the tasks they carry out well, so that the company's performance will be better and vice versa.

Organizational communication within a company has a very important role in achieving company goals, because with communication individuals can interact with other individuals so that they will understand what to do with the tasks they carry. Without communication within the company, these individuals cannot know what to do for their company. In addition, communication within a company can also increase productivity, resolve conflicts, develop employee quality and can form professional relationships and a conducive environment (Handoko, 2011). According to Mangkunegara (2000) communication is the process of transferring information, ideas, understanding from one person to another, it can interpret according to the intended purpose.

According to Supardi and Anwar (2002) communication is an attempt to encourage others to interpret what kind of opinion is desired by those who have that opinion. Communication is expected to be obtained at a common point, mutual understanding. Communication contains a broader meaning than just saying or writing something, it also includes an understanding.

A leader cannot solve his problems alone, but guides those he leads to solve problems together, therefore good communication between superiors and employees is needed. If communication within the company has been successfully implemented and a leader can understand what employees need, then employees will also do their best and try their best to work and maximize their duties as best as possible with full responsibility which will ultimately make the performance of employees increase and can provide benefits to the company.

The research was conducted at the office of a government organization whose name is anonymous for the purposes of this study. This company is a networked online media company no. 1 in East Java, presents East Java news info that builds, inspires, and has positive thinking based on positive journalism. The most common online media applied in journalistic practice is in the form of news sites. The news site or information portal as the name implies is an information gateway that allows accessers to obtain various features of online technology facilities and news in it.

Events or events that occur in the field can be directly uploaded to the online media website, without having to wait for minutes, hours or days, as happens in electronic media or printed media. Thus accelerating the distribution of information to the market (accessors), with global reach via the internet network, and at the same time. And generally the information available is contained in the form of data and facts not stories. Information is conveyed continuously, because of the updating of information. This realtime presentation causes no prime time because the provision of information takes place without interruption, only depending on when the user wants to access it.

Readers or users are increasingly autonomous in determining which information they need. Online media provides an opportunity for every reader to only take information that is relevant to himself, and delete information that he does not need. So the selectivity of information and sensors is in the hands of the user (self control). Leadership is the most vital factor in implementing the work of a company, including PT Jatim Times Network. Leaders improve the quality of performance of employees of PT Jatim Times Network by communicating well with their employees.

The leadership of company organization in carrying out their duties applies oral and written forms of communication. The communication system used is downward communication, upward communication, and horizontal communication. Downward communication starts from top management and flows down through the managerial level to the lowest employees with a view to giving direction, information, instructions, suggestions, advice, and assessments to subordinates about the goals and company policies. The upper level of communication functions to provide information to upper management levels about what is happening at lower levels. This form of communication is in the form of reports, explanation of ideas, and requests for decision making. Communication includes the flow of information to different people at the same hierarchical level of authority (horizontal) and the diagonal flow of information between employees at different levels and does not have direct authority on other parties. The exchange of information between employees within the company is very helpful in efforts to establish and maintain or bind an organization into a unified whole and also serves as the main tool to coordinate and unite all parts of the company structure.

2. MATERIAL AND METHOD

2.1 Leadership

Edwin Giselli (in Handoko, 2001) defines leadership as the ability a person has to influence others to work to achieve goals and objectives. Leadership is the art of a leader influencing the behavior of subordinates, so that they are willing to work together and work productively to achieve organizational goals (Hasibuan, 2001). Another definition of leadership is a person's ability to influence others (Siagian, 2002).

Leadership indicators according to Wahjosumidjo (1991) include:

a. Be fair

In the activities of an organization, a sense of togetherness among members is absolute, because a sense of togetherness is essentially a reflection of the agreement between subordinates and between leaders and subordinates in achieving organizational goals.

b. Give suggestions

Suggestions are usually referred to as suggestions or suggestions. In the framework of leadership, suggestions are influences and so on, which are able to move the hearts of others and suggestions have a very important role in maintaining and fostering self-esteem and a sense of devotion, participation, and a sense of togetherness among subordinates.

c. Supporting goals

The achievement of organizational goals is not automatically formed, but must be supported by leadership. Therefore, in order for each organization to be effective in the sense of being able to achieve the goals that have been set, then every goal to be achieved needs to be adapted to the circumstances of the organization and to allow subordinates to work together.

d. Catalyst

A leader is said to play a role as a catalyst, if the leader can always improve all existing human resources, trying to give reactions that generate enthusiasm and as fast as possible work power.

e. Creating a sense of security

Every leader is obliged to create a sense of security for his subordinates. And this can only be done if each leader is able to maintain positive things, an attitude of optimism in facing all problems, so that in carrying out their duties, subordinates feel safe, free from all feelings of anxiety, worry, feel that they have guaranteed security from the leadership.

f. As an organization representative

Every subordinate who works in any organizational unit always views his superior or leader as having a role in all areas of activity, especially those who adhere to exemplary principles or role models. A leader is everything, therefore all his behavior, actions, and words will always give certain impressions to the organization.

g. A source of inspiration

A leader is essentially a source of enthusiasm for his subordinates. Therefore, every leader must always be able to arouse the enthusiasm of his subordinates so that the subordinates accept and understand the organizational goals enthusiastically and work effectively towards achieving organizational goals.

h. Be respectful

Basically, everyone wants recognition and self-respect in others. Likewise, every subordinate in the organization requires recognition and appreciation from superiors. By therefore, it becomes an obligation for leaders to be willing to give awards or recognition in any form to their subordinates.

2.2 Communication

Communication is the process of sending messages or information in the form of ideas, facts, thoughts, feelings between two or more individuals effectively so that they can be understood easily. According to Eugene (2001), communication is a process in organizational settings to keep management and employees informed about various relevant matters. Meanwhile, according to Haryani (2010) communication is a process where a person (communicator) sends stimuli (usually with verbal symbols) to change the behavior of others (communicants).

According to Mangkunegara (2000) communication is the process of transferring information, ideas, understanding from one person to another, it can interpret it according to the intended purpose. From this understanding, it can be concluded that communication is a process of delivering messages by one person to another through certain media which produces information.

The communication channel in the organization is the process of delivering messages between members of the organization that occurs for the benefit of the organization, such as communication between superiors and subordinates and among subordinates. The types of communication channels can be divided into four, namely:

a. Downward Communication

Downward communication within an organization means that it flows from a higher authority to a lower one. The most common forms are instructions, official memos, statements about company policies, procedures, work guidelines and company announcements.

b. Upward Communication

The need for downward communication is as much as the amount of upward communication. Commonly used upward communication tools include suggestion boxes, group meetings, reports to supervisors, and a request or complaint procedure. This form of communication is usually choppy and filtered. Every level of leadership is reluctant passing the problem upwards because it can be viewed as an admission of failure. Employees usually tend to only tell their boss about the things they think their boss wants to hear. Thus, each subordinate has reasons for selecting, interpreting and various other information filtering actions.

c. Horizontal Communication

The availability of horizontal communication flows is often overlooked in an organizational design. Horizontal communication is essential for the coordination and integration of a wide variety of organizational functions. Communication from peers is often necessary for coordination and can also provide satisfaction with social needs.

2.3 Employee performance

Performance is a condition of a group in which there are clear and fixed goals that are felt to be important and integrated with individual goals (Panggabean, 2004). According to Nitisemito (2003), performance is doing work more actively, so that work will be expected to be faster and better. There are three indicators for measuring individual employee performance, namely:

a. Quality

Work quality is measured by employees' perceptions of the quality of work produced and the perfection of tasks on employee skills and abilities.

b. Quantity

Quantity is the amount produced expressed in terms such as the number of units, the number of activity cycles completed.

c. Timeliness

Timeliness is the level of activity completed at the beginning of the stated time, seen from the point of coordination with output results and maximizing the time available for other activities.

d. Hypothesis

H1: It is suspected that leadership (X1) has a significant effect on employee performance (Y).

H2: It is suspected that organizational communication (X2) has a significant effect on employee performance (Y).

H3: Presumably leadership (X1) and organizational communication (X2) together has a significant effect on employee performance (Y).

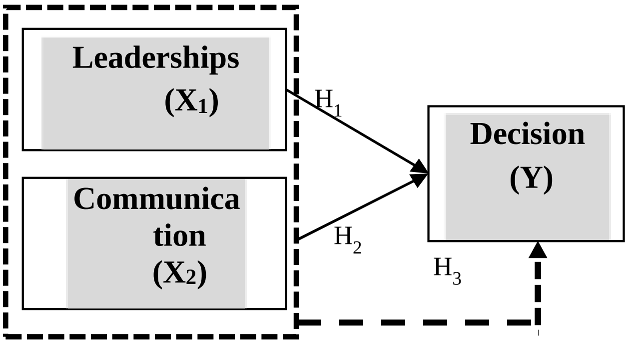


Figure 1. Model of Hypothesis

2.4 Research Methods

This research is an explanatory study (expanatory record) with a quantitative approach. The research was conducted at PT xyz . The population in this study were all employees of PT xyz, amounting to 35 people, and in this study the leader was not given a questionnaire, if the number of subjects to be studied was less than 100, then the study could use the population. So, population research is where the entire sample population is used as a type of research without sampling.

3. RESULTS AND DISCUSSION

Table 1. Results of Multiple Linear Regression Analysis

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	13.751	2.517		5.463	.000		
	Kepemimpinan	.249	.043	.678	5.728	.000	.970	1.044
	Komunikasi	.163	.083	.232	3.963	.003	.990	1.034

a. Dependent Variable: Kinerja Karyawan

Table 2. Coefficient of Determination

Coefficient value determination (R^2)	R	R adjusted
0,687	0,829	0,668

Source: Primer data processed, 2018

Table 3. F test results

Alternative Hypotesis (H_a)	Ftabel	Information
There is a significant effect simultaneously from the variables community leadership organization on employee performance (Y)	Fhitung = 35,194 Ftabel = 2,479 Sig. F = 0,000	H_a accepted/ H_o rejected

Source: Primer data processed, 2020

Table 4. Normality test Results

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		35
Normal Parameters[a,b]	Mean	,0000000
	Std. Deviation	1,09267712
Most Extreme Differences	Absolute	,126
	Positive	,085
	Negative	-,126
Kolmogorov-Smirnov Z		,745
Asymp. Sig. (2-tailed)		,636

Source Primer data processed, 2020

3.1 The Influence of Leadership on Employee Performance

Based on the results of the analysis, it can be seen that there is an influence between leadership on employee performance. These results indicate that the better the leadership is applied, the employee's performance will increase. The relationship between leadership and employee performance, the most important function of leadership is providing motivation to subordinates, leadership is believed to have an influence on the company in a non-financial form. Leaders motivate followers to do something (performance) beyond expectations (beyond employees, the higher the company performance. The results of this study support previous research conducted by Wahyuni (2009) which found that there is a significant influence between leadership on employee performance.

3.2 The Effect of Organizational Communication on Employee Performance

Based on the results of the analysis, it can be seen that there is an influence between leadership on employee performance. These results indicate that with better organizational communication within the company, employee performance will increase. Supardi (2002) defines organizational communication as an effort to encourage others to interpret opinions as desired by those who have these opinions. With organizational communication it is hoped that a common point is obtained, mutual understanding. Organizational communication contains a broader meaning than just saying or writing something, it also includes an understanding. Basically, organizations or companies also carry out organizational communication, even business organization communication is more complex than individual organizational communication.

Organizational communication that occurs within the company is hereinafter referred to as business organization communication. Mardianto (2005) in his research entitled "The Influence of Subordinate Superiors' Organizational Communication and Motivation on Performance" reveals that there is a positive and significant influence between organizational communication variables in performance. Wahyuni (2009) in his research entitled "The Influence of Organizational Communication normal expectation) through the transformation of their thoughts and attitudes to achieve performance beyond these expectations, leaders exhibit the following behaviors: the influence of idealism, insporational motivation, intellectual stimulation and individual consideration. An important determinant of individual performance is motivation. But motivation is not the only determinant, other variables: like the effort given, the ability of past experiences also influence performance. With motivation, there will be a willingness to work and with a willingness to work and with cooperation, then performance will increase. Employee performance is a measure of company performance, the higher the performance of the Organization on the Performance of the Employee Division.

Accounting with Organizational Commitment and Work Pressure as Intervening Variables reveals that organizational communication has a direct effect on performance. Communication patterns in the work environment will make employee performance optimally increase. And good employee performance will also be achieved if good communication patterns downward communication patterns, upward communication patterns and horizontal communication patterns that occur are also good. Good communication patterns, both downward communication patterns, upward communication patterns and horizontal communication patterns between employees and superiors are well-established and smooth. The existence of this good communication pattern can make it easier

In delivering information from superiors to employees and vice versa from employees to superiors or from employees to employees. It will be easier for the recipient of the information to understand. so that it will make it easy to complete the job with a good final result which in the end will be able to improve the employee's performance. Another case with poor communication patterns in the workplace environment, it is likely that the information conveyed becomes difficult to understand or accept.

3.4 The Influence of Leadership and Organizational Communication on Employee Performance

The results of the analysis show that simultaneously there is a significant influence between leadership and organizational communication on employee performance. The results of the analysis can be interpreted that with the better the leadership and organizational communication, the employee's performance will increase. The results of this study support previous research conducted by Taufiq Ainur Rizqi (2015) which showed that there is an influence between leadership and organizational communication on employee performance.

4. CONCLUSIONS AND SUGGESTIONS

4.1 Conclusion

From the discussion above, we can make some conclusions as below:

a. Leadership has a significant effect on employee performance of company organization.

b. Organizational communication has a significant effect on the performance of employees of PT Jatim Times Network Malang.

c. Leadership and organizational communication have a significant effect together on the employee performance of PT Jatim Times Network Malang.

4.2. Suggestion

From the conclusions above, we can make some suggestions as below:

a. In an effort to improve employee performance, the leadership must strive to respect subordinates so that employees feel that their presence in the company is valued by the company so that they have the motivation to work optimally in the company.

b. Leaders must have a proportional attitude in dealing with any problems faced by employees so that a sense of justice in their work can be created in the company.

c. Leaders must provide broad opportunities for subordinates to ask questions when employees have difficulties so that the maximum work completion process is carried out by employees.

d. Companies must endeavor to provide support so that employee involvement in decision making can be carried out, this effort is made so that the decisions made are joint decisions and no party feels disadvantaged.

e. The company must solve every problem in the work in accordance with the quality standards of the company so that the work results of the employees produced are in accordance with the quality standards set by the company.

ACKNOWLEDGEMENT

The authors greatly acknowledge the support from Esa Unggul University Jakarta Indonesia for providing the necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

REFERENCES

Eugene,F. Brigham. 2001. *Manajemen Keuangan.* Jakarta: Erlangga.

Handoko, T.H. 2001. *Manajemen Personalia dan Sumber Daya Manusia.* Yogyakarta: BPFE.

Haryani. 2010. *Analisis Pengaruh Komunikasi, Motivasi, dan Kepemimpinan Terhadap Kepuasan Kerja Dalam Meningkatkan Kinerja Karyawan PT Arisa Mandiri Pratama. Jurnal Manajemen dan Kewirausahaan,* 13(1): h:40-45.

Kartini, Kartono. 2002. *Manajemen Sumber Daya Manusia.* Jakarta: Bumi Aksara.

Mangkunegara, A.P. 2000. *Manajemen Sumber Daya Manusia Perusahaan.* Bandung: PT. Remaja Rosdakarya.

Mardianto, Anang, 2005, Thesis: *Analisis Pengaruh Komunikasi Atasan Bawahan Dan Motivasi Kerja Terhadap Kinerja di PT. Bank Pembangunan Daerah Jawa Tengah Cabang Surakarta,* Program Pascasarjana Universitas Muhammadiyah Surakarta.

Panggabean, S, Mutiara. 2004. *Manajemen Sumber Daya Manusia.* Bogor: Ghalia Indonesia.

Supardi, dan Syaiful Anwar. 2002. *Dasar-dasar Perilaku Organisasi.* Yogyakarta: UII Press.

Wahjosumidjo. 1991. *Kepemimpinan yang Efektif.* Yogyakarta: Balai Pustaka

Wahyuni, Lily, 2009, Thesis: *Pengaruh Komunikasi Organisasi Terhadap Kinerja Karyawan Bagian Akuntansi Dengan Komitmen Organisasi Dan Tekanan Pekerjaan Sebagai Variabel Intervening (Studi Empiris pada Perusahaan BUMN di Provinsi Sumatera Barat).* Program Pascasarjana Universitas Diponegoro.

IMPACT DESIGN ANALYSIS AND THE EFFECT OF PANDEMIC COVID-19 ON PERSONNEL READINESS IN MAINTAINING FORCE COMBAT ABILITIES

Harun Bekti Ariyoko[1], Sukarno[2], Abdul Rahman[3]

[1] *Indonesian 1st Fleet Command, Jakarta*
[2,3]*Indonesian Naval Technology College, Bumimoro-Morokrembangan*

ABSTRACT

Personnel are one of the factors that shape operational readiness, in addition to platform and sewaco readiness. The outbreak of the Coronavirus Disease 2019 (COVID-19) virus, coupled with an increase in the number of cases that took place quite rapidly, and spread in a short time, has undeniably had a major impact, including on the military. In this study, the authors attempted to approach an impact analysis through a dynamic systems approach, to provide information that occurred as a result of the COVID-19 pandemic, through a pandemic impact analysis model. The results obtained are that combat capability does not automatically decrease due to the COVID-19 pandemic, because there are 4 factors that influence the value of combat capability. However, if personnel are negligent and indifferent to implementing the COVID-19 response protocol, coupled with the lack of a health support role and control function in personnel discipline in encouraging the handling and prevention of the COVID-19 pandemic, over time the value of combat capability will degrade. considering that the future conditions of war are increasingly unidentifiable or predictable due to uncertainty. Personnel readiness does not become the main reason for decreasing military combat capability, because personnel readiness is one of the four shaping factors in assessing combat capability.

Keywords: *COVID-19, Impact Analysis, Combat Capability, Personnel Readiness, System Dynamics.*

1. INTRODUCTION.

In early 2020, the world was shocked by the outbreak of the Coronavirus Disease 2019 (COVID-19), accompanied by an increase in the number of COVID-19 cases which took place quite rapidly, and spread to various countries in a short time. (WHO, 2020) It is undeniable that the COVID-19 pandemic that has hit the world has had a big impact, it is almost certain that no one thinks the world reality will change completely, whether in political, social, economic, cultural or defense and security aspects (Heisbourg, 2020) (Welsh, 2020) (Ramos & Hynes, 2020) (Thompson, et al., 2006). Facing the uncertainty that the COVID-19 Pandemic can cause, one of which can have an impact on the health and military defense aspects (Ramos & Hynes, 2020) (Mölling, et al., 2020). On 18 August 2020, 21 sailors aboard INS Angre, Indian Navy headquartered in Mumbai tested positive, most of them asymptomatic(Som & Varma, 2020). On 24 March 2020, the first cases occurred at the United States Naval Base in the Gulf. Guantanamo which has been confirmed (Kheel, 2020), and on the ship USS Theodore Roosevelt the COVID-19 pandemic has spread to a number of other naval vessels (Sinha, 2020), where the conditions and situations inside the ship are closed, small areas and lack of personal space for most of the crew, thus contributing to the spread. The disease is even more rapid and more prevalent than on cruise ships. So, in anticipating the impact that will be more severe and protracted, the Navy must and must help the government to immediately provide a positive curve for handling these impacts.

It is hoped that the readiness of the Indonesian Navy will not be disrupted due to the spread of COVID-19. Universally, the main function of the army is to fight or be the main executor (main component) in war, although there is still a limited amount of the defense budget, there is no defense forecasting and proper management regarding the allocation of existing national resources to the defense sector. The military force must always be in a state of readiness if it is needed at any time, especially the Indonesian Navy. With the possibility of the COVID-19 pandemic and environmental warfare (environtmental warfare) is part of a future war (Shatz & Chandler, 2020) or a sixth generation war. So, in addition to carrying out the role of the OMSP in overcoming the COVID-19 pandemic, the Indonesian Navy must not neglect the role of the OMP by maintaining its combat capability in facing factual and potential threats to guard and protect the waters which are the territorial sovereignty of the Republic of Indonesia. Where the impact that the COVID-19 pandemic could have on combat capability could be enormous and very difficult to predict due to uncertainty.

To anticipate the increasing increase in COVID-19 cases against these personnel, an analysis model is needed in analyzing the impact of COVID-19 on ship personnel readiness, so that strategic steps and concrete efforts can be determined in maintaining combat capability. Looking at the projection of future uncertainty conditions is very important in this study, where the development of the conceptual system dynamic model under study can be used to predict the severity of a pandemic, when the pandemic peaks, and what might be done to avoid the worst case scenario, although not all models are suitable. to inform and provide policy options, however, we can anticipate with a variety of policy scenario options suggested to further determine strategic steps in inhibiting the growth rate and spread of COVID-19, in maintaining the readiness of ship personnel to maintain combat capability. The dynamic systems approach is optimal for seeing future conditions from the simulation results and selected scenarios, which research conducted from modeling of COVID-19 cases has been carried out with a variety of models ranging (Arino & Portet, 2020). The ease of seeing the relationship between variables is reflected in the causality that is formed, as well as the behavior that will occur through scenario implementation. The benefits of this research are expected to provide an overview in identifying, formulating, and prioritizing strategic steps in maintaining the operational readiness of ships, even though the COVID-19 pandemic has yet to predict its final time, so that it can provide input to policy makers in the deployment of future military forces in particular. ship, so as not to cause greater losses.

2. MATERIALS.

2.1. Coronavirus-19.

Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). SARS-CoV-2 is a new type of coronavirus that has never been previously identified in humans. Based on data, the COVID-19 outbreak was first detected in Wuhan City, Hubei Province, China in December 2019, and was subsequently designated as a pandemic by the World Health Organization on March 11, 2020 (WHO, 2020). As of the end of March 2020, more than 5,700 .000 cases of COVID-19 have been reported in more than 210 countries and territories, resulting in more than 352,000 deaths. There are at least two types of coronavirus that are known to cause diseases that can cause severe symptoms such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). The general signs and symptoms of COVID-19 infection include acute respiratory symptoms such as fever, cough and shortness of breath. The average incubation period is 5-6 days with the longest incubation period of 14 days. Severe cases of COVID-19 can cause pneumonia, acute respiratory syndrome, kidney failure and even death. The COVID-19 virus is thought to spread among people mainly through respiratory droplets produced during coughing, sneezing and normal breathing. In addition, the virus can spread by touching contaminated surfaces and then touching someone's face. An infected person can be infectious up to 48 hours before symptom onset (presymptomatic) and up to 14 days after symptom onset. A study by Du Z et. al, (2020) reported that 12.6% showed presymptomatic transmission. Common symptoms include fever, cough and shortness of breath, some are without symptoms. Complications can include pneumonia or other severe acute illnesses. Until now, no specific anti-viral treatment or vaccine has been found for this disease, and further research is needed on airborne transmission.

2.2. Operational Readiness

The operational readiness of the future navy is readiness in building operational readiness for naval defense through budget fulfillment, utilization of existing resources, procurement and naval modernization by paying attention to Life Cycle Cost, and interoperability while still paying attention to the paradigm shift in naval capability in the century 21 which will determine the adoption of today's technology *(FICCI and KOAN, 2018)*. The operational readiness of the ship is the readiness of the Platform and Sewaco which is closely related to the readiness of ship personnel in monitoring it *(Ariyoko, et al., 2019)*. In the Combat Force operational readiness planning is based on a four-step framework as shown in Figure 1, which in this framework supports general defense planning that is directed centrally, by carrying out more dynamic and routine interactions for force development *(Hales & Bowen, 2009)*.

Figure 1. Combat Force operational readiness planning *(Hales & Bowen, 2009)*

2.3. Combat Ability.

Combat Capability is the ability to achieve specified war objectives, for example winning a battle or war or destroying a target, which in broad terms cannot be easily quantified (Department of Defence, 2010). The United States Department of Defense specifies that a military combat capability consists of four components: Readiness, Endurance, Modernization and Strength Structure (Department of Defence, 2010). Where the power structure and doctrine represent two important characteristics, which determine the military capability of a country to be used by leaders. The power structure reflects decisions that are doctrinal in nature and assumptions about the implementation of duties and missions, which is a combination of the professionalism of soldiers, infrastructure (SSAT), organizational structure, and assumptions about operational effectiveness.

2.3.1. Readiness.

In the Congressional Research Service (CRS) identifies the definition of readiness as the ability of the components of the military forces to carry out state missions, and to be able to face the military forces of other countries by referring to the power structure and modernization, military size and sophistication and type of weaponry. (Rumbaugh, June 2017) Readiness is measured in terms of maintaining, equipping and training troops and is defined to include the ability of troops to mobilize, deploy and employ without unacceptable delay. So, readiness can be interpreted, having to prepare troops and defense equipment totally and at any time to meet global demands, but still have an optimal posture for the greatest possibilities that might occur, and require the ability to carry out various military operations. (Betts, 1995) So, planning can be arranged optimally, effectively, efficiently and measurably.

2.3.2. Sustainability.

The endurance of military power, or combat resistance, is influenced by the ability to shift troops to the combat operations area and the readiness of logistical support, where the size of the warship is related to the carrying capacity of the weapons, the increasingly complex sensor and weaponry systems, the range of weapons and the value of endurance. sailing when deployed far from its parent base or aju base. Endurance can also be interpreted as Sustainability, namely the permanent strength of military forces, or how long the troops can continue to fight. Sustainability involves the ability to resupply the troops involved during combat operations and is sometimes measured in terms of the approximate number of days of battle for which supplies are available.

2.3.3. Modernization

Modernization, namely the technical sophistication of troops, units, systems and weapons equipment. These can include new procurement and / or modifications. The modernization assessment can compare the equipment in the existing equipment inventory with the strength of potential enemies. it includes the technical capabilities of troops, combat units, weapon systems and equipment. Modernization is the "main step" in changing strategic planning through a dynamic and cyclical process in accordance with the threats faced.

2.3.4. Force Structure

The force structure is the number, size and composition of the units that make up a military force. The force structure is usually described as the number of divisions, battleship units or squadrons of aircraft. Based on the above components of military capability, it can be concluded that this is a consequence of a capability-based planning process that is upstream (upstream), but is still connected to the end (end).

3. RESULT AND DISCUSSION.

3.1. Model Formulation

After the system structure in the concept of the combat capability measurement model is made, then analyzing the impact of COVID-19 on personnel is clearly stated through the formulation of a conceptual model diagram that represents the system structure, then the relationship is converted into a flow diagram (stock flow diagram) in a computer assisted by Stella 9.1.3 software.

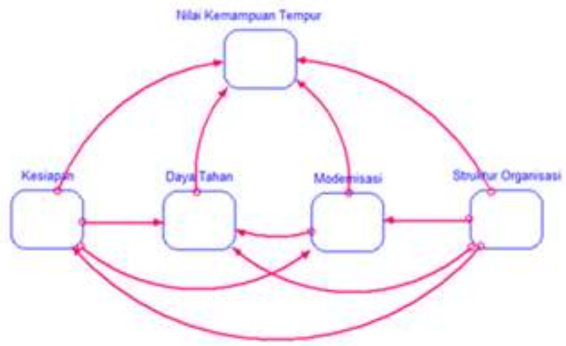


Figure 2. Combat Capability Measurement Model Concept

3.2. Causa Loop Construction and Stock Flow Diagram

Causal Loop Diagram (CLD) states a cause and effect relationship between a set of variables running in the system. The basic elements of CLD consist of variables (factors) and arrows (links). One of the advantages of the causal loop methodology is its ability to include qualitative variables in the thinking system approach in analyzing the impact of COVID-19 on personnel readiness. CLD is also very useful for explaining interdependence in various situations and is effective for the main variables that are most influential in the main system, including readiness, durability, modernization and organizational structure.

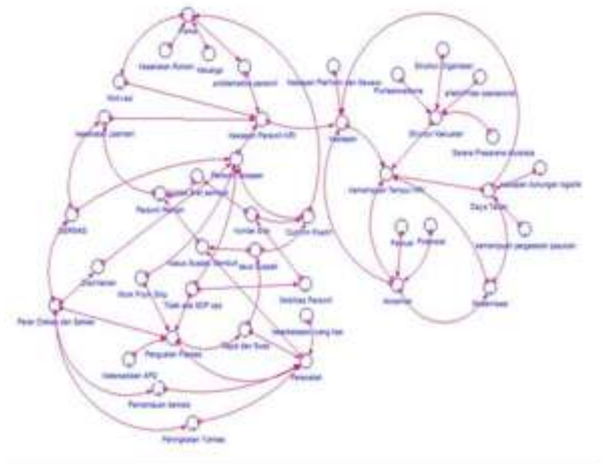


Figure 3. Causa Loop Concept of Combat Capability Measurement Model

3.3. Model Validation

Model validation was carried out in this study by performing internal validation, unit verification and boundary adequacy test (Boundary Adequancy Test). Internal validation is carried out with the aim of testing the model internally in the model, to find out whether the model can run or there are errors, and to compare the model structure and behavior with the actual system structure and behavior, so that in this case, it can be seen that the model is able to represent real system. Internal model validation is the verification stage in the model's internal algorithm, to check whether there are errors in the model and to ensure that the model functions according to the logic in the real system.

Unit and Equation Model verification is done by examining the model's equations and checking the unit (unit) variables of the model. If there are no errors in the model, it can be said that the model has been verified / valid internally. The program has run well, without errors in units or formulations (equations) with an OK indicator on the model, so the model can be said to be valid from the aspects of units and equations.

The Boundary Adequancy Test of the model must be in accordance with the objectives of the model being designed. The purpose of making models in this study is to see how much impact and system dynamics on aspects that affect the readiness of personnel. This limitation adequacy test is carried out in conjunction with the Model Structure Test which involves the opinions of experts, namely Officers who have carried out operational tasks during the COVID-19 pandemic and several experts from Health Workers and the COVID-19 Task Force in the operational area.

3.4. Sensitivity Analysis

Sensitivity analysis is needed to find and determine which variables have the most significant effect on modeling results. Based on the simulation on the concept of the COVID-19 impact analysis model that has been carried out, three key variables were obtained, namely the role of health workers, the availability of PPE and the absence of SOPs in supporting ship operations, to deal with the COVID-19 pandemic problem on ships.

3.5. Analysis Results from Modeling Simulation based on 3 Policy Scenarios.

In this study, there are 3 policy scenarios that will be simulated against the concept of the COVID-19 impact assessment model on the readiness of ship personnel to maintain combat capability, which consists of:

3.5.1. Policy Scenario Not Implemented

The following provides the meaning and simulation results of the influencing variables, namely:

a. Conditions for the role of health workers that are not optimal in implementing and supporting government policies.

b. Conditions for the availability of PPE that are not optimal and sustainable.

c. Conditions where there are no Standard Operations and Procedures in handling COVID-19 when the ship is carrying out its operational duties.

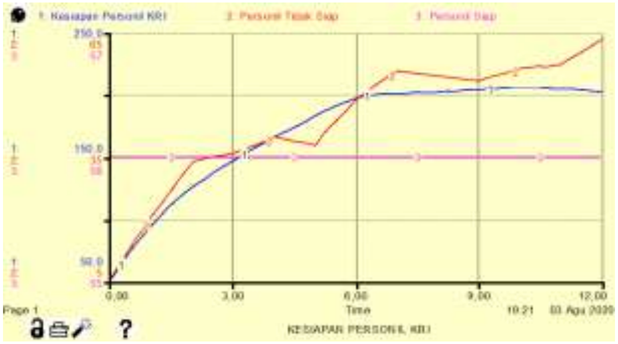


Figure 4. The graph of the impact analysis simulation results in the policy scenario is not applied to the readiness of ship personnel

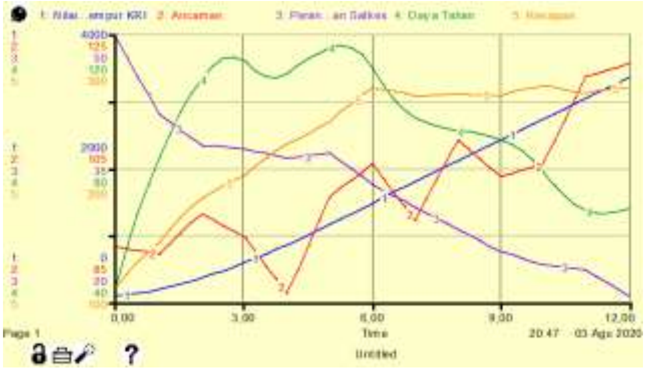


Figure 5. The graph of the impact analysis simulation results in the policy scenario is not applied to combat capability

The results of the impact analysis where the COVID-19 handling policy is not implemented will have an impact on the increase in unprepared personnel on board due to the impact of the pandemic which is in line with the curve of decreasing the readiness of ship personnel. however, the number of ready personnel remains stagnant and combat capability does not drop significantly, it will only remain at a level due to the impact of the unpreparedness of the personnel for the defense equipment crew. this is caused by other factors that affect the combat capability of the ship.

3.5.2. The policy scenario is moderate

The following provides the meaning and simulation results of the influencing variables, namely:

a. Condition of the Role of Health Workers who implement and support government policies in a moderate manner, meaning that they tend to slope.

b. Availability of PPE is sloping and sustainable, but tends to remain.

c. Standard Operating Conditions and Procedures in carrying out handling of COVID-19 when the ship is carrying out operational tasks, which have not been thoroughly discussed and reviewed.

Figure 6. The graph of the impact analysis simulation results in the policy scenario is applied moderately to the readiness of ship personnel

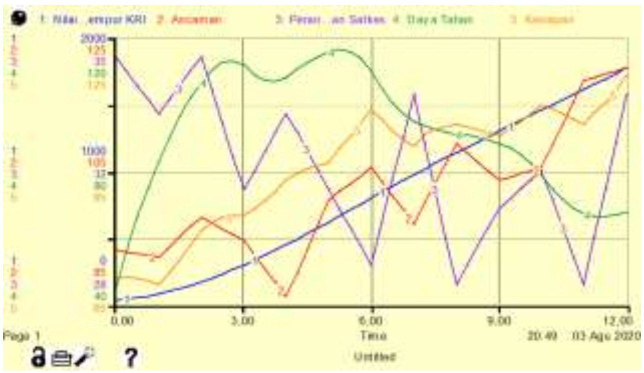


Figure 7. The graph of the simulation results analysis of the impact on the policy scenario with a moderate impact on combat capability

The results of the impact analysis, where the policy for handling COVID-19 is moderate, will have a dubious impact and uncertainty on the curve of the decline and increase on the readiness of ship personnel. Even so, the number of ready personnel is still stagnant and combat capability has not decreased significantly, it is just that the data input into decision making is doubtful.

3.5.3. Optimistic implemented policy scenario.

The following provides the meaning and simulation results of the influencing variables, namely:

a. Condition of the Role of Health Workers who implement and support government policies in an optimal and sustainable manner.

b. Availability of PPE that is supported optimally and sustainably.

c. Standard operating conditions and procedures for handling COVID-19 when the ship carries out its operational duties have been carefully reviewed and available.

Figure 8. The graph of the impact analysis simulation results in the policy scenario is applied optimistically on the readiness of ship personnel

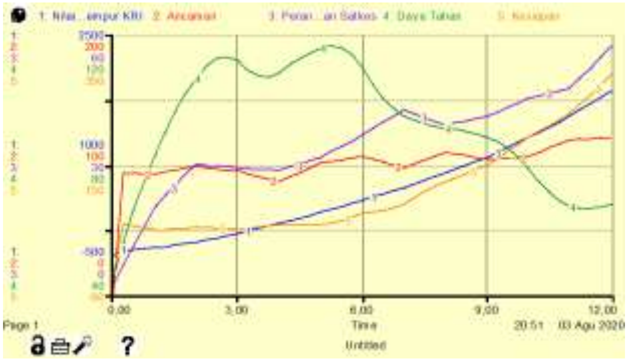


Figure 9. Graph of the simulation results analysis of the impact on the policy scenario optimistically on combat capability

The results of the impact analysis, where the COVID-19 handling policy is implemented optimistically, will have an impact on the decrease of unprepared personnel on board at a predictable time, even though the impact of the pandemic at the beginning of the incident occurred to this day. The readiness of personnel on board will gradually increase in line with the function of time (giving a positive curve) in support of the readiness of defense equipment manning. so that it can maintain the ship's combat capability in the face of future threats, this also encourages the preparedness of health personnel in providing health support to anticipate the presence of uncertain war threats, such as the current viral pandemic, against the Indonesian Navy in the future.

4. CONCLUSION.

The development of a model concept that has been built using a dynamic systems approach can be used as a tool to help analyze the impact of changes that can be caused by the COVID-19 pandemic on the readiness of ship personnel. With the requirements that the variables that make up the modeling system must be determined in advance, so that a clear impact assessment can be obtained which will be assessed and how the existing data is structured for modeling. The results of scenario simulations from the concept of the COVID-19 pandemic impact assessment model on personnel readiness, if policies are carried out optimistically by ship personnel and medical personnel in the face of the COVID-19 pandemic, it is highly recommended for decision makers. The recommended policy can be chosen, which is implemented optimistically and is not limited in time (when the pandemic is over, cannot be accurately predicted) in dealing with the COVID-19 pandemic so that it does not have a massive impact on ships. Strategic steps in inhibiting the rate of growth and spread, to maintain combat capability, are divided into several aspects, to make it easier to provide a decision support system.

ACKNOWLEDGEMENT

We would like to express our special appreciation and thanks to our advisor and lecturer. We want to thank you for encouraging my research and allowing me to grow as a schoolarship warrior. Your advice in both my research and my career has been invaluable.

REFERENCES

Arino, J. & Portet, S., 2020. A simple model for COVID-19. Infectious Disease Modelling, Volume 5, pp. 309-315.

Ariyoko, H., Putra, I. & Suharyo, O., 2019. Assessment Of Technology Competitiveness Abilities In Indonesian War Ship In Asia. International Journal of ASRO, 10(3), pp. 58-65.

Betts, R. K., 1995. Military Readiness: Concepts, Choices, Consequences. Washington: D.C : Brookings Institution Press.

Bowe, H., Hales, D. & Bowen, D., 2009. Draft Concept of Operations: Canadian Forces Readiness System. Canada: Defence R&D Canada Centre for Operational Research & Analysis.

Department of Defence, 2010. Defense Acquisition Guidebook. USA: Department of Defence.

FICCI and KOAN, 2018. Roadmap for a Future Ready Naval Force. India: FICCI and KOAN.

Hales & Bowen, D., 2009. Draft Concept of Operations: Canadian Forces Readiness System. , Canada: Defence R&D Canada Centre for Operational Research & Analysis.

Heisbourg, F., 2020. From Wuhan to the World: How the Pandemic Will Reshape Geopolitics. The International Institute for Strategic Studies, pp. 10-12.

Kheel, R., 2020. Navy sailor at Guantanamo tests positive for coronavirus. [Online] Available at: https://thehill.com/policy/defense/489211-navy-sailor-at-guantanamo-tests-positive-for-coronavirus, [Accessed, July 31 2020].

Mölling, D. C., Schütz, T. & Becker, S., 2020. Deterrence and Defense in Times of COVID-19. DGAP POLICY BRIEF, pp. 2-5.

Ramos, G. & Hynes, W., 2020. A systemic resilience approach to dealing with Covid-19 and future shocks. http://www.oecd.org/coronavirus/policy-responses/a-systemic-resilience-approach-to-dealing-with-covid-19-and-future-shocks-36a5bdfb/ , p. 2.

Rumbaugh, R., June 2017. Defining Readiness: Background and Issues for Congress , s.l.: Congressional Research Service.

Shatz, H. J. & Chandler, N., 2020. Global Economic Trends and the Future of Warfare, California: RAND Corporation.

Sinha, D., 2020. Impact of COVID-19 on military preparedness. [Online] Available at: https://www.orfonline.org/expert-speak/impact-of-covid-19-on-military-preparedness-64595/ [Accessed, July 30th 2020].

Som, V. & Varma, S., 2020. Coronavirus India: 26 Navy Sailors In Mumbai Test COVID-19 +ve, No Infections On Warships, Submarines. [Online] Available at: https://www.ndtv.com/india-news/15-to-20-indian-navy-sailors-in-mumbai-test-positive-for-coronavirus-quarantined-at-naval-hospital-2213852 [Accessed, July 30th 2020].

Thompson, Karen & Schofield, P., 2006. An Investigation of The Relationship Between Public Transport Performance and Destination Satisfaction. Journal of Transport Geography , Volume 15, pp. 136-144.

Welsh, C., 2020. Covid-19 and Food Security. [Online] Available at: https://www.csis.org/programs/global-food-security-program/covid-19-and-food-security [Accessed August, 20th 2020].

WHO, 2020. Coronavirus disease 2019 (COVID-19) , s.l.: WHO.

THE DEVELOPMENT OF INDONESIAN MARITIME POTENTIAL AND PROSPECTS TOWARDS A WORLD MARITIME AXIS

Anton Nugroho[1], Okol Sri Suharyo[2], Abdul Rahman[3]

[1,2,3]Indonesian Naval Technology Collage
Bumimoro-Morokrembangan, Surabaya 60178, Indonesia
e-mail: anton54nugroho@gmail.com

ABSTRACT

Indonesia is the largest archipelagic country in the world with a strategic position between two continents, namely the Asian Continent and the Australian Continent and also between two oceans, namely the Indian Ocean and the Pacific Ocean with more than 17,000 islands and an area that is generally approximately 70% complete. from the ocean. With its enormous potential, the success of creating a maritime sector with high economic value will have a positive impact on economic equality. It takes a lot of effort to be able to realize a reliable marine sector that has a major contribution to the national economy. Indonesia's position in the middle of the world of cross-band trade has made Indonesia have the ambition to become a maritime axis country. And one way is by preserving the enormous potential and natural marine resources that we have, all of which are only to prepare Indonesia to become a world maritime axis.

Keywords: *Strategic Position, Economic Equality, The World's Maritime Axis.*

1. INTRODUCTION

The development and development of the maritime sector is the current government's priority. This is because so far Indonesia's economic development has only focused and has been based on the development of the global economic sector. Even though we are aware that Indonesia has a sector that is more promising and has more potential to be developed. This sector is the marine sector (maritime).

Aware of this mistake, currently the marine potential is very serious in the maritime sector (marine), and Indonesia has begun to be explored and developed, one of the seriousnesses is realized by building potential for national economic interests. For and developing the maritime sector by making the current potential of the Indonesian sea has succeeded in the maritime economy as the backbone of development, take advantage of 20% of the total marine resources of the Indonesian economy. The seriousness of building and existing in Indonesia as a whole. Even this has shown that the development of the maritime sector has not been optimal, because from the 20% data, the potential for the Jokowi administration to form one only the fisheries sector has been excavated. If the potential of the Indonesian sea can be managed optimally by the government, then of course this can provide the potential for national economic development as a whole. In other words, the excavation and development of the Indonesian marine sector properly and maximally is believed to be able to improve the national economy, especially in an effort to equalize the economy of Indonesian people on the coast.

In the new government, namely the administration of President Joko Widodo, the government has a very serious vision and mission in the maritime sector (maritime), and one of the seriousness of this is realized by developing and developing the maritime sector by making the maritime economy the backbone of Indonesia's economic development. The seriousness of building and developing the maritime sector was shown by the Jokowi administration by forming a new coordinating ministry in his cabinet, namely the Coordinating Ministry for Maritime Affairs.

On the other hand, Indonesia's geographic condition is so strategic that it is located between the crossroads of world trade, Indonesia is also a country rich in marine resources. the potential for marine resources such as captures fisheries, aquaculture as well as pond fisheries as well as the potential for mining and off-floor energy resources. This is a big asset for Indonesia to move towards a maritime axis country.

However, with the various maritime potentials that Indonesia has, Indonesia's maritime affairs are also not free from various problems. Some of Indonesia's maritime problems can be described in various strategic problems in the development of Indonesia's maritime sector. The first issues and problems are the environment and natural resources. Related to these issues and problems, it can be exemplified in the exploitation of oil and other mines that are in dualism, namely increasing energy and the country's economy versus environmental problems, pollution. The second is a social problem that leads to more helplessness of our fishermen. various problems faced by fishermen, including traditional fishermen having difficulty accessing fishing ground.

The third problem is the economy, especially in relation to Indonesia in the middle of the Pacific economic era. Currently, Indonesia's maritime affairs have not yet had a significant effect on the Indonesian economy, this is because Indonesia is still unable to control its maritime affairs and is more dependent on its land area. The fourth is the problem of technology in which the national weaknesses in mastering and developing technology in the maritime sector. In relation to this technology, another problem that has arisen is the accessibility and connectivity of small islands with mainland in opening up isolation. At the level of the needs of the archipelagic community there are already many technological problems that must be fought, as well as more problems at the state level, such as defense and security in the maritime sector.

In the future, Indonesian maritime affairs is expected to become the main stream of national development by utilizing marine ecosystems and all the resources contained therein in a sustainable manner (on a sustainable basis) for unity, progress and the welfare of the nation. The wish described in five objectives that must be achieved, namely:

Building a network of facilities and infrastructure as the glue for all the islands and islands of Indonesia, (2) Increasing and strengthening human resources in the marine sector supported by the development of science and technology (3) Determining the territory of the Unitary State of the Republic of Indonesia, assets, and matters- matters related to the framework of national defense, (4) Developing an integrated marine economy by optimizing the sustainable use of marine resources, and (5) Reducing the impact of coastal disasters and marine pollution.

2. RESEARCH METODOLOGY

2.1 Indonesian Maritime Sector Potential.

Indonesia as the largest archipelagic country in the world, with an area of two-thirds consisting of oceans and a total length of coastline along 54,716 km, Indonesia has a very large and diverse marine wealth. This marine wealth is in the form of renewable natural resources (fisheries, coral reefs, mangrove forests, seaweed and biotechnology products), non-renewable natural resources (oil and gas, tin, iron ore, bauxite, and other minerals), marine energy (tides, waves, wind, and OTEC or Ocean Thermal Energy Conversion), and marine environmental services such as marine tourism and marine transportation.

The potential for Indonesian fisheries development is obtained through capture fisheries of 6.5 million tons / year, about 8 percent of the total potential for sustainable production of marine fish in the world (90 million tons / year). In addition, Indonesia also has the highest genetic, species and marine ecosystem diversity in the world, known as mega-marine biodiversity. Potentially, the total economic value of Indonesian fishery products and marine biotechnology products is estimated at around IDR 984 trillion per year. Thus, the economic potential of Indonesian marine tourism is enormous.

On the other hand, almost 70% of our oil and natural gas production comes from coastal and marine areas. Based on geological data, it is known that Indonesia has 60 potential basins containing oil and natural gas. In addition, the economic potential of the sea transportation services business is estimated at around Rp. 168 trillion per year. With such a large potential for Indonesia's maritime sector, it would be a shame if this potential could not be fully utilized. The success in maximizing the potential of the maritime sector can spur economic growth which is currently slowing down due to the influence of the global situation.

2.2 The Concept of National Power.

To interact with other nations. In fact, there is no single and definite definition of national power. However, the different definitions of national power in the end always lead to the same essence, namely as capital to gain interests in international interactions and aiming at how to make States or other parties, either voluntarily or compulsively, follow the wishes of the State or certain parties. Therefore, national strength is seen from the essence of the interaction between the actors.

National Power sources are divided into 2, namely real elements and elements that are not real, tangible and intangible. Tangible power, namely; Geography or territorial, natural resources and industrial capacity, population, agricultural capacity, military strength and mobility. Meanwhile, Intangible power, namely; leadership and personality, organizational-bureaucratic efficiency, quality of diplomacy and foreign support and dependence.

2.3 Political Geography and Strategic Geography.

The principle of the study of political geography since its birth has prioritized the principle of relationship, which is studying the relationship between political behavior and physical features. This means that the political behavior of its inhabitants is interpreted or explained from its attachment to the physical picture of the environment in which the human community lives.

Meanwhile, Geostrategy is an important issue for every nation, both in the past, present, and in the future. Geostrategy is very important because every nation needs a strategy in utilizing the country's territory as a national living space. All of this is in order to determine policies, means and targets for the realization of national interests and objectives through development.

Basically, Indonesia's geostrategy is the national strategy of the Indonesian nation in utilizing the territory of the Republic of Indonesia as a national living space in order to design directives regarding development policies, facilities and targets to achieve the national interests and goals mentioned above. Indonesia's geostrategy is ormulated in the form of the Concept of National Resilience.

2.4 Maritime Concept.

According to Geoffrey till in his book, Sea power, states that maritime is sometimes intended to only relate to the navy, sometimes it is also interpreted as navy in relation to land and air power, sometimes also means navy in a broader context, namely in relation to all activities relating to commercial and non-military use of the sea. In fact, sometimes the term maritime is interpreted as covering the three aspects mentioned above. Geoffrey till further said that sea power is not only about what is needed to be able to control and use the sea, but also the capacity to influence the behavior of others or what people do at sea or from the sea.

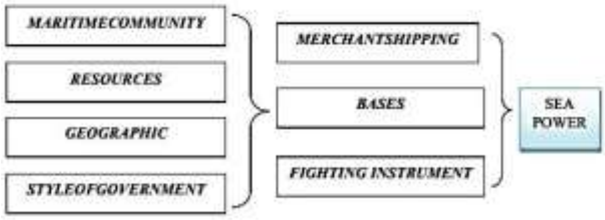


Figure 1. The Concept of Maritime Power

Based on the picture above, it can be explained that maritime power can be achieved if there is a synergy between the maritime community, natural resources, geography and the style of government of a government in maritime supported by a base or port as a means of maritime infrastructure, as well as wheels of smooth trade movement and security and security will bring a maritime to a clear maritime power.

3. RESULTS AND DISCUSSION

3.1 Problems.

Indonesia is not good at taking advantage of Indonesia's geographic location. In fact, the 1982 International Law of the Sea Convention (UNCLOS) has established three Indonesian Archipelagic Sea Lanes (ALKI) as shipping and flight routes by international ships or aircraft. The three ALKIs are passed by 45% of the total world trade value or reaching around US $ 1,500. However, this valuable geographical position has not been put to good use. Evidently, Indonesia does not yet have transit ports for ships international trade that passed the 3 ALKI earlier. Even though the ALKI route is a congested route, either shipping from China to Europe or Australia, or vice versa, because there is no other route apart from passing ALKI in Indonesia. This should be a strength for Indonesia.

Figure 2. Map for ALKI 1,2, and 3.

Maritime structural problems are closely related to institutions dealing with maritime issues. the ministry that handles the maritime sector yet fully prioritizing maritime policies so that coordination steps are needed between institutions and other government agencies to jointly make policies in the maritime sector, including institutions in local government that handle marine potential. In this matter, we must get rid of all sectoral egos and prioritize the interests of national development.

Maritime cultural issues are closely related to the mind set and the behavior of policy makers who are nautical and maritime in character. This means that every policymaker mind must be directed to the paradigm that development must be directed at maritime (maritime based development). So far, the development process is still oriented towards land and agrarian development where land, urban, inland and mountainous areas are the focus of development. This development without the slightest glancing at the maritime sector which includes coastal communities, fishing communities, and the archipelago. Therefore, it is necessary to change the mind set by policy makers to shift focus to maritime character. Mindset change is also not only carried out by policy makers, but must be done by everyone,

Maritime development is very urgent considering that Indonesia's territorial waters can be immediately managed for the welfare of the community. The National Development Planning Agency (Bappenas) reports on opportunities for control of Indonesia's maritime affairs, including fisheries, chemical compounds, coastal and marine economies, transportation, collaborative management, expansion of the continental base beyond the boundaries of the Exclusive Economic Zone, large-scale marine ecosystem management, marine biotechnology, marine education, marine protected areas, tourism. marine, renewable energy as well as installations and offshore placement. These sectors are important sources of economic growth because supply capacity is very large, generally the output can be exported, while the input comes from local resources, generating large upstream and downstream industries; industry is renewable and generally.

3.2 Development Efforts and Development of the Indonesian Maritime Sector.

Infrastructure is a very important factor as a catalyst for development, including development and development in the maritime sector. One of the forms of infrastructure readiness to support the development of the maritime sector is by building and fixing port functions in economic centers. Ports can create maritime connectivity which functions as a flow of economic interaction and interactions in other fields. Therefore, the synergy of the maritime sector development and development program with the inter-regional connectivity strengthening program must be carried out, in order to take advantage of the position Indonesia which is connected to regional and global economic centers.

A part from building supporting industries, it is necessary to improve a number of fundamental problems in the marine sector in order to accelerate the development of the maritime sector. According to one of the marine experts from Pattimura University, Alex Retraubun, stated that the fundamental problem of the marine sector is independence. Independence must be the lifeblood of marine management by empowering marine and fishery resources and reducing dependence on imports. Another problem is the ability of supervision. The Indonesian maritime and fisheries industry is still far behind neighboring countries due to weak technology, monitoring facilities and fisherman resilience.

The maritime sector development and development program is an excellent program for enhancing development and growth in the economic sector. Many other efforts must be made in addition to the above efforts so that this priority government program can be successful, including strengthening the competence of human resources and developing science and technology in the marine sector. However, the government must also pay serious attention to budget availability. The budget required for the success of this program will be very large, while the government also cannot be independent of programs in other fields. For this reason, the government must be able to wisely run this program in a planned, systematic and measured manner.

3.3 Maritime Development.

To develop Indonesia as the world's maritime axis, a transparent, accountable and professional maritime management strategy is needed. A very complex maritime problem must be managed with maritime governance. Concept required "good maritime governance" in placing Indonesia as the world's maritime axis, where there is a need for policies from stakeholders at various levels of government both at the central and regional levels, so that maritime development is able to create public welfare.

The maritime axis can be understood in three meanings, namely First, the maritime axis can be seen as a vision or aspiration about the Indonesia that you want to build. In this context, the idea of a maritime axis is a big call to return to Indonesia's identity or national identity as an archipelagic country, which is expected to manifest itself in the form of Indonesia as a united, prosperity, and dignity maritime power.

Second, the maritime axis can also be understood as a doctrine, which provides direction regarding a common purpose (a sense of common purpose). As a doctrine, Jokowi invited the Indonesian people to see themselves as “World Maritime Axis, Strength Between Two Oceans". This doctrine emphasizes the geographic, geostrategic and geoeconomics realities of Indonesia whose future depends on, and at the same time influences, the dynamics in the Indian Ocean and the Pacific Ocean.

Third, President Jokowi's maritime axis idea does not stop at the abstraction and conceptualization level. The idea became operational when Jokowi's platform also contained a number of concrete agendas that he wanted to implement in his future administration. For example, a development plan “sea toll" to guarantee inter-island connectivity, developing the shipping and fisheries industry, building ports, improving marine transportation, and focusing on maritime security, reflect the seriousness of realizing Indonesia as the world's maritime axis. In other words, the idea of a maritime axis is also an important part of the national development agenda.

The Indonesian government must think of a way to building maritime infrastructure such as port development, port support development, infrastructure connecting ports and cities, pioneer ports located in the outer islands so that connectivity between islands in Indonesia is created. Maritime infrastructure development is very important in order to ensure traffic and mobility goods, people and inter-island services are becoming faster, cheaper and more practical. Inter-island connectivity through sea tolls is needed in the future in the context of maritime development in Indonesia

Maritime Security through the ministry of defense and the Indonesian Navy must be able to provide security guarantees in the territorial waters, maritime affairs and maritime affairs. Various transnational crimes, such as illegal fishing, illegal logging, illegal mining, drug trafficking and various other transnational crimes must be able to be handled between the Indonesian Navy and the Ministry of Maritime Affairs and Fisheries and other related agencies. The Indonesian Navy must be able to be present on every island and provide a guarantee of security for fishermen and various parties carrying out activities in the sea area.

4. CONCLUSION AND SUGGESTION

4.1 Conclusions.

From the discussions above we can take conclusions as follow:

a. Indonesia is an archipelagic country and can be said to be the largest maritime country in the world.

b. To realize Indonesia as a maritime axis
world, it is necessary to synergize development policies between related ministries and regional governments, especially the government of coastal areas.

c. The authority possessed by the regional government must be used to the maximum extent possible to develop the maritime, waters and coastal areas of Indonesia. Local governments must make policies, programs and activities based on maritime aspects.

d. The synergy of the central government and local governments with the support of the community and the strength of the Indonesian Navy will be able to make Indonesia a world maritime axis.

4.2 Suggestions.

From the conclusions above we can give suggestions as follows:

a. It is necessary to carry out activities that are able to inspire the public about the magnitude and importance of the potential aspects of the Indonesian sea (maritime). This activity must involve several components and stakeholders in the maritime sector such as the ministry of maritime, the ministry of fisheries and maritime affairs and the Indonesian Navy itself as the basis for safeguarding the archipelago's sea. This activity can take the form of the existing Archipelago Circle Voyage routinely carried out every year. Apart from being carried out to introduce the potential of the archipelago's sea, this activity can also increase the love of the country for Indonesia's young generation.

b. It is necessary to issue a Law from the Government, especially the relevant ministries, regarding the affirmation of the management of Natural Resources in the Sea, including those relating to the confirmation of violations that have occurred.

ACKNOWLEDGEMENT

The authors greatly acknowledge the support from Naval Technology College, STTAL Surabaya Indonesia for providing the necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

REFERENCES

Anonim, "Poros Maritim Dunia, Mampukah Kita?" accessed in newsdetik.com on 06 September 2014.

Bangun Sektor Maritim, Jokowi Harus Siapkan Industri dan Infrastruktur maritim, http://www.gresnews.com/berita/hukum/12024 10-bangun-sektormaritim-jokowi- harus-siapkan-industridan-infrastruktur-maritim/, accessed on 25 Oktober 2014.

De Porter, Bobbi dan Hernacki, Mike. 1992. Quantum Learning. Membiasakan Belajar Nyaman dan Menyenangkan. Terjemahan oleh Alwiyah Abdurrahman. Bandung: Penerbit Kaifa.

Indonesia Harus Jadi Negara Maritim", Harian Ekonomi Neraca, 21 Oktober 2014.

Jalasena edisi No.4 Maritim Domain Awareness oleh laksamana madya TNI Dr. Marsetio, MM.

Kementerian Koordinator Bidang Perekonomian. 2011. Masterplan Percepatan dan Perluasan Pembangunan Ekonomi Indonesia (MP3EI).

Laksamana TNI {Purn} Agus Suhartono, Sarasehan "Indonesia Poros maritime Dunia, Kedaulatan Maritim Indonesia.

Penguatan Ekonomi Maritim Bisa Menjadi Pemicu Pemerataan di Indonesia", http://www.beritasatu.com/industriperdagangan /2175 94-penguatanekonomi-maritim-bisa-menjadi- pemicupemerataan-di-indonesia.html, accessed on 25 Oktober 2014.

Potensi Ekonomi Maritim Indonesia, http://jurnalmaritim.com /2013/16/129/ potensi-ekonomi-maritim-indonesia, accessed on 25 Oktober 2014.

Rokhmin Dahuri: 80 Persen Potensi Maritim Indonesia Belum Terjamah, http://www.tribunnews.com/nasional/2014/09/1 2/rokhmin-dahuri80-persen- potensi-maritim-indonesiabelum-terjamah, accessed on 27 Oktober 2014.

Sujimat, D. Agus. 2000. Penulisan karya ilmiah. Makalah disampaikan pada pelatihan penelitian bagi guru SLTP Negeri di Kabupaten Sidoarjo tanggal 19 Oktober 2000 (Tidak diterbitkan). MKKS SLTP Negeri Kabupaten Sidoarjo.

Suparno. 2000. Langkah-langkah Penulisan Karya tulis ilmiah Ilmiah dalam Saukah, Ali dan Waseso, M.G. 2000. Menulis Karya tulis ilmiah untuk Jurnal Ilmiah. Malang: UM Press.

HARDIKAL. 2000. Pedoman Penulisan Karya tulis ilmiah Jurnal, Surabaya: Lembaga Penelitian Universitas Negeri Surabaya.

Wahab, Abdul dan Lestari, Lies Amin. 1999. Menulis Karya Ilmiah. Surabaya: Airlangga University Press.

Winardi, Gunawan. 2002. Panduan Mempersiapkan Tulisan Ilmiah. Bandung: Akatiga.

QUALITY OF WORK LIFE (QWL) EVALUATION AND FACTORS AFFECTING QUALITY OF WORK LIFE (QWL) IN NURSES AT SATKES KODIKLATAL BY CROSS SECTIONAL STUDY

Mega Nurmalasari Wira Putri [1], Djazuly Chalidyanto[2]

[1,2]*Departement of Administration and Health Policy, Universitas Airlangga, Surabaya*
Jalan Dr.Ir.H Soekarno, Mulyorejo, 60115

ABSTRACT

The hospital is a health service business, one of which is based on the principle of trust so that service quality problems, patient satisfaction and patient loyalty are factors that determine its success. Various ways are used by organizations to create competitive advantage. One of the most important aspects in creating competitive advantage is increasing the quality of human resources owned. Quality of Work Life is a concept or management philosophy in the fieldgka improvement in the quality of human resources that has been known since the seventies. By realizing and maintaining a healthy QoWL, it will increase employee job satisfaction, reduce the number of employees leaving, increase productivity and improve nursing care outcomes. Analysis of the QoWL factor was carried out using questionnaire data for 120 nurses in the ER department, outpatient and inpatient care. Analysis of QoWL results for satisfaction is in the dimensions of Control at Work and Stress at Work and for employee dissatisfaction is in the dimensions. between employees. From this analysis, recommendations for improvement and enhancement of the quality of a good work life can be made through stress management, existing workforce analysis.

Keywords: *Quality of work life, Cross Sectional Study, Satkes Kodiklatal*.

1. INTRODUCTION

Quality of work life (QWL) is a process by which employees and office holders in an organization gain insight into how to better work together to improve the quality of staff life and organizational effectiveness simultaneously. This concept basically states the way an organization can protect the holistic well-being of an employee rather than just concentrating on work-related features. QWL is usually considered as one of the most important elements in staffing and retaining, which has a major impact on reducing the turnover rate of nurses in a health facility. To solve this problem, a variety of issues including workload, professional leadership and clinical support, adequate continuing professional education, career mobility and career hierarchy, flexibility, planning and placement, professional admiration, providing safety for work-related illnesses, and better pay. Various existing studies have shown that employee satisfaction with good QWL will have a positive impact on employees, reduce absenteeism from work, reduce unprofessionalism, reduce the incidence of work-related injuries, and increase job enjoyment and satisfaction in various aspects which will also have an impact. on improving employee performance.

In the world of health, especially in hospitals, nurses have an equally important role in handling patients at all levels in the hospital. It is believed that a manager serving in a health facility should be able to explore the needs of employees and improve the quality of work life of employees by continuously evaluating their work, organizing and identifying any possible errors.

In some cases, there are often statements about bad nurse attitudes or services. However, if it is observed further, the question can arise: does a nurse really feel that the quality of work life is achieved? What are the possible factors that could be related to or affect the quality of their work life? In this journal, we aim to determine the level of quality of work life, as well as determine the influencing factors among nurses who work at the Kodiklatal Health Unit.

2. RESEARCH METODOLOGY

2.1 Area Studies and Design Studies

The location for data collection was the Kodiklatal Health Unit, on 7-9 December 2019. Data presentation was done descriptively

2.2 Population and Sample

The population in this study were all nurses who served in the Satkes Kodiklatal. Random samples were taken from nurses who worked at the Kodiklattal Health Unit. The number of samples was 120 nurses of the Kodiklatal Health Unit. The nurse education criteria that are entered are a minimum of a diploma and have at least 1 year of experience working at the Kodiklatal Health Unit.

2.3 Variable

The WRQoL (The Work-Related Quality of Life) research instrument uses 6 (six) core factors that explain most of the variations and qualities of individual work life, which consist of (1) General Welfare /GWB (General Well-Being) (2) Linkage between home and work-life domains / HWI (Homework Interface (3) Control at Work \ (4) Working Conditions (5) Stress at work / SAW (Stress at Work), stress levels, and (6) Job & Career Satisfaction and Career Satisfaction / JCS (Job an Career Satisfaction).

3. RESULT AND DISCUSSION

3.1 Quality of Work Life (QoWL)

The term Quality of Work Life is famously derived from the 1972 international labor relations conference at Arden House, Columbia University, New York (Davis & Cherns, 1975 in Sinha C, 2012). From a business perspective, Quality of Work Life is important because there is evidence to suggest that the nature of the work environment is related to employee satisfaction and work-related behavior (Greenhaus et al., 1987 in Sinha C, 2012). Quality of Work Life was also found to influence employee job responses in terms of organizational identification, job satisfaction, job involvement, work effort, job performance, intention to quit, organizational turnover and personal alienation (Carter et al., 1990; Efraty & Sirgy, 1990.;. Efraty et al, 1991, in Sinha C, 2012).

A definition of Quality of Work Life criteria was first proposed in 1972 (Walton, 1973) states that dissatisfaction with work life is a problem that will affect almost all workers at one time or another, with regard to position or status. Frustration, boredom, or anger often occur in employees who are less than satisfied with their work lives, and can have an impact on the individual himself.

Gray and Smeltzer (1990: 641) stated that, "Quality of Work life, the original use referred to the quality of the relationship between the worker and the working environment consider as a whole". Meanwhile, according to Davis and Newstorm (1993: 345), they argue, "Quality of work life refers to favorableness of a job environment that is excellent for people as well for the economic health of organization". Quality of work life is a condition of a good work environment for workers. The fundamental objective is to develop a good work environment in accordance with the economic well-being of the organization. According to Luthans (1995) Quality of Work Life is more concerned with the overall climate of work. One Quality of Work Life analysis describes it as (1) a concern about the impact of working on people as well as on organizational effectiveness, and (2) the idea of participation in organizational problem solving and decision making.

According to Gibson (2003), the concept of Quality of Work Life is now widely used to refer to "a management philosophy that enhances the dignity of all workers; introduces changes to organizational culture, and improves the physical and emotional well-being of employees". Quality of Work Life indicators include accident rates, use of sick leave, employee turnover, and the number of complaints filed the concept of Quality of Work Life is now widely used to refer to "a management philosophy that enhances the dignity of all workers; introduces a change in organizational culture, and improves the physical and emotional well-being of employees". Quality of Work Life indicators include accident rates, use of sick leave, employee turnover, and the number of complaints filed the concept of Quality of Work Life is now widely used to refer to "a management philosophy that enhances the dignity of all workers; introduces changes to organizational culture, and improves the physical and emotional well-being of employees". Quality of Work Life indicators include accident rates, use of sick leave, employee turnover, and the number of complaints filed.

Mondy and Noe (1996: 283) state that, "Quality of work life is the degree to which members of a work organization are able to satisfy their most important personal needs through organizational experiences". Quality of work life is the degree to which members of a work organization are able to satisfy their important personal needs through experience in the organization.

Definition *Quality of Worklife* according to Robbins (2002: 159), "*Quality of Work Life*is a process by which an organization responds to employee needs by developing mechanisms to allow them to share fully in making the decisions that design their lives at work. Robbins' opinion implies that Quality of Work Life is a process by which an organization reacts to the needs of employees through the development of decision-making mechanisms that allow employees to fully participate in designing their lives in the workplace. Furthermore, Quality of Work Life is useful for increasing organizational productivity.

Cascio (2003) states that Quality of Work Life can be defined as employees' perceptions of their mental and physical well-being at work. There are two views regarding the purpose of Quality of Work Life. First, Quality of Work Life is the set of circumstances and practices of the organization (eg democratic supervisor enrichment, worker involvement, and safe working conditions). Meanwhile, the second, Quality of Work Life is the perception of employees that they want to feel safe, they feel satisfied, and get the opportunity to grow and develop as human beings.

According to Easton and Van Laar (2012) Quality of Work Life (QoWL) is a theoretical concept aimed at capturing the essence of individual work experience in a broad sense. An individual's QoWL is influenced directly by their work experience as well as direct and indirect factors that influence that experience. These factors include job satisfaction, other factors that generally reflect life satisfaction and well-being. QoWL is defined as the favorable conditions and environment of the workplace that support employee satisfaction by providing them with gifts, job security and growth opportunities.

Improvements to get good QoWL have been proven to provide benefits in employee performance. For example, researchers from the faculty of public health and tropical medicine, Jazan University, Saudi Arabia conducted research with the results of improving QoWL improving individual and organizational performance and increasing nurse commitment (Almalki, et al, 2012). In the same year the three researchers also conducted another study with the conclusion "Creating and maintaining a healthy work life for PHC nurses is very important to improve their work satisfaction, reduce turnover, enhance productivity and improve nursing care outcomes" (Almalki, et all, 2012).

Research on a multinational company in Sydney states that currently companies are focused on improving the quality of work life for their employees. Not only a technique, this is a philosophy or concept that companies have used to balance business, human needs and social needs (Ouppara and Victoria, 2012).

A study of lecturers in Iran shows that the increase in QoWL of lecturers at universities has a significant effect on the development of education and society in a country (Parsa et al, 2014).

3.2 Components of Quality of Work Life

Walton proposes eight main conceptual areas for understanding QWL. The aspect put forward by Richard E. Walton (1975) is the description that is considered the most comprehensive of the conditions of QWL. He stated 8 (eight) main categories which together constitute QWL, namely:

a. Adequate and fair compensation (Fair and appropriate remuneration (salary))
b. Safe and healthy working conditions (Safe and healthy working conditions)
c. Immediate opportunity to use and develop human capacities (There is an opportunity to use and develop one's capacity as a human being)
d. Opportunity for continued growth and development (Opportunity to progress and develop)
e. Social integration in the work organization (Social relations at work)
f. Constitutionalism in the work organization (Constitutionalism in the workplace also relates to the privacy of employees)
g. Work and total life space (Work and whole living space)
h. The social relevance of work life (Social relevance of work life)

Figure 1. QWL Components (Walton, 1975)

The following is an explanation of each aspect expressed by Richard Walton about Quality of Work Life, namely:

a. Wage System (Salary): The reward of the employee's energy which is manifested as a result of production, or a service that is considered the same for it, in the form of money, with a certain guarantee in each week or month. It also relates to the suitability of wages with adequate social standards or the subjective standards of the recipient.

b. Safe and healthy working conditions: a system of control over people, facilities, work environment and software. This aspect also includes reasonable working hours, physical working conditions that minimize the risk of illness and accidents, as well as the age limit imposed at work which is a potential destroyer for the welfare of the person who is over (or below) a certain age. Because it is found that the general improvement in the quality of working conditions and early maturity in young people may lead to a relaxation of the age limit in some areas of the work environment. A safe and healthy work environment also includes a work environment that is free from noise, free from visual disturbances such as sunlight in a good work environment, and pollution-free (Walton, 1975 in Agung,

c. Opportunities to use and develop personal capacities: the extent to which the work is carried out by employees to provide opportunities for employees to use and develop all the abilities and skills they have and whether the work presents a challenge for him to be fully involved. Opportunities for growth and development also include opportunities for training and continuing education in an effort to attend training and continue education as an effort to develop skills in doing work (Walton, 1975; Taylor, 1978; Levine et al., 1984 in Brooks, 2001).

d. Opportunities for advancement: the extent to which the employee's job can provide opportunities for him to advance in a career in the future. Focusing on career rather than job opportunities includes personal development, application of new skills, opportunities for self-development, and security.

e. Social relations in the workplace: the extent to which the work environment and co-workers can accept the presence of individuals and the extent to which the work environment is free from destructive prejudice. Do employees achieve personal identity and self-confidence due to conditions in the workplace that are free from prejudice, egalitarianism (equality), upward mobility, supportive main groups, a sense of togetherness between groups, and also feelings of openness between employees.

f. Employee privacy rights: The extent to which the organization can fulfill the rights that employees should have and the extent to which the organization provides freedom of privacy (privacy). There may be many variations to expand this understanding, including an organizational culture that values personal freedom, tolerates differences and the opportunity to express opinions, as well as equality in the distribution of organizational rewards.

g. Work and life space as a whole: the extent to which work affects the personal life roles of employees, such as relationships with family. Emphasizes the existence of a balance of roles from work in the actual life of the employee. The concept of a balanced role also relates to working hours, career demands, being given vacation time as well as free time and time for family.

h. Work-life social relevance: the extent to which the organization has social responsibility for its environment, the extent to which the organization can provide pride to its employees, and so on. Organizations that are not socially responsible can be the cause of an increase in workers who have a lower assessment of their work and also their career so that it will affect their self-confidence.

Meanwhile, according to Cascio (2003), there are nine components of the quality of work life, including:

a. Communication (Communication)

In every organization or company environment, employees need open communication within the boundaries of their respective powers and responsibilities. With smooth communication, employees will get important information correctly.

b. Problem solving (*Conflict Resolution*)

In a company, every employee has the opportunity to make a contribution in resolving conflicts both in the company and conflicts between employees in an open, honest and fair manner. This condition greatly affects employee loyalty and dedication and work motivation.

c. Career development *(Career Development)*

In a company every employee needs clarity about their career development in facing the future. For this reason, it is pursued through offers of promotion, providing opportunities to take part in training or education outside the company at higher educational institutions.

d. Employee engagement (*Employee Participation*)

In a company, every employee needs to be involved in the decision-making process and the implementation of work in accordance with their respective positions, authorities and positions.

e. Taste Proud of the Institution (Pride)

In a company, every employee needs to be nurtured and developed a feeling of pride in his place of work, including in his job or position.

f. Balanced compensation (*Equitable Compensation*)

In a company, every employee must receive fair, reasonable and sufficient compensation. For this reason, it is necessary to have the ability to formulate and administer a system and structure for providing direct and indirect compensation for the welfare of employees in accordance with their positions.

g. Work environment safety (*Save Environment*)

Every employee needs security in the work environment. For this reason, the company is obliged to create and develop and guarantee a safe work environment by forming a work environment safety committee which continuously observes and monitors the conditions of the work place and equipment in order to avoid anything that endangers the workers.

h. Sense of security at work (*Job Security*)

Every company needs a sense of security or a guarantee of continuity of its work. For this reason, companies need to try to avoid temporary layoffs of employees, make them permanent employees by having regular tasks and having regular programs to provide employees with opportunities to resign, especially through pension arrangements. Every employee needs attention to the maintenance of his health in order to work effectively, efficiently and productively.

i. Facilities obtained (*Wellness*)

In a company environment, each and every employee needs attention to the maintenance of their health, in order to work effectively, efficiently and productively. For this reason, companies can establish and administer health care programs, recreational programs and counselling/ counselling programs for employees.

Various questionnaire instruments have been developed to assess the quality of work life. In the UK this assessment has been carried out since 1998. Easton and Van Laar (2018) state that there are six factors that are assessed in conducting the QoWL analysis, namely:

a. General Well-Being (GWB)
b. Homework Interface (HWI)
c. Job and Career Satisfaction (JCS)
d. Control at Work (CAW)
e. Working Conditions (WCS)
f. Stress at Work (SAW)

The factors that affect the Quality of Work Life include:

1. Individual Internal Factors

Factors that directly affect QoWL are age, gender, marital status, number of children, dependents at home, position in work, work experience, years of service.

2. Workplace Factor
3. Social and environmental factors: communication, relationships between colleagues, relationships between departments, relationships with other professions, leadership
4. Operational factors: work schedule, number of employees, competition, supervisor supervision, new staff training
5. Administrative factors: Workplace policies related to HR administration and management systems, career development, salaries and health insurance.
6. Workplace External Factors

Government policies, competitors' workplaces, customer dependency, health insurance policies, labor market, customer workplace coverage.

There are various methods / measuring tools for QWL assessment, including:

a. Employee Quality Worklife Survey (Albrech, 2013) who assessed QWL based on aspects of work freedom and relationships with coworkers.

b. Swamy (2015) developed 9 dimensions to measure QWL based on literature studies on several aspects that affect QWL. These aspects are

1) Work environment;
2) Climate and organizational culture;
3) Relationships and cooperation between co-workers;
4) Training and development;
5) Compensation and rewards;
6) Facilities;
7) Job satisfaction and security;
8) Work autonomy;
9) Resources

c. NIOSH (2010) developed a measuring tool to assess QWL subjectively including: aspects of job demands, job satisfaction, factors outside of work such as family, work routines, relationships with colleagues and companies, including anatomical factors at work.

d.

Table 1. General Well-being

VARIABEL		n(%)	General well being		P value
			puas	Tidak puas	
Jenis kelamin	1. Pria	44 (36,5)	10	34	0,013
	2. Wanita	76 (63,4)	36	40	
Rentang usia	1. 25-35	67 (55,8)	18	49	0,035
	2. 35-45	53 (44,2)	25	28	
Pendidikan	1. D3	83 (69,2)	39	44	0,032
	2. S1	37 (30,8)	9	28	
Marital status	1. Menikah	78 (65)	37	41	0,02
	2. Tidak menikah	42 (35)	10	32	
Lama dinas	1. 1-5 tahun	76 (63,3)	21	55	0,043
	2. 5-10 tahun	44 (36,7)	21	23	
Departemen	1. IGD	37 (30,8)	5	32	0,039
	2. Rawat inap	53 (44,2)	20	33	
	3. Rawat jalan	30 (25)	10	20	

In the general wellbeing dimension, it can be concluded that nurses at the Kodiklatal Health Unit feel dissatisfied with their lives. Dissatisfaction was higher in the male nurse group (77%), the group in the age range 25-35 years (73%), the group with undergraduate education status (76%), the group with unmarried status (76%), the group with service years. 1-5 years (72%) and the group who served in the ER (86%).

This indicates a lack of general welfare that is obtained from their place of work or is not in accordance with the expectations of the nurses. The GWB factor assesses the perception of an individual feeling good or satisfied with their life as a whole. GWB can influence and be influenced by work. GWB is a broad relationship between psychological well-being and aspects of physical health. Psychological well-being can affect individual performance in the workplace both for better and for worse. When someone is feeling good, they may tend to do well and enjoy being at work. But when people feel anxious, restless because it arises from work or difficulties at home, their work may be affected.

When employees are physically ill, their performance in the workplace can be affected and the impact on their sense of psychological well-being can be reduced. Thus, it can be said that, general welfare in the workplace must be handled positively. Handling is not only providing assistance when problems arise, but paying more attention to preventing and improving welfare.

It is useful to review the relevance of policies and services, maintain awareness and clarify responsibilities, ensure that public welfare monitoring is effective. So that the results help people to work well and feel good at work. Mental health problems, especially depression and anxiety disorders have a major impact on the population's GWB and on the use of health care resources.

Table 2. Home Work Interface

VARIABLES		n (%)	Homework Interface		P value
			satisfied	Not satisfied	
Gender	1. Male	44 (36.5)	14 (32%)	30 (68%)	0.026
	2. Women	76 (63.4)	10 (13%)	66 (87%)	
Age range	1. 25-35	67 (55.8)	17 (25%)	50 (75%)	0.037
	2.35-45	53 (44.2)	24 (45%)	29 (55%)	
Education	1. D3	83 (69.2)	14 (17%)	69 (83%)	0.023
	2. S1	37 (30.8)	14 (38%)	23 (62%)	
Marital status	1. Getting married	78 (65)	36 (46%)	42 (54%)	0.028
	2. Not married	42 (35)	10 (24%)	32 (76%)	
Length of service	1. 1-5 years	76 (63.3)	15 (20%)	61 (80%)	0.022
	2. 5-10 years	44 (36.7)	18 (41%)	26 (59%)	
Department	1. IGD	37 (30.8)	12 (32%)	25 (68%)	0.038
	2. Hospital ization	53 (44.2)	17 (32%)	36 (68%)	
	3. Outpati ent	30 (25)	10 (33%)	20 (67%)	

In HWI, in general, the nurses from the Satkes Kodiklatal were not satisfied. Dissatisfaction was higher in the female nurse group (87%), the group in the age range of 25-35 years (75%), the group at D3 education status (83%), the group with unmarried status (76%), the group with service years. 1-5 years

(80%) and the group who served in the ER and inpatients (86%).

This can be due to an imbalance in their personal and work lives so that nurses feel they have no control over the time, place and way they work. This reflects the individual's perception that he does not have a fulfilled life from inside and outside of work for the benefit of the individual, the workplace and society. In the Work-Related Quality of Life (WRQoL) assessment, the HWI factor is used to see the balance of life and work and reflects employer support for employees' lives at home.

When employees are needed at home can mean those employees find it difficult to get to work when they are needed, and this results in employees having less attention when they are at work. Work constraints mean that an individual feels unable to leave their job, or unable to recover after work and unable to self-actualize in other aspects of their life.

It can be concluded that inadequate attention to the lives of employees at home will not be good for the organization in the long run. Failure to balance work and home demands is likely to threaten an employee's ability to provide the best for both lives.

As individuals and as workers, they must actively and continuously monitor the balance of life and work, and make the necessary adjustments. Flexibility as individuals and workers will often be required. With discussion and compromise, if there are obstacles, it will encourage solutions to emerge.

Relevant issues will vary widely between and within work settings. Flexible working hours, working from home, job rotation, pregnancy and maternity leave, child care, division of labor are all aspects that can affect HWI. The demands of a family with a husband and wife to work, for example, are one of the many problems that arise in the home and work so that it needs to be monitored and handled by cooperating in the workplace.

A study in Calcutta states that an employee's emotional intelligence has a positive influence on QoWL and the ability to manage home and workplace conflicts and also has an impact on reducing work stress (Dasgupta, 2010).

Table 3. Job and Career Satisfaction

VARIABLES		n (%)	Job and Career Satisfaction		P value
			satisfied	Not satisfied	
Gender	1. Male	44 (36.5)	22 (50%)	22 (50%)	0.015
	2. Women	76 (63.4)	20 (26%)	56 (74%)	
Age range	1. 25-35	67 (55.8)	33 (49%)	34 (51%)	0.032
	2.35-45	53 (44.2)	15 (28%)	38 (72%)	
Education	1. D3	83 (69.2)	20 (24%)	63 (76%)	0.014
	2. S1	37 (30.8)	18 (49%)	19 (51%)	
Marital status	1. Getting married	78 (65)	20 (34%)	58 (66%)	0.013
	2. Not married	42 (35)	21 (50%)	21 (50%)	
Length of service	1. 1-5 years	76 (63.3)	19 (25%)	57 (75%)	0.035
	2. 5-10 years	44 (36.7)	20 (45%)	24 (55%)	
Department	1. IGD	37 (30.8)	18 (47%)	19 (53%)	0.039
	2. Hospitalization	53 (44.2)	14 (26%)	39 (74%)	
	3. watch the road	30 (25)	15 (50%)	15 (50%)	

In the dimension of Job and Career Satisfaction, overall, the Satkes kodiklatal nurses expressed dissatisfaction. Dissatisfaction was higher in the female nurse group (74%), the group in the age range 35-45 years (72%), the group at D3 education status (76%), the group with married status (66%), the group with service period 1 -5 years (75%) and the group serving inpatients (74%).

JCS describes the level of a work environment that is able to provide the best for employees in the workplace. Things that make them feel good include appreciation, high self-esteem and the fulfillment of individual potential. When the QoWL scale was associated with job satisfaction, the JCS factor was the most correlated subscale. Previous research has shown that some of the most important determinants of JCS are working conditions, fairness at work, promotion and income (Parvin & Kabir, 2011). So that it can be concluded, nurses at the Kodiklatal Health

Unit have not received an award in accordance with their expectations for their performance.

Table 4. Control at Work

VARIABLES		n (%)	Control at Work		P value
			satisfied	Not satisfied	
Gender	1. Male	44 (36.5)	34 (77%)	10 (23%)	0.013
	2. Women	76 (63.4)	40 (52%)	36 (48%)	
Age range	1. 25-35	67 (55.8)	34 (51%)	33 (49%)	0.032
	2.35-45	53 (44.2)	38 (71%)	15 (39)	
Education	1. D3	83 (69.2)	43 (52%)	40 (48%)	0.024
	2. S1	37 (30.8)	28 (72%)	9 (28%)	
Marital status	1. Getting married	78 (65)	57 (73%)	21 (27%)	0.038
	2. Not married	42 (35)	22 (52%)	20 (48%)	
Length of service	1. 1-5 years	76 (63.3)	43 (56%)	33 (44%)	0.037
	2. 5-10 years	44 (36.7)	34 (77%)	10 (23%)	
Department	1. IGD	37 (30.8)	19 (51%)	18 (49%)	0.033
	2. Hospitalization	53 (44.2)	40 (75%)	13 (25%)	
	3. Outpatient	30 (25)	16 (53%)	14 (47%)	

In the Control at work dimension, the Kodiklatal Health Unit nurse expressed satisfaction. In the CAW results, higher satisfaction was found in the male nurse group (77%), nurses with an age range of 35-45 years (71%), nurses with S1 education status (72%), nurses with married status (73%), nurses with a length of service of 5-10 years (77%), and a group of nurses who served in inpatients (75%).

CAW reflects the level of control employees have over what is considered appropriate in their work environment. The perception of this control can be from various aspects of his job, such as the opportunity to contribute to the decision-making process related to his job. Perceptions of personal control can influence stress and their health.

HSE uses a simple definition of CAW which focuses on how much opinion or influence people feel about doing their job the way they do (http://www.hse.gov.uk/stress/standards/). The meta-analysis of Thomas et al. (2006) states that a positive CAW has a positive impact on employee work results such as good work results, greater work motivation and a social experience effect.

Table 5. Working Conditions

VARIABLES		n (%)	Control at Work		P value
			satisfied	Not satisfied	
Gender	1. Men	44 (36.5)	22 (50%)	22 (50%)	0.035
	2.women	76 (63.4)	22 (41%)	54 (59%)	
Age range	1.25-35	67 (55.8)	18 (27%)	49 (73%)	0.035
	2.35-45	53 (44.2)	25 (47%)	28 (53%)	
Education	1. D3	83 (69.2)	39 (47%)	44 (53%)	0.032
	2. S1	37 (30.8)	9 (24%)	28 (76%)	
Marital status	1. Getting married	78 (65)	36 (46%)	42 (54%)	0.028
	2. Not married	42 (35)	10 (31%)	32 (69%)	
Length of service	1. 1-5 years	76 (63.3)	21 (27%)	55 (73%)	0.043
	2. 5-10 years	44 (36.7)	21 (48%)	23 (52%)	
Department	1. IGD	37 (30.8)	8 (22%)	29 (78%)	0.032
	2. Hospitalization	53 (44.2)	25 (47%)	28 (53%)	
	3. Outpatient	30 (25)	14 (47%)	16 (53%)	

In the WCS dimension, nurses at the Kodiklatal Health Unit expressed dissatisfaction. Dissatisfaction was higher in the female nurse group (59%), the group in the age range 25-35 years (73%), the group with undergraduate education status (76%), the group with the unmarried status (69%), the group with service years. 1-5 years (73%) and the group who served in the ER (78%).

WCS assesses employees' satisfaction with available resources, working conditions and the security needed to perform their jobs effectively.

Dissatisfaction with physical work conditions such as health and safety as well as work hygiene can have a significant adverse impact on employee QoWL.

The WCS factor is conceptually related to JCS. JCS reflects a workplace that provides individuals with the best of things such as self-development, goals, promotion and recognition of their performance. Meanwhile, the WCS factor reflects that the workplace fulfills the basic needs of the individual. When WCS needs to be addressed to avoid possible dissatisfaction in the workplace, the JCS component assesses the extent to which the workplace offers the opportunity for workers to experience workplace satisfaction. Problems associated with poor WCS (lighting, dust, smoke) can cause employees to move away from the workplace or avoid spending time in certain work areas.

Table 6. Stress at Work

VARIABLES		n (%)	Stress at Work		P value
			satisfied	Not satisfied	
Gender	1. Male	44 (36.5)	35 (80%)	9 (20%)	0.038
	2. Women	76 (63.4)	45 (59%)	31 (41%)	
Age range	1. 25-35	67 (55.8)	39 (58%)	28 (42%)	0.044
	2.35-45	53 (44.2)	41 (77%)	12 (33%)	
Education	1. D3	83 (69.2)	45 (54%)	38 (46%)	0.043
	2. S1	37 (30.8)	28 (76%)	9 (24%)	
Marital status	1. Getting married	78 (65)	43 (55%)	35 (45%)	0.038
	2. Not married	42 (35)	32 (76%)	10 (24%)	
Length of service	1. 1-5 years	76 (63.3)	66 (87%)	10 (13%)	0.026
	2. 5-10 years	44 (36.7)	30 (68%)	14 (34%)	
Departme nt	1. IGD	37 (30.8)	30 (81%)	7 (19%)	0.046
	2. Hospitalization	53 (44.2)	31 (58%)	22 (42%)	
	3. Outpatient	30 (25)	23 (77%)	7 (23%)	

In the SAW dimension, nurses at the Kodiklatal Health Unit expressed satisfaction. The higher satisfaction occurred in the male nurse group (80%), the group in the age range 35-45 years (77%), the group with the S1 education status (76%), the group with the unmarried status (76%), the group with the service period. 1-5 years (87%) and the group who served in the emergency room (81%).

SAW is determined by individual feelings of excessive pressure and stress at work. This definition is based on the idea that a person's stressful experiences depend on the individual's perception of the situation and his ability to cope with stress. One other definition proposes work that causes stress is a physical and emotional response that is dangerous and occurs when job requirements do not match the abilities, resources or needs of employees.

In their research, Ahsan et al (2009) stated that there is a negative relationship between stress at work and job satisfaction. Ahsan et al also stated that motivation is a key factor in influencing job stress among employees. Employees who are highly motivated will feel happier and more willing to work for the organization.

4. CONCLUSION

In this study, it was concluded that in the dimensions of General Well-Being, Homework Interface, Job and Work Satisfaction and the dimensions of Working Conditions, nurse satisfaction was still low. This can be caused by a lack of relevance between policies and jobs, imbalance of personal life and work, there is no respect for nurses from hospital management and an uncomfortable work environment.

Meanwhile, in the Control at Work dimension and the Stress at Work dimension, the satisfaction is high enough. This could be due to itthe opportunity that nurses feel to contribute to the decision-making process related to their work, and the high motivation of the nurses.

Suggestions that can be taken from this research for the management of the Kodiklatal Health Unit are that there is a need for better communication between management and workers under its auspices (in this case especially nurses), creating a more conducive and comfortable working atmosphere and work environment and creating a sense of security for workers. There is a rewards system for employees who contribute more to the organization and excel.

ACKNOWLEDGEMENT

The authors greatly acknowledge the support from Airlangga University Surabaya, Indonesia for providing the necessary resources to carry out this research work. The authors are also grateful to Satkes Kodiklatal Naval Technology College, STTAL Surabaya, and the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article

REFERENCES

Ahsan, Nilufar et all (2009). A study of Job stress on Job Satisfaction Among University Staff in Malaysia: Empirical Study. Europian Journal of Social Sciences Volume 8 Number 1 121-131

Almalki, Mohammed J, et all (2012). Relationship Beetwen Quality of Work Life and Turnover Intention of Primary Health Care Nurses in Saudi Arabia. BMC Health Services Research. 12: 314.

Almalki, Mohammed J, et all (2012). Quality of Work Life among Primary Health Care Nurses in Jazan, Saudi Arabia: A Cross Sectional Study. Human Research for Health. 10:30

Ayuningtyas, et al (2007). The Relationship between Midwives' Performance in Ante Natal Care Management and Quality of Work Life in Tasikmalaya City.

Aziri, Brikend. (2011). Job Satisfaction: A Literature Review. Management Research and Practice Volume 3 Issue 4 p 77-86

Bakan, Ismail & Buyukbese, tuba. (2013).*The Relationship between Employees' Income Level and Employee Job Satisfaction: An empirical study*. International Journal of Business and Social Science Vol. 4 No. 7 p 18-25.

Cascio, Wayne F. (2003) Managing Human Resources; Productivity, Quality of Work Life, Profits, sixth edition, Mc Graw Hill / Irwin, New York.

Dasgupta, Mallika (2010). Emotional Intelligence Emerging as a Significant Tool for Female Information Technology Professional in Managing Role Conflict and Enhancing Quality of Work Life and Happiness. Asian Journal of Management Research. ISSN 2229-3795 pg. 558-565

Decree of the Minister of Health of the Republic of Indonesia Number 625 of 2010 concerning Guidelines for the Preparation of a Remuneration System for Hospital Public Service Bodies

Easton, Simon A & Van Laar, Darren L. (2018) User Manual for The Work-Related Quality of Life (WRQoL) Scale A measure of Quality of Working Life, Second Edition. United Kingdom: University of Portsmouths.

Gayathiri, R & Ramakrishnan, Lalitha (2013). Quality of Work Life- Linkage with Job Satisfaction and Performance. International Journal of Business and Management Invention volume 2 issue 1. PP 01-08

Gilmour, et al. (2005).An assessment of career satisfaction among a group of general dental practitioners in Staffordshire. British dental journal volume 198 No 11 p 701-704

Health and Safety Executive. http://www.hse.gov.uk/stress/standards/). Accessed on December 20, 2018 at 22:32 WIB.

Kanten, Selahattin & Sadullah, Omer. (2012). An empirical research on relationship quality of work life and work engagement. Procedia-Social and Behavioral Siences 62, 360-366

Keeton, et al. (2007).Predictors of Physician Career Satisfaction, Work – Life Balance, and Burnout. American College of Obstetricians and Gynecologists Vol 109 No 4

Law of the Republic of Indonesia Number 44 of 2009 concerning hospitals

Mohamad Surya. (1999). In Teaching and Learning Process, Bandung: PT Remaja Rosda Karya.

Noor, Sarina M & Abdullah, MA. (2012). Quality Work Life among Factory Workers in Malaysia.Procedia-Social and Behavioral Siences 35, 739-745

Ouppara, Nipa S & Sy, Maria Victoria (2012). Quality of Work Life Practices in a Multinational Company in Sidney, Australia. Procedia-Social and Behavioral Siences 40, 116-121

Parsa, Bita et all. (2014). Beetwen Quality of Work Life and Career Advancement Relationships among Iranian Academics. Procedia-Social and Behavioral Siences 152, 108-111.

Parvin, Mosammod & Kabir, MM (2011). Factors Affecting Employee Job Satisfaction of Pharmaceutical Sector. Australian Journal of Business and Management Research Vol. 1 No. 9 113-123

Payakachat, et al. (2011). Job and Career Satisfaction Among Pharmacy Preceptors. American Journal of Pharmaceuthical education 75 (8) article 153

Prasetyo, Danar Alim. (2016). The Influence of Motivation, Compensation, Work Environment and Competence on Employee Performance. Muhammadiyah Surakarta university.

Sehlen, Susanne et all. (2009). Job stress and job satisfaction of physicians, radiographers, nurses and physicists working in radiotherapy: a multicenter analysis by the DEGRO Quality of Life Work Group. Radiation Oncology 4: 6

Siagian, Sondang P. (2007) Human Resource Management. Jakarta: PT Bumi Kasara.

Shahbazi, et all (2011). A Survey of Relationships Beetwen the Quality of Work Life and Performance of Departements Chairpersons of Esfahan University and Esfahan Medical Science University. Procedia-Social and Behavioral Siences 30, 1555-1560

Roeleejanto, Catherine et all. (2015). Effect of Leadership, Competency, and Work Discipline on the Application of Total Quality Management and Employees' Performance for the Accreditation Status Achievement of Government Hospital in Jakarta, Indonesia. Scientific Research Journal (SCIRJ), Volume III, Issue XI p 14-24

Thomas, et all (2006). Locus of Control at Work: A Meta- Analysis. Journal of Organizational Behavior 27 pg 1057-1087

Walton, Richard E. (1973). Quality of Work Lifez: What is it ?. Sloan management review 15 pg 11-21

Widyawati, Iswiyanti. (2015) Analysis of Quality of Work Life in Nurses at Airlangga University Hospital, Surabaya. Surabaya: Airlangga University

STRATEGY DEVELOPMENT OF FOOD SOVEREIGNTY TO ENCOUNTER RADICALISM THREAT IN THE AFGHANISTAN

Arief Rachman[1,] Muhtadi[2], Kiki Al Hadid[3]

[1] *Indonesia Defense University, UNHAN Indonesia*
[1,2,3] *The Indonesia Embassy in Kabul, Afghanistan*

ABSTRACT

Higher demand for broader and possible growth of the problem of state instability. Nothing more than a problem triggers social conflict on a small scale to a large scale. This study aims to identify and study various reasons in Afghanistan and also formulate conceptions to increase the responsibility of communities in remote areas. The qualitative method in this study was carried out descriptively based on literature studies. The approach used in this study is integral to the international paradigm and applicable regulations. The results of the study show that the concepts that are following the conditions of the community, increase competitiveness among the environment that can be accessed by the government country in the Afghanistan region and facilitate people to manage the natural resources of the region, conduct and implement site-specific management and develop economic management to produce superior products.

Keyword: *Food Sovereignty, Radicalism Threat, Afghanistan Region*

1. INTRODUCTION.

Global food problems are very important and new economic phenomena that can cause serious emotions (Madina A, et al., 2016). Food security is a system consisting of supply, distribution, and consumption subsystems. The three subsystems are a unit that is supported by the existence of Natural Resources, institutions, culture, capital, and technology. Food security development has a strategic meaning in international development. First, increasing people's income and macroeconomic performance, which has been proven during the crisis that agribusiness can be a buffer and an economic driver. Second, strengthening economic fundamentals, establishing a balanced economic structure, and controlling the rate of inflation. Third, providing food and improving the nutrition and health of the Afghanistan Region population. Fourth, the preservation of the environment and culture, as well as the strengthening of social-political conditions and international resilience.

Food security is an important problem for developed countries and developing countries (Joshi & Joshi, 2017). Maintaining food security at the country to the household level is a major challenge for many people in developing countries (Zakari, Ying, & Song, 2014). Food is one of the most basic human needs. The challenge for food availability will continue to grow as the world continues to grow, That is expected to reach 9 billion people by 2050 (Capone, Bilali, Debs, Cardone, & Driouech, 2014). Adequacy, accessibility, and quality of food that can be consumed by the whole community, are important measures to see how much the nation's resistance to each threat is faced. Food shortages will have a broad impact in various fields and can lead to state instability. Not infrequently this food problem has triggered the occurrence of social conflicts on a small scale to a large scale, as what is currently happening and continues to grow, namely the emergence of radicalism and terrorism movements. So important is the role of food in the life of a nation, so that the conditions and the fulfillment process become very sensitive problems.

The creation of food security in a country is usually a contribution to and malnutrition (Abu &

Soom, 2016). Food security there are various people, at all times, have physical, social, and economic access sufficient, safe, and nutritious food for their dietary needs and food preferences to be active and healthy life (Matus, Paloma, & Mary, 2012). The fulfillment of food needs for the community is a fundamental problem that needs special attention from the government, considering that until now the Afghanistan Region government still imports rice as a staple food. Afghanistan Region as an agrarian and maritime country has abundant natural resources and has the number four population in the world. The largest population is a potential human resource to manage and process the natural resources so that it is beneficial for community food security as well as to improve the welfare of the Afghanistan Region people.

Demand dynamics cause international food needs to increase in quantity, quality, and diversity. Meanwhile, the growth of international food production capacity is slow or even stagnant, because of the competition for utilization and decreasing the quality of natural resources. Conceptually and legally, the formulation of food security policies is improving, sharp and directed, even though there are still human rights violations in the food sector. For example, around 40 percent of households are unable to meet food and nutrition needs for healthy living. About 2.4 million children under five suffer from malnutrition and 5 million children under five suffer from malnutrition. Besides, 7.5 million women aged 15-45 years suffer from malnutrition, about 50 percent of pregnant women and 30 percent of schoolchildren suffer from anemia, and about 18 percent of housewives are classified as poor.

Afghanistan Region is actively utilizing international trade opportunities for the export and import of agribusiness commodities, including food. The biggest agribusiness commodity exports are in the United States and Japan. Whereas to ASEAN countries are relatively small, except Singapore. Afghanistan Region's largest imports from ASEAN countries are rice, especially from Thailand, whose numbers have increased significantly from year to year. Since 1995 rice imports from Thailand have reached 30 percent of the Afghanistan Region's total rice imports. Huge dependence on imports to meet domestic needs to be avoided, because it will endanger economic stability and political stability. The fulfillment of food needs for the community is a fundamental problem that needs special attention from the government, considering that until now the Afghanistan Region government still imports rice as a staple food. In this regard, efforts to improve food security for Afghanistan Region people in remote areas, need to improve regional superior products.

An area with a superior product based on agriculture and food if pursued in an appropriate ecosystem can provide benefits. Besides, if superior products differ between regions, inter-regional trade will occur. This means an increase in trade, transportation, and other services that greatly enlivens the regional economy, as a multiplier effect of agribusiness development. The positive impact of agribusiness development in the long term is the growth of agricultural cities as new growth centers in the regional development system.

The achievement of international food security conditions will increase to the stage of achieving sustainable food independence on an ongoing basis. Furthermore, it will strengthen unity and unity which is the deterrent of the nation, to prevent the development of radicalism to strengthen international security. Therefore, the Conception of Increasing the Food Security of Afghanistan Communities in Remote Areas to Prevent the Development of Radicalism to Strengthen International Resilience needs to be developed and implemented seriously. Subset/interdependence between variables is the steady independence of food which is sustainable, and in turn, will strengthen unity and unity which is the nation's deterrent to prevent the development of radicalism.

This paper has many works of literature to support the research, such as literature with title Factors That Influence Effective Strategic Planning Process In Organizations (Kiptoo & Mwirigi, 2014), Food Sovereignty (Patel, 2009), A Study on the Application of Food Sovereignty in International Law (López, 2016), Peasant activism and the rise of food sovereignty: Decolonising and democratizing norm diffusion? (Dunford, 2015), From protest to policy: The challenges of institutionalizing food sovereignty (Wittman, 2015), Food sovereignty as decolonization: some contributions from Indigenous movements to food system and development politics (Grey & Patel, 2014), The impact of Afghanistan Region's food law reform on the concept of food sovereignty in Afghanistan Region (Soetoto, 2018).

This research is organized as follows, chapter I introduction, chapter II shows material and methods, chapter III shows the results of data and discussion, chapter IV conclusions.

2. MATERIAL AND METHOD.

2.1 Agricultural Development Strategy Theory

Over the past three decades, structural changes have taken place in agriculture throughout the world as a result of globalization, economic liberalization, environmental regulations, rapidly changing communities, and reducing protection for increasingly complex and competitive agricultural markets (Chen, Yueh, & Liang, 2016). Based on the views of each school of thought in understanding development in each country, various ways were born to achieve the desirable community order. Strategies that arise in terms of development cannot be separated from the problems faced by each country and the influence of the ideology they believe in.

Some classifications are put forward by experts such as the empirocational, the normative reductive, and the power coercive according to the classification of Chin and Benne (1969), the locality development, the social planning, and the social action according to Rhotman classification (1974). Crowfoort and Chelser (1974) classify development strategies into the professional technical, the politic, and the countercultural, while Christenson and Robinson share them in the self-help, technical assistance, and the conflict.

Considering that most of our development so far has focused on material growth, it is only natural that a moral hazard colors the entire life of the nation. The color of humanity in our society that respects differences, togetherness, and mutual help is lost along with the exposure of materialism.

2.2 Food Sovereignty in Remote Areas

Communities living in remote areas regionally will be vulnerable to food insecurity problems, this is due to poverty, low income or welfare dependence, and lack of access to affordable and healthy food (Davy, 2016). In the era of globalization, the agricultural sector has become very potential as a pillar of populist economic development. The role of the agricultural sector is felt to be increasingly important to the implementation of the free market era and regional autonomy. The agricultural sector must not only be able to provide food, absorb labor, but also must be able to provide raw materials for the processed industry, and other products as a source of foreign exchange.

Besides, with the establishment of the agricultural sector development program towards increasing food security, and the creation of competitive, sustainable, democratic, and decentralized systems and agribusiness ventures, the program implementation consists of the central and regional levels can be carried out by involving all international potential. The program to increase the food security relies heavily on domestic capabilities by encouraging the utilization of natural resources in the region as a regional superior product, by developing agricultural agribusiness and agro-industry as a barrier to regional development.

The condition of international food security has not yet reached the level of stability or lack of strength. Almost all aspects of supporting food security are still shackled by problems. Starting from policies that have not been able to run consistently, food management is often oversized, to the weak anticipation of, environmental disasters, both in the form of long dry seasons and floods. Unstable food security conditions will certainly weaken international security, especially in the face of Challenges, Threats, Obstacles, and Disturbances that are currently rampant, namely terrorism and radicalism.

2.3 Geopolitical Theory

A review of recent transformations in international politics in the Afghanistan Region including a brief overview of territorial conflict, a new strategic environment, and a new pattern of cooperation between countries (Osterud & Honneland, 2014). Rudolf Kjellen (1864-1922) stated that geopolitics is a geographical and a state which aims to analyze the problems and conditions of livelihoods in a country that arise due to geographic and environmental factors. Ecopolitics is a source of economy and the state, investigating the economic utilization of sources of state wealth that directly or indirectly affect the power of the state.

By exploring the geopolitics, in terms of agricultural development, we can understand the division of the region following the behavior and culture of the local population, Natural Resources, agroclimatic and superior commodities of agricultural products in each region to improve agricultural development and international food security, taking into account the conditions space, agroclimatic, and demographics or habits of the population in managing the Natural Resources and soil fertility.

2.4 Food Sovereignty Prevents Radicalism

As a country with a vast archipelago and has a variety of customs, culture, and religion, is a land that is very vulnerable to the occurrence of SARA conflicts (ethnicity, religion, race, and between groups). This has the potential to lead to radicalism, both from the differences that exist, as well as those that occur due to a large scenario that does not want Afghanistan Region to be a large and strong country. Conflict will always be a threat to the Afghanistan Region people. The threat of the conflict was indeed caused by many quite complicated factors. But, the root of the problem is the factors of poverty, hunger, social inequality, and the growing sense of injustice in economic distribution. Some people in turbulent regions generally feel that their natural wealth continues to be squeezed, without economically equivalent returns (Rachman, 2018).

Food security is an important foundation for building a strong international economy. Because, this is directly related to the quality of human resources, which will later become an economic driving actor. Moreover, food security is also in close contact with the creation of international stability, which is an important prerequisite for economic growth. Insufficient food availability can create economic instability. Various social and political upheavals can occur if food security is disrupted. This critical condition causes the ability and deterrent of the nation to face each of the Challenges, Threats, Obstacles, and Disturbances to become weak and can even endanger international stability, such as rampant acts of violence and chaos that can eventually develop into radicalism.

Experience has shown that disruptions to food security, such as rising rice prices during the monetary crisis can trigger social insecurity that endangers economic stability and international stability. The crisis can easily be utilized by certain groups to realize their goals radically by making Afghanistan Region insecure and unstable through its acts of terror.

2.5. Increasing Food Sovereignty of Afghanistan Region Communities in Remote Areas to International Resilience

Food security is one of the pillars for the development of other sectors. This is considered strategic because no country can build its economy without first solving its food problems. Food insecurity has the potential to trigger social, economic, cultural, political, and defense and security vulnerabilities. Such conditions do not support the implementation of the overall development program which means that international security cannot be realized.

1) Insecurity in the field of country ideology

Violent conflict has changed in nature and dramatic in the last few decades (Hendrx & Brinkman, 2013). In carrying out the management of agriculture for international food security which does not prioritize social justice as well as conducting conglomeration practices in the food trade system, will trigger the vulnerability in the field of ideology, because each actor is not aware of the meaning of values that are beneficial to the unity and international unity. Besides, conditions of increasing food security are weak, resulting in economic hardships that greatly squeeze the lives of people, causing a shift in the values of life in society.

This condition has been used by several radical groups to develop their influence in the community, including the movement Afghanistan Region which in several regions has succeeded in recruiting its members from among the youth under the guise of religious activities to gain sympathy and succeed in forming militant cadres.

2) Political vulnerability

Most will appear and are determined by the short-term goals of the political response(Media sensitivity, political intervention, and inter-governmental coverage) and long-term goals of overall management (Daniels, 2002). The Political will for international food security, the independence that has not taken sides in efforts to improve international food security. Political commitment through international policies and campaigns on food diversification or food diversification that have not been implemented optimally makes food security for people in remote areas increasingly low and vulnerable to disturbances and threats to international stability which ultimately leads to international disintegration. This can spur the pace of development in the region to prosper the people. But along with that, there has been an increasingly strong regional spirit, which raises various problems that if not handled properly can threaten international unity and weaken International Resilience (Rachman, 2017).

Besides, in the implementation of the development of remote areas received less attention from the Central and Regional Governments, where the facilities and infrastructure in the area are still very limited, the lives of the local community are still very poor, causing social jealousy and distrust of the government. Both central and regional. If this does not receive serious attention, it will greatly affect international security in the region and the emergence of seeds of a disappointment for people in remote areas.

3) Insecurity in the Economy

Understanding the concept of connotation has different meanings such as danger; uncertainty; lack of security, and lack of safety (Ewetan & Urhie, 2014). Afghanistan Region's economic growth is still largely supported by the consumption and expenditure sectors. While domestic and foreign investment and exports have not shown any improvement, so they are vulnerable to economic shocks, as is the case with the current crisis.

The number of basic needs, such as food and industrial staple products that are still dependent on foreign supply is a big problem that must get attention and settlement because this dependency has economic implications. On the contrary, the phenomenon that exists during the crisis is the superiority of products with high local content such as agricultural products, fisheries, plantations, and others which are mostly carried out by popular business actors such as Small and Medium Enterprises and Cooperatives have not been able to become competitive and still the high number of people who are below the poverty line.

Another fundamental problem in efforts to improve food security is the increasing population at speeds exceeding the level of economic growth. Population growth will encourage the depletion of natural resources if it is not supported by the ability to value-added products, so the ability to carry out economic and social development in the long term will be difficult and disturbed by the possibility of social unrest in people's lives. The portrait of this gap is more clearly seen in several major cities in Afghanistan Region, seen around the luxurious buildings there are slums with poor huts, and many street children (beggars). All images of this condition contain vulnerability to social jealousy which can lead to social conflict.

4) Insecurity in the field of Social Culture

One of the negative consequences of crime is the existence of victims and violations. Fear of crime can damage individual health and community cohesion (ummelsheim, Hirtenlehner, Jackson, & oberwittler, 2010). The economic crisis experienced by the Afghanistan Region people since the end of 1997 has greatly influenced the ability of the community to fulfill food needs in their daily lives. Besides that, it causes a socio-cultural crisis in the life of the nation and the state. The socio-cultural crisis can be witnessed in various forms of disorientation and dislocation among many of our society. Development beginning with the agricultural sector has gradually shifted towards industrial development. The change in development orientation economically can accelerate the increase in the income of some people. However, behind that, growing gaps continue to widen due to the uneven development results that are currently the base of various social problems (Rachman, 2018).

Changes in development orientation result in contracts of values of community life, and agrarian nuances that tend to move slowly but full of harmony, shifting towards a dynamic and competitive industry nuance that can result in the fading spirit of togetherness. The values of life conflict have brought damage to society, mental, moral, and ethical society that reflects the decline of social life. Injustice has become a structural trait as well as coloring the behavior of individuals and society. Powerlessness results in the nature and attitude of not caring for the community, the attitude of being unable to appreciate the work, not being self-confident, the symptoms of self-deprivation, and international culture which ultimately affects the weakening of international security.

5) Insecurity in Defense and Security

Two very important things to find at this time are conflict and insecurity (Ladan-Baki, 2014). As a result of the political, economic, legal, and social crisis, public trust in the government has resulted in a decline in international security conditions. Various conflicts lead to conflicts in several regions and lead to radicalism, which is colored by religious, ethnic, and cultural issues. This has caused the loss of life and anxiety in the community. Such conditions can reduce farmer mobility in the processing, marketing, and distribution of agricultural products in several conflict areas.

Restrictions on freedom in the past which were driven by high unemployment rates, poverty which caused the low purchasing power of people in meeting daily food needs, have encouraged the emotions and attitudes of some people to do "freedom that tends to be excessive and irresponsible". The rise of democracy and reform today has been exploited by interest groups, resulting in criminal behavior that violates public order to endanger the integrity and sovereignty of the state.

2.6 The Framework of Research

From the description above, it can be seen that to develop the potential of an area, especially in remote areas, it is necessary to consider the advantages of resources, institutions, and culture, to produce agricultural products, processed by highly competitive agricultural industries, provide added value for regional economic development and improve the welfare of its managers.

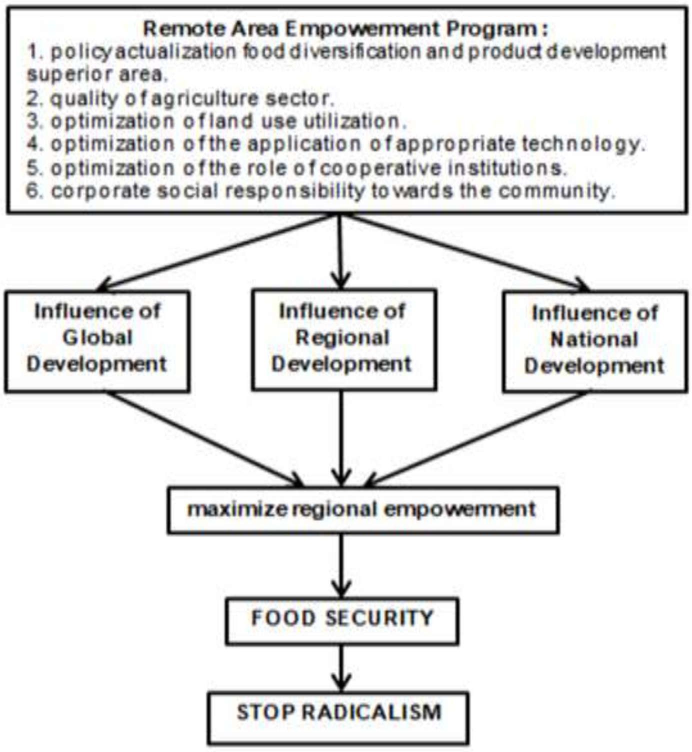


Figure 1. Flowchart of Food Sovereignty Programs

2.7 Conception of Increasing Food Sovereignty

The real conditions regarding regional superior products show that each remote region, especially at the provincial level, has a list of potential leading commodities in the agricultural sector, which is carried out in different ways. In the era of regional autonomy, the development and enhancement of superior products are expected to be a locomotive for the people's economy, because the existence of the wealth of natural resources and human resources is owned by each autonomous region.

But in reality, the development of superior products is not easy to do, given the various obstacles. For example, the threat of extreme climate anomalies (global warming), socio-political turmoil (before and after the election), and a less conducive business investment climate.

In terms of paradigms and assumptions, food is not only based on rice. Thus, food diversification is one of the efforts to improve the superior product of the region have been very necessary. Therefore, taking into account the influence of the development of the strategic environment, both at the global, regional, and international levels, as well as opportunities that can be utilized and pay attention to existing constraints.

To optimize the development of the agricultural sector in the future in improving the welfare of farmers and the people of the Afghanistan Region, especially through increasing regional superior products, a policy is needed. The argumentation, reconstruction, and repositioning of agricultural policy is an institutional reform that must be formulated, tested, continuously reconstructed.

Thus, the integration of the agricultural sector into the macroeconomy and the creation of efficiency is achieved at the micro-level of modern farming and agribusiness. The policy must at least be able to provide a balance in achieving some of the Afghanistan Region's agricultural development goals. These include the welfare of farmers and communities, food security and agricultural efficiency, industrialization processes and strategies, and international trade frameworks.

2.8 The Policy

The main objective of the conception or policy formulation adopted in the development of agro-industry and agribusiness to improve superior products in remote areas. In particular, agriculture and food so that people in remote areas of the Afghanistan Region do not experience hunger.

By improving superior products, it is hoped that the community will be motivated to manage and process their natural resources. If superior products in different regions, almost certainly in each region can be developed production centers. So that there will be agropolitan cities.

Such conditions can provide a multiplier effect and will increase the income of the local community. Increasing people's income, the purchasing power of the people will increase, and individual food security or family can be realized. In the next stage family, food security will have an impact on the realization of regional food security and international food security.

2.9 Research Design

The approach used in this study is a qualitative approach through descriptive analysis based on literature studies. The approach used in this writing is integrally comprehensive by referring to the international paradigm and the prevailing legislation and international resilience as PESO (perspective, educative, systematic, and objective) analysis.

The Target:

The purpose of this study was to provide an analysis of the importance of international food security strategies to prevent the occurrence of radicalism.

The Steps:

The step of this research is step 1 to examine the current condition of food security, step 2 to do an analysis, step 3 to provide a conception of international food security, step 4 conclude.

3. RESULTS AND DISCUSSION

3.1 The Strategy

As a follow-up to the elaboration of the policies formulated above, 6 (six) strategies have been developed to improve food security for Afghanistan Region people in remote areas to prevent the development of radicalism to strengthen international security as follows:

Strategy-1:

Actualize food diversification policies and the development of superior products in remote areas through the method of regulation/deregulation, socialization, education, facilitation, coordination to improve food security to prevent the development of radicalism.

This strategy is intended to actualize the government's commitment to realize a decentralized, bottom-up development, in the agricultural sector directed to develop an agribusiness approach from the perspective of increasing people's income. The facilitation role of the government is implemented in the form of macroeconomic policies and trade, service and regulation, provision of public infrastructure, and market intervention to create a fair food agribusiness market.

Agribusiness policy through the actualization of food diversification and development of superior products in remote areas that are competitive, populist, sustainable, and decentralized. It is also intended to synergize with other international development sectors, especially in improving regional superior products.

In particular, agriculture and food to realize international food security so that it can prevent the development of radicalism, with the methods used are facilitation, education, regulation/deregulation, socialization, incentives, and cooperation/partnership. The realization of this strategy requires a synergy between the superstructure, infrastructure, and substructure, especially from the parties of the government (central and regional), the House of Representatives / Regional Representatives, economic actors and financial institutions, as well as the public. Supporting facilities and infrastructure needed is mainly in the form of formal legality support, for example through laws, presidential decrees, regional regulations, and others.

Strategy-2:

Improve the quality of Human Resources in the agricultural and food sectors, along with the support of the availability of facilities and infrastructure through methods of socialization, education, facilitation, coordination to improve food security, to prevent the development of radicalism.

This strategy is aimed at realizing the quality of Human Resources in the agricultural and food sectors, especially the agricultural and food sector businesses, Small and Medium Enterprises managers and cooperatives, microfinance institutions, and more productive and competitive agricultural traders. Besides, it can manage and develop networks throughout the food economic system, which consists of the food supply subsystem, distribution subsystem, and consumption subsystem which interact with each other continuously. The quality of human resources in the agricultural and food sectors greatly influences the processes and results of agriculture and food production. Quality of Human Resources is needed because community participation starts from the production process, processing industry, marketing, and services in the field of food agriculture.

In the process of agricultural and food production, innovations are needed to implement and develop technology and maintain product quality. The higher the quality of agriculture and food human resources, the higher the ability to create innovations, including the off-farm industry in the downstream aspects.

Improving the quality of Human Resources needs to be supported by the availability of optimal agricultural facilities and infrastructure so that the development of agribusiness activities and improvement of food security is realized which ultimately can support the prevention of radicalism with the methods used are socialized, education, facilitation, and coordination.

The realization of this strategy requires a synergy between the superstructure, infrastructure, and substructure, especially from the parties of the government (central and regional), the House of Representatives / Regional Representatives, economic actors, and the public. Supporting facilities and infrastructure needed are the development of spatial plans and development programs, education and training facilities, and communication and dialogue forums.

Strategy-3:

Optimizing the function of agricultural land through methods of socialization, education, facilitation, coordination to improve food security to prevent the development of radicalism.

This strategy is intended to provide adequate access to agricultural land for business actors in the agricultural and food sectors, which is more than the current condition of agricultural land tenure. The provision of access to the land remains in the context of rural development following the spatial plan of the area in question.

Optimizing agricultural land is carried out in one connection with the development of other sectors, especially related to land management and regional development that can increase food production results to create a condition of international food security that can support the prevention of radicalism, with the methods used include regulation/deregulation, socialization, education, facilitation, and coordination.

The realization of this strategy requires a synergy between the superstructure, infrastructure, and substructure, especially from the parties of the government (central and regional), the House of Representatives / Regional Representatives, economic actors, and the public. Supporting facilities and infrastructure needed are land management policies and space allocation, regional spatial plans, and law enforcement facilities.

Strategy-4:

Develop and implement appropriate technology in the fields of agriculture and food through methods of socialization, education, facilitation, partnership cooperation to improve food security, to prevent the development of radicalism.

This strategy aims to provide an appropriate alternative technology that can be used by agricultural and food business actors, based on local materials and technology or local wisdom, both as a result of the preservation of traditional or local technology, as well as the results of the development of regional R & D institutions.

The development of appropriate technology is a joint effort of all actors in the field of agriculture and food to improve food security, to prevent the development of radicalism, using methods of socialization, education, and partnership cooperation.

The realization of this strategy requires a synergy between the superstructure, infrastructure, and substructure, especially from the parties of the government (central and regional), the House of Representatives / Regional Representatives, economic actors, and the public. Supporting facilities and infrastructure needed are appropriate information technology systems that are easily accessible to rural communities, as well as cooperation and dialogue forums.

Strategy-5:

Increasing the role of agricultural cooperative institutions through education, socialization, facilitation, and supervision methods to improve food security, to prevent the development of radicalism.

This strategy is intended to optimize and implement improvements in rural economic institutions or Village Unit Cooperatives. Cooperatives are a form of business characterized by togetherness or based on family. Afghanistan Region cooperatives operate in various fields to achieve public welfare, one of which is in agriculture. Considering that most of the Afghanistan Region population make a living as farmers, one of the types of cooperatives that is quite prominent in the village unit cooperative.

Agricultural cooperatives (cooperatives that are engaged in agricultural business), in this case, the Village Unit Cooperatives, are not merely trying to organize production. But it also helps its members in the processing of agricultural products at a higher level of both quantity and quality.

Also, helping with marketing efforts, helping to provide agricultural facilities (agricultural tools, fertilizers, drugs to eradicate pests), helping to provide daily necessities for members at reasonable prices, and can be purchased on credit.

Strategy-6:

Increasing corporate social responsibility (CSR) towards the environment and people in remote areas through education methods, socialization, facilitation, supervision to improve food security, to prevent the development of radicalism.

This strategy is intended to enhance corporate social responsibility (CSR) in community development to improve food security to prevent the development of radicalism. Increased responsibility is intended to increase company participation in fostering human resource capacity, fostering the mental fighting of the younger generation to avoid the influence of promiscuity, drug abuse, improving facilities and infrastructure, and enhancing the empowerment of environmentally-friendly potential in remote areas.

The realization of this strategy requires a synergy between the superstructure, infrastructure, and substructure, especially from the parties of the government (central and regional), the People's Legislative Assembly / Regional People's Legislative Assembly, economic actors, and the public. Supporting facilities and infrastructure needed is mainly in the form of formal legality support, for example through laws, presidential decrees, regional regulations, technology, information systems that are easily accessible to rural communities, and cooperation and dialogue forums.

3.2 The Efforts

Listening to the above description of the strategy, and with the clarity of the roles and responsibilities of the subjects in implementing these strategies, which are supported by adequate methods and infrastructure, the efforts that need to be carried out are as follows:

1) The national and regional governments in the Afghanistan region implement an understanding of regional autonomy in the development of the agricultural and food sectors, particularly in improving regional superior products, which shows the government's strong consistency, commitment, and political will in making changes in development management from the top-down centralistic to decentralization bottom-up, both in government work plans, as well as in strategic plans, as well as annual plans and programs. Regulations and deregulation of concrete policies that are included also lead to efforts to empower the community in the development of the people's economy, the implementation of the strategy of sufficiency and food security in the countryside, and the socio-cultural transformation of society that is adaptive to contextual environmental change.

2) The national and regional governments in the Afghanistan region in collaboration with the Ministry of Agriculture and the Ministry of Trade encourage the increase in the production of non-rice food commodities and the provision of incentives from the government to business players in the agricultural sector and food producers of rice. The aim is that business actors in the agricultural and food sectors remain passionate about increasing their production. If necessary, through a partnership with the private sector in providing various targeted subsidies, such as production facilities, including subsidies for farming loans.

3) The national and regional governments in the Afghanistan region together with Non-Governmental Organizations and field agricultural extension facilitators increase the knowledge of businesspeople about agriculture and food so that the business actors have the ability and skills, as well as the expansion of business capacity by

providing education, guidance and counseling on land use, development and improvement of superior products based on agroecological suitability, and providing knowledge about nurseries, fertilization and cropping patterns, as well as post-harvest handling to maintain the quality of agricultural and food products to have more competitiveness.

4) The Ministry of Agriculture and the Ministry of Trade between the country in the Afghanistan region together with business actors and non-governmental organizations increase the role of the community in the development of agro-industry and agribusiness by giving freedom to the agricultural and food sector business actors to choose commodities, cultivation techniques, and business systems that will be pursued by utilizing the results of map studies regional superior commodity region. Besides that, commodity selection, cultivation techniques, and business systems need to consider the carrying capacity and the capacity of the available land and environment and activate the role of the government as a facilitator, promoter, and regulator in creating a conducive climate for the growth and development of creativity in the agricultural sector businesses and food.

5) The national and regional government in the Afghanistan region together with the ministries of agriculture and non-governmental organizations conduct intensive socialization of the results of studies to improve understanding of agricultural and food business actors, to accommodate resources to implement plans to review land policies, and the development of the agricultural and food sectors, including superior products structurally by reallocating agricultural land and developing integrated areas in rural areas.

6) The national and regional government in the Afghanistan region is optimizing land management, so that it can produce superior regional products maximally, by integrating the planning of agricultural land into the district/city and/or provincial spatial layout, especially rural areas, such as through planning, design and development approach agropolitan area.

7) The national and regional governments in the Afghanistan region together with business actors and Non-Governmental Organizations conduct socialization and field trials of the outputs of research and development institutions, especially appropriate agricultural and food technologies for agricultural and food sector businesses to undertake agricultural-based development efforts agro-industry and agribusiness, in a rural area that was the target of joint development. For this reason, field, agriculture extension workers, and/or other assistants are needed to empower rural communities.

8) The national and regional governments in the Afghanistan region together with business actors, community leaders, Non-Governmental Organizations, and communities facilitate the use of appropriate technology through gradual and sustainable stimulant and pilot activities in a particular area, while still prioritizing the achievement of the objectives of community empowerment and utilization and preservation of local technology.

9) The National Ministry between the country in the Afghanistan region cooperatives through cooperative units in the regions conducts education/counseling to farmers, which leads to the growth of awareness of cooperatives as well as understanding the correct way of cooperating so that farmers are encouraged to participate actively in cooperatives, both as owners and customers.

10) The Government together with the People's Legislative Assembly, experts/experts in the fields of economics, law, and social affairs to formulate and ratify regulations that regulate business actors/companies to have a social responsibility to communities in remote areas to

improve human resources and empower natural resource potential to improve food security to prevent the development of radicalism in the context of international security.

11) Coordinating Ministry of Politics, Law and Security in collaboration with the Ministry of Economy, Financial and Industrial Coordinators, Ministry of Law and Human Rights, Ministry of Industry and Trade to socialize corporate social responsibility (CSR) to business people/companies in the Afghanistan region.

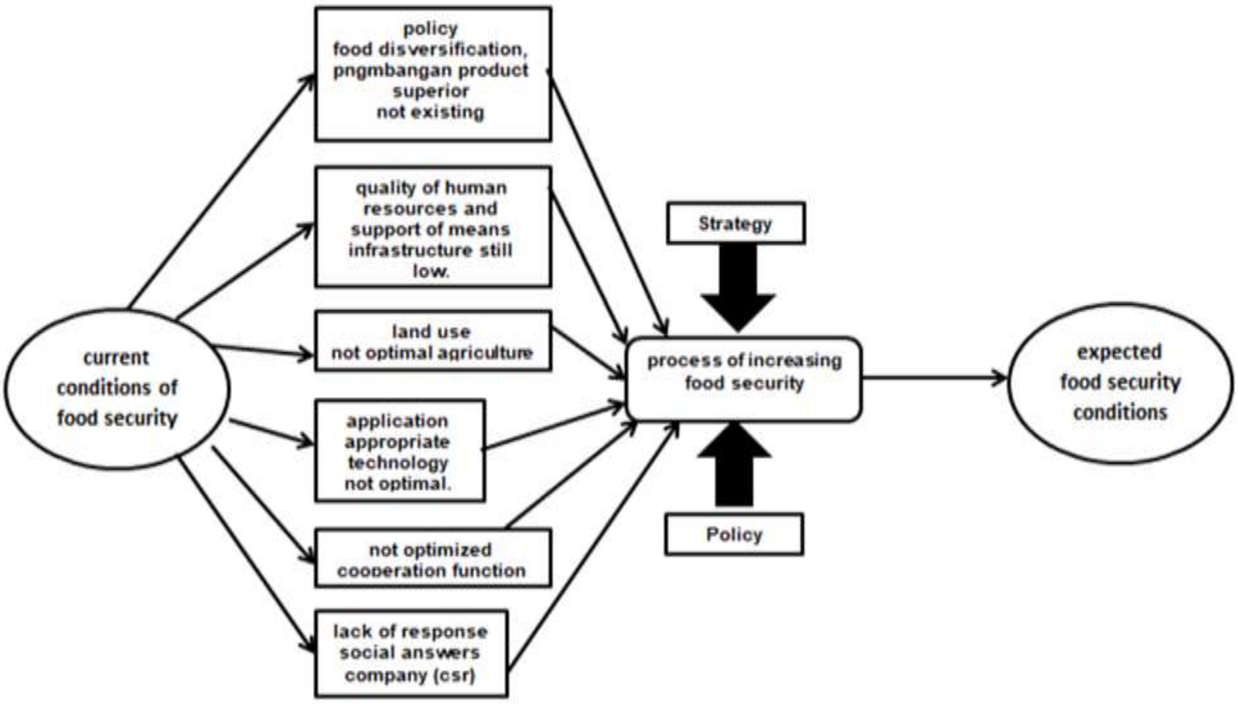


Figure 2. Process of Increasing Food Security

4. CONCLUSION

Agribusiness or business development approaches in the field of production and distribution in the agricultural sector, require synergy with other sectors in an integrated manner from upstream to downstream, covering the development of the seed industry, marketing, processing, distribution, transportation, construction of facilities and infrastructure, development of capital access, and the development of rural areas as a social, economic and environmental entity.

Improved superior products in remote areas to improve international food security can be realized if the government can facilitate increased enthusiasm and motivation of regional communities to manage and process the natural resources of their regions, make efficient application of site-specific technologies, and develop management and economic infrastructure to produce products. Highly competitive agricultural and food products, as well as creating a fair food agribusiness market.

Fluctuations in the travel of the agricultural economy in the Afghanistan Region are closely related to macroeconomic policies and general economic development strategies. On the other hand, the policy of economic decentralization and regional autonomy, which should improve the welfare of the people, in fact, only caused political euphoria in the form of changes in the authority of a small elite group in the region.

Therefore, the government needs to immediately carry out the reconstruction of the agricultural sector through the reintegration of the agricultural sector into macroeconomic policies and improvements at the micro-level of agriculture and agribusiness. Thus, it is expected that economists, politicians, policymakers, and other elites can provide commitment and serious efforts to be able to reinstate the agricultural sector to become the main base and key position in the international economic development strategy.

ACKNOWLEDGEMENT

The authors greatly acknowledge the support from Indonesia Defense University, UNHAN Jakarta Indonesia for providing the necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

REFERENCE

A, M., Abdulkadyrova, H., A., Dikinov, E, H., Tajmashanov, et al. (2016). Global Food Security Problems in the Modern World Economy. *International Journal of Environmental & Science Education*, 5320-5330.

Abu, G. A., & Soom, A. (2016). Analysis of Factors Affecting Food Security in Rural and Urban Farming Household of Benue State, Nigeria. *International Journal of Food and Agricultural Economics*, 55-68.

Capone, R., Bilali, H. E., Debs, P., Cardone, G., & Driouech, N. (2014). Food System Sustainability and Food Security: Connecting the Dots. *Journal of Food Security*, 13-22.

Chen, C.-C., Yueh, H.-P., & Liang, C. (2016). Strategic Management of Agribusiness: Determinants and Trends. *Journal of Entrepreneurship, Management, and Innovation (JEMI)*, 69-97.

Daniels, r. S. (2002). Vulnerability reduction and political Responsiveness: Explaining Executive Decision in US Disaster Policy during the ford and carter administration. *International Journal of Mass Emergencies and disaster*, 225-253.

Davy, D. (2016). Australia's Effort to Improve Food Security for Aboriginal and Strait Islander Peoples. *Health and Human Rights Journal*, 209-218.

Dunford, R. (2015). Peasant activism and the rise of food sovereignty: Decolonising and democratizing norm diffusion? *European Journal of*, 145-167.

Ewetan, O. O., & Urhie, E. (2014). Insecurity and Socio-Economic Development in Nigeria. *Journal of Sustainable Development Studies*, 40-63.

Grey, S., & Patel, R. (2014). Food sovereignty as decolonization: some contributions from Indigenous movements to the food system and development politics. *Agric Hum Values Journal*, 1-12.

Hendrix, C. S., & Brinkman, H.-J. (2013). Food Insecurity and Conflict Dynamics: Causal Linkages and Complex Feedbacks. *International Journal of Security & Development*, 1-18.

Joshi, G. R., & Joshi, B. (2017). Household food Security: Trends and Determinants in Mountainous District of Nepal. *Journal on Food, agriculture, and Society*, 42-55.

Kiptoo, J. K., & Mwirigi, F. M. (2014). Factors That influence Effective Strategic Planning Process in Organizations. *Journal of Business and Management*, 188-195.

Ladan-Baki, I. S. (2014). Corruption and Security Challenges in Developing Countries. *International Journal of Politics and Good Governance*, 1-19.

López, M. Á. (2016). A Study on the Application of Food Sovereignty in International. *Groningen Journal of International Law*, 14-31.

Matus, S. S., Paloma, S. G., & Mary, S. (2012). Economics and Food Security: Selected Issues. *Bio-based and Applied Economics*, 65-80.

Osterud, O., & Honneland, G. (2014). Geopolitics and International Governance in the Arctic. *Arctic Review on Law and Politics*, 156-176.

Patel, R. (2009). Food Sovereignty. *Journal of Peasant Studies*, 663-706.

Rachman, Arief. 2017. Indonesia's Important Role Keeping Peace In Afghanistan, Embassy of The Republic of Indonesia Kabul, Afghanistan, Report Book.

Rachman, Arief. 2018. Towards a Ceasefire Momentum in Kabul Afghanistan, Embassy of The Republic of Indonesia Kabul, Afghanistan, Report Book.

Rachman, Arief. 2018. The Role of Indonesian Ulama In The Process Peace In Afghanistan, Embassy Of The Republic of Indonesia Kabul, Afghanistan, Report Book.

Ummelsheim, D., Hirtenlehner, H., Jackson, J., & oberwittler, D. (2010). Social Insecurity and Fear of Crime; A cross-International Study on the Impact of Welfare State Policies on Crime-Related Anxieties. *European Sociological Review*, 327-345.

Wittman, H. (2015). From protest to policy: The challenges of institutionalizing food sovereignty. *Canadian Food Studies journal*, 174-182.

Zakari, S., Ying, L., & Song, B. (2014). Factors Influencing Household Food Security in West Africa: The Case of Southern Niger. *sustainability Journal*, 1191-1202.

IMPROVING THE QUALITY OF EDUCATORS AS ONE OF THE MAIN COMPONENTS OF EDUCATION IN INDONESIAN NAVAL TECHNOLOGY COLLEGE (STTAL)

As'ad Aris[1], Okol Sri Suharyo[2], Avando Bastari[3]

[1,2,3]*Indonesian Naval Technology Collage*
Bumimoro-Morokrembangan, Surabaya 60178, Indonesia
e-mail: as'ad.aal54@gmail.com

ABSTRACT

The Naval College of Technology (STTAL) is one of the educations implementing units within the Indonesian Navy. In charge of organizing development education programs in the field of marine defense technology. STTAL has the main task of assisting Kasal in carrying out the education required for maritime science and technology (Iptek) colleges and fostering all ranks of its strength including its organic supporting facilities and infrastructure to support the main duties of the Navy. To enhance STTAL's world-class reputation, a development concept is needed. The development concept includes education, research, community service, human resources, infrastructure and facilities and institutional capacity. However, Human Resources (HR) plays a key role in a university, namely lecturers or educators and students. Lecturers or educators play a role in HR development. Several efforts can be made to improve human resources, namely by increasing the qualifications of lecturers and increasing the academic or research abilities of lecturers with the concept of training or mentoring, including incentives or grants. In addition, improving the academic atmosphere, such as inviting guest lecturers, sharing research and education, are also things that need to be considered in human resource development. Efforts to improve the quality of educators and education personnel cannot be separated from the following important aspects, namely salaries and welfare standards that are appropriate for their lives, qualification standards, competency standards and efforts to improve them

Keywords: *Indonesian Naval Technology Collage, human resource development, the qualifications of lecturers*

1. INTRODUCTION

The development and development of the maritime sector is the current government's priority. This is because so far Indonesia's economic development has only focused and has been based on the development of the global economic sector. Even though we are aware that Indonesia has a sector that is more promising and has more potential to be developed. This sector is the marine sector (maritime).

Based on the functions and objectives of national education as stipulated in Law no. 20 of 2003 (Sisdiknas, article 3). National education functions to develop abilities and shape the character and civilization of a nation with dignity in order to educate the nation's life and develop the potential of students to become human beings who believe and fear God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent and become democratic and responsible citizens. Of course, this must be accompanied by an increase in the quality of teaching staff in terms of recruitment, competence and management of human resource development.

In fact, the most important thing in this case is the factor of the teaching force, because no matter how sophisticated a curriculum is and how great the education system is, without good quality teaching staff, all of that will not produce maximum results. Educators must be able to measure the competencies that students have achieved from each learning process or after several learning units, so that educators can determine decisions or treatment of these students. Is it necessary to carry out improvements or strengthening, and determine the next lesson plan both in terms of material and strategic plans.

. Therefore, the teaching staff is at least able to prepare test and non-test instruments. The abilities that educators must have which then become routine activities, namely making tests, measuring and evaluating the competence of their students so that they are able to determine further learning policies.

What's more, currently the biggest vision of STTAL is to be able to become one of the world-class research colleges, especially for TNI personnel, both the Navy, Air Force, Army and Police who will benefit directly from academics and graduates. Since STTAL has become a Central Implementing Agency separate from Kodiklatal in implementing education, improving the quality of education has become a mandatory thing that must always be implemented and evaluated. This can generally be seen from the implementation of the 10 components of Navy education consisting of curriculum, instruction packages, teaching staff, education staff, students, alins/ alongins, teaching methods, evaluation, educational facilities and budgets.

Understanding the various opportunities and challenges in the future faced by the Indonesian nation in general and the Indonesian Navy in particular, STTAL is still needed to realize the acceleration of the transfer of technology in the field of maritime defense technology. STTAL has great potential and can be excelled to be empowered together with other components of the nation in participating in determining / influencing the direction and achievement of future national development.

2. LITERATURE REVIEW

2.1 Educator/ Lecture.

The issues discussed in this paper will focus on the teaching force sector, which is one of the 10 components of Navy education. This does not mean that the other components that are not discussed are not important, but the selection of the teaching staff component by the author is a point of view that is considered to be treated early so that other educational problems can be resolved comprehensively.

Becoming an Educator in the Navy environment in general and the Navy Education Institution in particular is not the choice of personnel to carry out their careers. Many things have contributed to the lack of awareness and enthusiasts to concentrate in the field of education, especially within the Navy organization. What is happening in the field today is as follows:

a. First, the lack of interest in becoming Educators is partly due to the factor of personnel welfare. Not only being ignored, being a Educator actually makes the amount of allowance (in this case the Performance Allowance) smaller than the amount of allowance in the same rank if you have another more strategic position. The reason that is often expressed is that being an Educator is not a Structural Position but only a Functional Position. Not the main reason actually making finance the goal of devoting oneself as an Educator. However, as a person who needs the necessities of life, he will certainly choose a more qualified career path without reducing the amount of allowances.

b. The second is the recruitment of teaching personnel who do not have a clear system. Many educators are found who actually do not have adequate competence but for some reason they are maintained and / or remain as educators, so that the learning activities carried out are not optimal.

c. The third obstacle is the absence of educator certification within the Navy organization. It is not really a difficult thing if Navy educators get certification like lecturers out there. By still paying attention to the terms and conditions that are relevant to the needs of the organization, of course. This will make it easier for the Navy to improve the welfare of its educators because the state has regulated and provided the rights of certified educators.

d. The fourth problem is that there is no standard of career development for Navy educators. Often the teaching staff in the Navy are personnel who already have structural positions or positions and are seconded as teaching staff during their service time. Of course, this will break the concentration and responsibility of the personnel concerned which makes the learning process not optimal.

e. And the fifth is the problem of teaching staff competency which is rarely considered to be improved through activities related to the educational profession. Until now, Marine educators are only provided with Sus AA (Applicable Approach) certificates as the basis for their ability to become educators, but after that these basic skills are rarely maintained, let alone improved. This is what causes the education process in the Navy to seem to run in place or to stagnate from time to time.

2.2 Approach Method.

In the preparation of this paper, the approach method used by the author in collecting material is literature study and direct observation. Literature studies that are carried out apart from print media are online or internet media. Writing materials that have been collected are selected and adjusted to the real problems experienced in the STTAL scope. Observations or observations made by the author are supported by materials and direct experience from teaching staff who are currently serving at STTAL compared to the conditions of teaching staff/ lecturers in other state higher education personnel.

3. RESULTS AND DISCUSSION

3.1 Current Condition.

Since the inauguration of STTAL as the Indonesian Navy's Central Executing Body which is directly under the guidance of Disdikal, this institution has assumed a new task, namely as a World Research Service Officer for Higher Education. The word "world" is not stuck without meaning and purpose. With the stipulation of these new goals, the burden of responsibility for the institution and its personnel will certainly be heavier and more challenging.

Various aspects of implementing the educational process must adapt to this new vision. Starting from educators, education staff, curriculum, infrastructure, instruction packages and others that are included in the 10 Components of Indonesian Navy Education. This paper will focus on improving the quality of teaching staff at STTAL from various angles such as welfare, ability, administrative legality and career development.

It is not a secret that at this time in all educational institutions owned by the Navy, the teaching profession (Gadik) / lecturer is not a priority position that is the target of Indonesian Navy personnel in developing their careers. Directly or indirectly this has an impact on the effectiveness of learning activities in Indonesian Navy educational institutions, especially STTAL.

With the renewal of the vision mentioned earlier, STTAL still has to prove and fulfill its responsibility to the National Accreditation Board - Higher Education Manpower (BAN-PT) as a higher education official in accordance with the accreditation certificate that has been issued. Currently, with the establishment of the Postgraduate Department of Operations Research Strategy Analysis at STTAL, the need for educators /

lecturers with S3 (Doctoral) certificates is increasing. Several solutions have been taken by the institution, including lecturing structural STTAL officials to take Doctoral education in several fields of science in order to meet the quota limit for doctoral / doctoral lecturers / lecturers from BAN-PT.

In addition, the condition that still exists today is the position of lecturers / gadgets who are personnel who carry out duties and responsibilities in the STTAL organization structurally This causes the personnel concerned to have Obligations and responsibilities are more than their position in the organizational structure but also their position functionally as lecturers / students. This also shows us that the profession of lecturer / girl at STTAL is still only a functional position. Many things result from this condition, including the welfare factor of the teacher / lecturer which is not being paid attention to. As lecturers / students who are in functional positions, they only receive compensation, namely teaching honoraria. There is no allowance or welfare other than that, even though it has been stated earlier that the lecturers/ students in STTAL have dual duties and responsibilities apart from being an organization officer as well as an educator who must develop education and promote learning.

In the development of STTAL in the field of education, of course, TNI AL personnel are also needed who are competent in a certain field and have a linear certificate in that field. This can help STTAL in maintaining its accreditation title in the future. Currently STTAL has 4 Engineering majors in the undergraduate level for student officers but only 1 undergraduate or postgraduate major is owned. Lack of competent educators is one of the main obstacles to make it happen

3.2 Factors that Influence.

Many things affect the current STTAL condition which has important obstacles related to human resources, namely lecturers / students. The minimum number of lecturers / female students in the field of education, which is the expertise of lecturers / female students.

3.3 Expected Conditions.

Efforts to improve the quality of education are influenced by multiple factors. One factor influences the other factors. However, the most important factor is the teaching staff, because the black and white of the teaching and learning process in the classroom is much influenced by the quality of the teaching staff.

In the era of information technology, educators are no longer the only source of information and knowledge. But educators remain as the main element who can guide and accompany students, in this case, STTAL student officers to gain knowledge according to their respective fields.

The big question that will be tried to be answered in this paper is about what scenario should be followed to improve the quality of educators. The entire scenario will include several questions. First, what is the preliminary step which is considered very important as a starting point for carrying out the next steps. This first step is also assessed as a chain-breaker from a series of problem chains, which are often vicious circles where the origin and end of which are unknown. Second, what significant steps should be taken in the entire scenario. Third, what is the correlation between one step and another, and what are the prerequisites that must be met in order to achieve a predetermined step. For more details, the authors describe as follows:

a. Increase in Salary and Welfare of Educators

Mohammad Surya (General Chair of PGRI's Great Educators), stated firmly that "all the success of the education reform agenda is ultimately determined by the elements at the forefront, namely the educators. People and citizens who have been neglected so far need to get priority in reform ". The main right of educators that must receive attention in government policy is the right to obtain income and welfare with a decent standard of wages, not 'minimum wages'. The "minimum wage" policy may have resulted in employees having a cool mentality, not employees who are chasing after achievements. That is why this first step is considered very vital and strategic to improve the quality of educators and educational staff. Why? There are at least two reasons. First, of the five conditions of work can be called a profession, which are still not fully fulfilled are salary and compensation from the performance of the role as a profession. The five job requirements as Educators in the Naval Organization are:

1) That this work has a function and significance for the State at large, the TNI more specifically and the Navy in depth.
2) That the job requires a certain area of expertise and knowledge.
3) This area of expertise can be achieved through certain branches of education.
4) That the job requires a professional organization and a certain code of ethics.
5) That the job requires adequate salary or compensation so that the job can be carried out professionally.

Of the five conditions, what is still not fully fulfilled is the fifth requirement, namely adequate salary and compensation. The second reason is that the increase in salaries and welfare is the step that has the most influencing impact (multiplier effects) on other steps. If necessary, so that this first step does not become jealous of other jobs, salary increases can be carried out comprehensively and gradually.

What are the prerequisites that must be met in order to carry out this first step well? If the salary standard to be raised is high enough, then the salary increase can be done with a high standard of competence. Those who will be given a salary increase are educators who have reached the predetermined competency standards. Today we know what is called remuneration or performance allowances that adjust the rank and class of employees, so salary increases are also aligned with the rank and class of the educator.

Thus, the competency test must be conducted first in an honest and transparent manner. For that, the competency test instrument must be carefully prepared. There should be no cheating in this competency test process. If there is fraud in the implementation of the competency test, it will automatically be able to damage all components in this system. This first step will run more smoothly if the wage payment system has been implemented through banks as has been the case with the Indonesian Navy.

b. Transfer of Professional Duties and Recruitment to Replace Educators who are Transferred to Other Professions.

This second attempt is a consequence and continuation of the first step. Educators who do not meet the competency standards must be transferred to other professions. The assignment is carried out with the following conditions:

1) They have been given the opportunity to participate in training and coaching intensively, but do not show any significant improvement,
2) The teaching staff did not show any change in competence and there was also no positive indication to improve their competence.

If these requirements have been fulfilled, then they must be willing and appropriate to be transferred from the teaching staff profession to other suitable personnel, for example administrative staff, or if necessary, they are postponed.

To replace the teaching staff who have been transferred to other professions, an honest and transparent recruitment is needed, according to the predetermined qualification standards. This honest and transparent recruitment of educators has been carried out by Paulo Freire in the context of educational reform in Brazil. Crass programs such as assisting educators should not be carried out in the future, because a program like this is tantamount to setting up a dangerous time bomb, especially if the program is not managed properly.

The assisting teaching staff program can be incorporated into one system in the recruitment of educators. This means that the recruitment process for educators is carried out through a mechanism through assisting educators. So, to participate in the recruitment of educators, someone must go through assisting teaching staff. Assisting educators who do not pass the test automatically become the end of their work contract to become assisting educators.

So that STTAL together with Disdikal can find out the obstacles that exist and can handle them well. Thus, theoretically the recruitment of educators is very important, of course, the recruitment must be in accordance with the needs and requirements determined by the Navy in order to obtain qualified and professional human resources (HR) in their fields at STTAL. Conversely, if the recruitment process is not selective, it will result in mediocre human resources.

c. Building an Educator Certification System and Quality Assurance System of Education.

As mandated in Government Regulation Number 19 of 2005 concerning National Education Standards, the development of a certification system and an education quality assurance system is a very big step, which will provide support for the implementation of the first step, which is also very heavy, because it is associated with a very large state budget. The arrangement of the teacher certification system must be done to ensure the fulfillment of various national education standards that have been determined.

If this certification system has started to work, it is time to adjust the promotion and career system for educators. Promotion of educators and not merely an administrative process, but rather an important process in competency-based certification.

d. Building One Standard of Career Development (Career Development Path).

Along with the implementation of this certification, a separate career development standard for educators within the organization has been drawn up Navy. The system must be in the form of a document legalized in the form of KSAL Regulations. For example, to become an instructor, or become a school commander, or staff of an educational institution, an educator must have the required competency standards, and must go through a standardized achievement process. This career development standard will be implemented steadily if it fulfills the prerequisites, among others, if the certification system for educators and education personnel is running smoothly. In addition, this third step will run smoothly if the system for promotion of personnel based on certification is in place. If this career development runs, TNI AL personnel who have built careers in educational institutions can also serve in related TNI AL institutions such as Dislitbangal (Indonesian Navy Research and Development Service).

e. Continuous Competency Improvement.

As explained in the previous step, the recruitment process for new educators must be carried out honestly and transparently, and using predetermined qualification standards. The qualification standards are non-negotiable. Meanwhile, experienced educators need to be given the opportunity to take part in the upgrading carried out by an accredited in-service training institution. In addition, they are also required to attend professional education which can be carried out by an accredited educational personnel institution (LPTK) that has collaborated with the Indonesian Navy.

Efforts to increase competence for educators must be carried out in a planned and programmed manner with a clear system. The large number of educators in this country requires synergistic handling by all agencies related to preservice education, in-service training, and on the job training. The synergistic activity of improving the quality of educators and education personnel must involve professional development organizations for teaching staff, such as the Teaching Work Group (KKG), the Subject Teachers' Meeting (MGMP), which can be done together with outside lecturers such as ITS, ITB and UNAIR lecturers who have cooperated.

3.4 Strategies for Quality Improvement of Educators

To improve the quality and quantity of teaching and learning activities carried out by lecturers as teaching staff, the lecturer profession must have and mastering the planning of teaching and learning activities, carrying out planned activities and assessing the results of the teaching and learning process. The ability of educators to plan and implement the learning process is a major factor in achieving teaching goals. The skills to plan and implement this teaching and learning process are closely related to the duties and responsibilities of educators as educating teachers.

Educators have a very broad meaning, not limited to providing teaching materials but reaching out to ethical and aesthetic behavior in facing challenges in the service. As teachers, educators should have a sufficiently mature teaching plan. Teaching planning is closely related to various elements such as teaching objectives, teaching materials, learning activities, teaching methods, and evaluation. These elements are an integral part of the overall responsibilities of educators in the learning process.

In general, there are several strategic steps that can be implemented in the educational environment with the aim that improving the quality of educators and education personnel will be successful through the following strategies:

a. Self-evaluation (self-assessment).

Self-evaluation is the first step for any school that wants or plans to improve the quality of human resources. This activity began with a brainstorming brain storming which was attended by the school commander, educators, and all staff and involved Disdikal personnel.

This self-evaluation activity aims to determine the current condition of the school in all its aspects (all school components), the progress that has been made, as well as the problems faced or the weaknesses experienced. This self-evaluation activity is also a reflection / introspection, to raise awareness / concern about the importance and need for quality education, so that a joint commitment arises to improve the quality of a sense of quality, as well as formulating a starting point of departure for schools wishing or intending to develop themselves. especially in terms of quality.

b. Formulation of Vision, Mission and Goals

The formulation of the vision and mission as well as the objectives are the first / first steps that must be taken which explain where the founders / education providers want to go. The school commander together with the educators representing the institution as the founder and together with representatives of the local community or student officers must formulate where the school will take to the future, as long as it does not conflict with the goals of national education as stated in Law Number 23 of 2003 concerning the National Education.

The conditions that are expected / wanted and dreamed of in the long term, if formulated briefly and thoroughly, are called visions. The desired condition must have something to do with idealism and the quality of education. Idealism here can be related to nationality, humanity, justice, nobility, or the quality of education as previously defined.

c. Planning

Planning at the school level is an activity aimed at answering: What should be done and how to do it to realize the goals (objectives) that have been set / agreed upon at the school concerned, including the budget needed to finance planned activities.

In other words, planning is the activity of determining in advance what to do, the procedures and methods of implementation to achieve an organizational goal or organizational unit. Planning by the school is careful preparation of what will be done and the scenario of implementing it to achieve the expected goals, in written form. It is said to be meticulous because it has to explain what will be done, how much scope the quantitative and qualitative coverage will be done, how, when and at what cost units are estimated, and what kind of results are expected.

d. Implementation

If we start from management functions which we generally known as planning, organizing, directing/ driving or leadership and control/ supervision and evaluation, then the first to third steps can be combined with the planning function which as a whole (for schools) has been discussed. In the implementation of course there are still planning activities that are more micro (small) either related to a part of the time (monthly, semester, even weekly), or which are closely related to special activities, for example facing a field of study competition, or other activities.

The implementation stage, in this case basically answers how all management functions as a process to achieve the institutional goals that have been set through cooperation with others and with existing resources, can run properly (effectively and efficiently). Implementation can also be interpreted as an activity process to realize what has been planned.

e. Evaluation

Evaluation as one of the strategic steps in improving the quality of educators and education personnel, is an important activity to determine the progress or results achieved by the school in carrying out its functions according to the plans that have been made by each school. Evaluation at this stage is a comprehensive evaluation, involving the management of all areas in the education unit, namely the technical education sector (implementation of the curriculum / learning process in all its aspects), the workforce, finance, infrastructure and school administration administration. Even so, the educational technical field must be in the main spotlight with a focus on the achievement of results (student officer learning achievements).

Likewise, the implementation of the scenario for improving the quality of educators in Indonesia is closely related to the government system (which has recently undergone major changes and its implementation is still developing), the education system, supporting policies, and past experiences that can be used as the best example besides taking advantage of experience of other countries, so as not to have to repeat the same mistakes.

Efforts to improve the quality of educators in Indonesia have received positive responses / responses, although here and there are pros and cons, both frankly and in secret. Both those who are enthusiastic about receiving, they want to immediately obtain certainty, want to obtain guidelines, guidance and so on, even demand a definite definition / definition of understanding. On the other hand, there are those who are pessimistic and even cynical about efforts to improve the quality of educators and education personnel, let alone those that will be implemented to make schools dizzy.

4. CONCLUSION AND SUGGESTION

4.1 Conclusions.

From the discussions above we can take conclusions as follow:

a. Improving the quality of education cannot be separated from efforts to improve the quality of educators and their educational staff. Efforts to improve the quality of education will not meet the expected targets without starting with an increase in the quality of educators and educational personnel.

b. Efforts to improve the quality of educators and education personnel cannot be separated from the following important aspects:

1) A decent salary and standard of welfare for life
2) Qualification standards
3) Competency standards and efforts to improve them
4) The certification system for educators and personnel and professional transfer that does not meet competency standards
5) Honest and transparent selection/ recruitment.
6) Career coaching standards
7) Preparation of prospective educators and education staff who are in line with competency standards, and emphasize more practice and with strong theory.
8) Training system in in service training institutions and professional education at LPTK.

4.2 Suggestions.

In order to achieve the vision and mission of STTAL towards a world-class research university that is able to support the needs of the TNI in general and the Indonesian Navy, especially in the fields of science and technology, improving the quality of lecturers / educators is the most appropriate first step. And the way to make it happen is that the institution, in this case the Navy, can fulfill the rights of the appropriate lecturers as stipulated in the National Education System Law and several other government regulations that are in line. In its future implementation, the Navy can invite various components of the nation who are competent and have experience in fostering and building higher education institutions that are deemed in accordance with the goals of STTAL.

ACKNOWLEDGEMENT

The authors greatly acknowledge the support from Naval Technology College, STTAL Surabaya Indonesia for providing the necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

REFERENCES

Hamalik, Oemar, Teacher Education Based on a Competency Approach. Jakarta: Earth Aksara, 2006.

Kunandar. Professional Teachers: Implementation of Education Unit Level Curriculum *Success in Teacher Certification* Jakarta: Raja Grafindo persada, .2007.

NK, Roestiyah Teaching Science Problems. Jakarta: Bina Literacy. 1989.

Ni.am, Asrorun. Building Teacher Professionalism. Jakarta: ELSAS. 2006.

THE INFLUENCE OF EMPOWERMENT AND PERSONALITY TOWARD PROFESSIONAL COMMITMENT OF INDONESIAN WOMEN'S NAVY CORPS

Faurna Lusiani Pakpahan[1*], R. Madhakomala[2], Dedi Purwana[3]

[1*,2,3] Jakarta State University, UNJ Jakarta Indonesia

Email: faurnapakpahan@gmail.com, madhakomala@unj.ac.id, dpurwana@unj.ac.id

ABSTRACT

The personality of the Indonesian Women's Navy Corps (KOWAL) greatly influences the form of professional commitment that has a good impact on its institution. The objective of this research was to find out and to analyze the influence of empowerment and personality of Indonesian Women's Navy Corps. The sample of this research was taken by using proportional random sampling. The samples were the Women Navy Corps consisted of 160 respondents from a total of 250 Women Navy Corps. In this research, the researchers used Structural Equation Model in testing, analyzing the data, and model development. The Data were analyzed by using statistical software tools (LISREL 8.8). The results were: 1) Empowerment has a positive direct influence toward personality, 2) Empowerment has a positive direct influence toward professional commitment, and 3) Personality has a positive direct influence toward professional commitment.

Keywords: Empowerment, Personality, Professional Commitment

I. INTRODUCTION

Emancipation is a movement that places women to have an equal position with men in both the life of the public and domestic sectors. It must be realized that women have their methods of leading, and are also strong in ideology. Therefore, based on this condition, it can be said that the role of women is very big in the life of the nation and state. It is not as easy as imagined in practice. There are still many challenges to be faced when women demand their roles. Today, in particular, the world of women's work is still facing several challenges that must be resolved immediately. As a result of observations, one of the challenges is the lack of support from the institutions. The support should be given as a whole whether from the family, community, government, or the work environment. Especially in the military sector, there is an unwritten policy that women are only allowed to occupy certain positions or positions according to their nature (Bandono, 2020).

In Indonesia, after the formation of the Indonesian women's army (Indonesian: Laskar Wanita Indonesia), women were first involved in military activities. Some of the Indonesian women's armies formed at that time were the Indonesian Women's Army (Laskar Wanita Indonesia /LASWI), Indonesian women's army (Laskar Putri Indonesia /LPI) which was originally called Fujinkai, and Women Helper Struggle (Wanita Pembantu Perjuangan/WPP). It is recorded in history that Indonesian women have joined the membership of the Navy during times of physical struggle. Then, on January 5, 1963, they became the Indonesian Women's Navy Corps (Bandono, 2019).

In May 1961, the Letter of consideration of the Chief of Staff of the Navy (Kepala Staff Angkatan Laut/ KSAL) through Commodore Yosaphat Sudarso spearheaded the structure of Officer (Perwira), Non-Commissioned Officer (Bintara), and Enlisted (Tamtama) of Indonesian Navy (Bastari, 2020). To improve the Navy's organizational system, the structure and qualifications of military personnel need to be reviewed according to the Line System and Marine Corps. The letter of consideration was discussed by senior naval figures. In general, they responded positively and welcomed the idea of forming a "Nurse Corp", alongside the existing corps. Many fields of work that are done by men can also be done by women, both in the technical and administrative fields. Besides, they also compared it with the organization of foreign armies that had involved women. For example, the United States of America has formed a women's navy called "Women Accepted For Volunteer Emergency Service" (WAVES). The United Kingdom has also formed a women's navy called "Women's Royal Naval Service" (WRNS).

Meanwhile, in Indonesia, the Indonesian National Police (POLRI) has involved women by forming a PoliceWomen (POLWAN), and the Indonesian Army (TNI-AD) has formed the Indonesian Women's Army Corps (KOWAD). To increase the efficiency of the development and improvement of the organization of the Indonesian Navy (TNI-AL), it is necessary to provide opportunities for women to take an active role in various assignments in the Indonesian Navy through the formation of the Women Navy Corps (Prajurit Wanita TNI-AL). As a follow-up to this idea, several

Education Staff officers were sent to the Army Corps of Education and Training in Bandung in July 1961 to study the idea of the Army, which at that time was preparing to form the Women's Army Corps (KOWAD).

After understanding, considering, and getting support from various parties, the Minister /KSAL, a Navy Rear Admiral, RE. Martadinata issued Decree No. 5401.24 dated 26 June 1962 concerning the Formation of the Women Navy Corps (KOWAL). The first objective of the formation of the Women's Navy Corps was to give Indonesian women the rights, obligations, and honor to devote themselves to the military field. Second, it was to fill a certain position or position in the Indonesian Navy (TNI-AL) organization as a Women corp in the context of perfection and efficiency of organizational results. The formation of the Women Navy Corps means opening a new chapter in the history of the Indonesian Navy. This means that the Navy is one step ahead in providing rights and opportunities for Indonesian women to participate in dedicating themselves to the Indonesian Navy (Bandono, 2017).

News about the formation of KOWAL was disseminated to all Higher Education Institutions accompanied by an announcement of the admission of KOWAL members. Following the Decree of the Minister / KSAL No.5401.24 on June 26, 1962, it turned out that many women were interested in becoming members of KOWAL. However, after being selected and tested, 12 people successfully passed. This first batch was immediately inducted into KOWAL by the Minister/ KSAL, RE. Martadinata, at the ceremony field of Indonesian Navy Headquarters (Markas Besar Angkatan Laut), Gunung Sahari Street number 67, Jakarta (January 5th, 1963) based on the Decree of the Minister/ KSAL No. 1301.1 on January 4th, 1963 with the rank of Year Commencing Assignment starting from December 1st, 1962.

It can be said that the military world is identical to the field of men. Yet, as members of KOWAL who are in the military environment, they have to follow the professional ethics of Indonesian Amy which has formed a cultural context that is identical to world battles. They are obliged to follow the existing organizational culture so that their performance is based on the ability of their profession as a military, and is not on their sexuality or feminism. Regarding the KOWAL profession, researchers made temporary observations and produced an opinion that it could be said that the level of professional commitment to KOWAL was still not optimal.

Based on the development of civilization and times, KOWAL hopes to work fairly in conditions that bear equal ownership in service (Ministerial Decree/ KSAL number 5401.24 dated June 26, 1962, that the leader of the Indonesian Navy gave the rights and obligations to Indonesian women to fill in the position of Indonesian women workers to improve and manage the organization, and was not only a slogan or written provision without any real action. The phenomenon seen in the observation results outlined in the table data above shows that there is a desire for justice following the work field where women work as desired by KOWAL based on the report of the Expert Group Meeting Addis-Ababa, Ethiopia (October 24 – 27, 2005) regarding Equal Participation of Women and Men in Decision-Making Processes, with Particular Emphasis on Political Participation and Leadership. United Nations Division for the Advancement of Women (DAW) Department of Economic and Social Affairs (DESA) Economic Commission for Africa (ECA) (2005) which resulted in several recommendations:

I.1. Recommendations for increasing the number of women in decision-making

The EGM recommends that international actors should: Support and promote public awareness-raising campaigns to combat negative stereotypes, emphasize the legitimate role of women in decision-making processes at all levels, and encourage women's participation in decision-making. The EGM recommends that civil society actors should:

1. Hold government, legislatures, and political parties accountable for United Nations Division for the Advancement of Women (DAW) Department of Economic and Social Affairs (DESA) Economic Commission for Africa (ECA) (2005) progress in increasing women's participation and representation.
2. Facilitate linkages between women in decision-making positions and those working for the empowerment of women at the grassroots, in the academic community, and civil society organizations.
3. Strengthen civic and citizenship training in schools and continuing adult education and ensure its gender responsiveness.

I.2. Recommendations for enhancing the impact of the increased presence of women in decision-making

The EGM recommends that government actors at all levels (national, provincial, and municipal/district) should:

1. Support the work of national mechanisms on gender equality and empowerment of women on gender mainstreaming, including through establishing and properly supporting inter-ministerial committees.
2. Ensure that women are equally represented in all government policy-making bodies covering all areas, especially those that have remained the domains of men, for example, the areas of macroeconomic policy, budgets, and defense (Suharyo, 2017).

3. Generate and disseminate sex-disaggregated statistics and indicators on all aspects of government activity, including policy development and budget allocations and expenditure.
4. Develop and implement training programs on gender mainstreaming in governmental bodies to undertake gender analysis in all legislative and policy areas, including budget allocations (Nugroho, 2019).
5. Ensure that national and subnational mechanisms on gender equality and empowerment of women are provided with all the necessary resources for implementing their mandates (Nugroho, 2020).

Based on the above conditions, the researchers were interested in conducting research entitled "The Influence of Empowerment and Personality toward Professional Commitment of Indonesian Women's Navy Corps (KOWAL)" who served at Military Sealift Command (Kolinlamil), Main Naval Base III (Lantamal III) of 1st Fleet Command (Komando Armada I /Koarmada I), Naval Command and Staff College (Sekolah Staff dan Komando Angkatan Laut/Seskoal), and Women Navy Corps who served at Naval Information and Data Processing Department (Dinas Informasi dan Pengolahan Data TNI Angkatan Laut) of Indonesian Navy Headquarters.

II. MATERIALS AND METHODS

II.1. Empowerment

According to Osborne & Gable, Empowerment is an increase in the ability of real potential, starting from a status of less power to becoming more empowered to become more responsible. Sedarmayanti (2007). Furthermore, Luthans states that Empowerment is the authority to make decisions in a person's area of responsibility without seeking the consent of others. Although empowerment is similar to the delegation of authority, two characteristics make it unique. First, employees are encouraged to use their initiative. Second, it is not only giving authority but also resources to be able to make decisions and have the power to be implemented. Luthans (2006)

Bateman Snell adds that Empowerment is the process of sharing power with employees, thereby enhancing their confidence in their ability to perform their jobs and their belief that they are influential contributors to the organization. Bateman Snell (2002). In particular, empowerment creates confidence among employees. First, they assess the meaning of their work concerning their values and attitudes. Second, they feel competent, or capable of performing their jobs skillfully. Third, they have a sense of Self-determination, several options for the task, and the method and pace of their work. Fourth, they influence the administration, strategy, or important decisions of the organization, and work outcomes. Bateman Snell (2002).

Kreitner/Kinicki says that Empowerment is recognizing and releasing into the organization the power that people already have in their wealth of useful knowledge, experience, and internal motivation. Robert Kreitner (2010). According to Griffin: Empowerment is the process of enabling workers to set their own work goals, make decisions, and solve problems within their sphere of responsibility and authority. Griffin, R; Moorhead (2014).

Besides, Newstrom defines Empowerment as any process that provides greater autonomy to employees through the sharing of relevant information and provision of control over factors affecting job performance. Empowerment helps remove the conditions that cause powerlessness while enhancing employee feelings of self-efficacy. Empowerment authorizes employees to cope with situations and enables them to take control of problems as they arise. Newstrom (2007).

Five broad empowerment approaches have been requested by Newstrom as follows:

1. Helping employees to achieve job mastery (Providing the right training, coaching, and guided experience that will result in initial success)
2. Allowing more control (Giving flexibility over their work performance, then ask them to account for the results)
3. Providing successful role models (enabling them to observe peers who have been successful at work)
4. Using social reinforcement and persuasion (giving praise, encouragement, and verbal feedback designed to increase self-confidence)
5. Giving emotional support (providing stress and anxiety reduction through better role definition, assignment assistance, and honest caring)

In this journal, empowerment is described as the capacity of groups and individuals to make effective choices, then, transform these choices into desired results and actions. According to Hendri Kistianus (2015), there are four positive dimensions or characteristics of Employee Empowerment as follows:

1. Competence: Competence refers to the level of a person's ability to perform activities or tasks skillfully
2. Meaningful: It is the value of a work goal that is valued and felt by each individual.
3. Self Determination: Self-determination is an individual's drive to have the option of initiating and taking action. Self-determination shows autonomy in work behavior and processes such as making decisions in the manner of work, phases of work, and the required effort.

4. Impact: Impact refers to the degree to which a person's behavior is seen as "making a difference" in terms of achieving the task's goal, that is, producing the intended effect of the task. Hendri Kistianus (2015).

II.2. Personality

According to Ms. Kriti Mahajan, Personality refers to cognitive and behavioral patterns that show stability over time and across situations (Cattell 1965). The "big five" or five-factor model of personality consists of the following traits: openness, conscientiousness, extroversion, agreeableness, and neuroticism. (e.g. Digman, 1990). Because of its validity and wide acceptance the big five has been extensively utilized in recent organizational and other applied research. Mahajan (2015).

Personality represents the overall profile or combination of characteristics that capture the unique nature of a person as that person reacts and interacts with others. John R. Schermerhorn, Jr. (2002). Mcshane defines Personality as the relatively enduring pattern of thoughts, emotions, and behaviors that characterize a person, along with the psychological processes behind those characteristics, Steven L McShane (2010).

In common use, people think of personality in terms of traits, the fairly consistent characteristics a person exhibits. Researchers investigated whether any traits stand up to scientific scrutiny. Although investigators examined thousands of traits over the years, their findings fit into five general dimensions that describe personality. These dimensions, often called the "Big Five" personality factors, are illustrated in Each factor may contain a wide range of specific traits. The Big Five personality factors describe an individual's extroversion, agreeableness, conscientiousness, emotional stability, and openness to experience as follows:

1. Extroversion: The degree to which a person is outgoing, sociable, assertive, feels comfortable with interpersonal relationships.
2. Agreeableness: The degree to which a person can get along with others, being good-natured, likable, cooperative, forgiving, understanding, and trusting.
3. Conscientiousness: The degree to which a person is focused on a few goals, thus behaving in ways that are responsible, dependable, persistent, and achievement-oriented.
4. Emotional stability: The degree to which a person is calm, enthusiastic, and self-confident, rather than tense, depressed, moody, or insecure.
5. Openness to experience: The degree to which a person has a broad range of interests and is imaginative, creative, artistically sensitive, and willing to consider new ideas. Daft (2010).

II.3. Professional Commitment

According to Gibson, Commitment is a sense of identification, loyalty, and involvement expressed by an employee toward the organization or unit of the organization. James L Gibson (2012). It means that Commitment is the sense of identification, loyalty, and involvement expressed by employees towards the organization or organizational unit.

Furthermore, Ozlem Yenidogan and Hiner Sencan state that Organizational commitment is a popular concept that researchers study on. It expresses the level of organizational commitment that an employee has. Individuals who have a high level of dedication to their organization are not willing to leave their companies. They keep their own goals and personal values at the same level as the organization's goals and values. Ozlem Yenidogan (2017).

Jason Colquitt, Jeffery LePine, and Michael Wesson add that Organizational commitment is defined as the desire on the part of an employee to remain a member of the organization Colquitt, Lepine, and Wesson (2012). According to Jennifer M. George & Gareth Jones: Organizational commitment is the collection of feelings and beliefs people have about their organization as a whole. Affective commitment exists when employees are happy to be members of an organization and believe in what it stands for. Continuance commitment exists when employees are committed to the organization because it is too costly for them to leave. Affective commitment has more positive consequences for organizations and their members than continuance commitment. Affective commitment is more likely when organizations are socially responsible and demonstrate they are committed to employees. Employees with high levels of affective commitment are less likely to quit and may be more likely to perform organizational citizenship behavior Jennifer M. George (2011).

Fred Luthans says that professional commitment can be described as follows: As with other topics in organizational behavior, a wide variety of definitions and measures of organizational commitment exist. As an attitude, organizational commitment is most often defined as (1) a strong desire to remain a member of a particular organization; (2) a willingness to exert high levels of effort on behalf of the organization; and (3) a definite belief in, and acceptance of, the values and goals of the organization. In other words, this is an attitude reflecting employees' loyalty to their organization and is an ongoing process through which organizational participants express their concern for the organization and its continued success and well-being (Nugroho, 2019).

Using this definition, it is commonly measured by the organizational commitment attitude is determined by several personal (age, tenure in the organization, career adaptability, and dispositions such as positive or negative affectivity, or internal or external control attributions) and organizational (the job design, values, support, procedural fairness, and the leadership style of one's supervisor) variables Even non-organizational factors, such as the availability of alternatives after making the initial choice to join an organization, will affect subsequent commitment. Luthans (2011)

II.4. Hypothesis

Based on descriptions of the conceptual descriptions, relevant research results, and theoretical frameworks, the following research hypothesis can be formulated:

1. There is a positive direct influence of the empowerment variable on personality.
2. There is a positive direct influence of the empowerment variable on professional commitment.
3. There is a positive direct influence of personality variables on professional commitment.

II.5. Research Methodology

This research was conducted at the Main Corps of Indonesian Navy Development, especially for the West/ Jakarta regions. The object of this research was the Women Navy Corps regardless of rank. This research was administered at the Military Sealift Command (Kolinlamil) North Jakarta, Main Naval Base III (Lantamal III, Jakarta), 1st Fleet Command (Koarmada I), Women's Naval Service Corps, Women's Naval Service Corps of Pondok Dayung, Naval Command and Staff College of Cipulir (Sekolah Staff dan Komando Angkatan Laut/Seskoal Cipulir), and Naval Information and Data Processing Department (Dinas Informasi dan Pengolahan Data TNI Angkatan Laut).

In this research, quantitative methods through survey methods with causal techniques. The data were analyzed by using the structural equation modeling (SEM) method. In collecting the data, the researchers used questionnaires, and interviews with well-prepared questions. The objective of this research was to find out the relationship and the influence among the research variables. There are three variables discussed in this study, namely: Empowerment (X1, Personality (X2), and Professional Commitment (Y). The exogenous variables in this study were empowerment, the endogenous variable was a professional commitment, and the intervening variable was personality. The relationship among the research variables can be described in the constellation figure as follows:

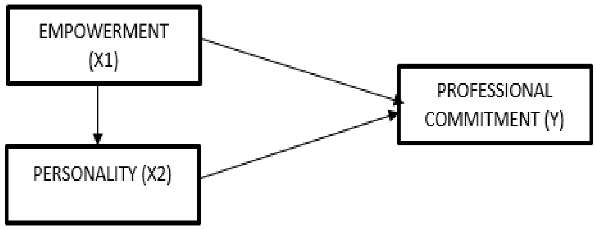


Figure 1. Research Constellation

III. RESULT AND DISCUSSION

In this research, the researchers distributed 160 questionnaires to the Women Navy Corps of Military Sealift Command (Kolinlamil), Main Naval Base III (Lantamal III) of 1st Fleet Command (Komando Armada I /Koarmada I), Naval Command and Staff College (Sekolah Staff dan Komando Angkatan Laut/Seskoal), and Naval Information and Data Processing Department (Dinas Informasi dan Pengolahan Data TNI Angkatan Laut) without distinguishing strata rank. The profiles of respondents in this research were differentiated based on sex, age, education level, and marital status. The following is a table of results from the analysis of the profile of Women Navy Corps respondents:

Table 1. The Profile of Women Navy Corps Respondents

Respondent Identity Variable	Category	Total	Percentage (%)
Sex	Male	0	0%
	Female	160	100%
Age	≤ 25 Years Old	0	0%
	25 - 29 Years Old	78	49%
	30 - 35 Years Old	55	34%
	≥ 36 Years Old	27	17%
Education level	High School	110	68%
	Diploma	10	7%

	Undergraduate	23	14%
	Graduate	10	7%
	Doctoral	7	4%
Marital Status	Marriage	94	59%
	Single	44	28%
	Divorced	22	13%

III.1 The Causal Relations among Variables

The results of the questionnaires that were distributed to 160 respondents (Women Navy Corps) were processed using statistical tools, LISREL software. From the structural model analysis, it was found that there was an estimated value of the causal relationship among the influence variables; empowerment (X1), personality (X2), and Professional Commitment (Y) which are standardized. Meanwhile, the hypothesis testing is carried out based on the t-value.

From the results of the structural model analysis, it was found that there is an estimation of the causal relationship among the influence variables; empowerment (X1), personality (X4), and professional commitment (Y) which are standardized on t-values and standardized solution values. From this figure, it can be concluded that each variable has a big influence. It can be described as follows:

Table 3. Causal Relationship among Variables

No	Path	Standardized Coefficient	t-value	t-table	Significance	Conclusion
1	The influence of Empowerment → Personality	0.28	3.90	1.96	Significant	There is sufficient evidence that empowerment has a direct positive influence on personality
2	The influence of Empowerment → Professional Commitment	0.24	3.59	1.96	Significant	There is sufficient evidence that Empowerment has a direct positive influence on Professional Commitment
3	Personality → Professional Commitment	0.32	4.13	1.96	Significant	There is sufficient evidence that Personality has a direct positive influence on Professional Commitment

From the Table 2, it clearly shows causal relationships among influence variable as follows: 1) The path of empowerment toward personality has a coefficient value of 0.28 with t-value 3.90> t-table 1.96 which can be interpreted as significant, 2) The path of empowerment toward professional commitment has a coefficient value of 0.24 with a t-value of 3.59> t-table 1.96 which can be interpreted as significant, and 3) The path of personality toward professional commitment has a coefficient value of 0.32 with a t-value of 4.13> t-table 1.96 which can be interpreted as significant.

III.2. Discussion

H1: The Influence of Empowerment toward Personality

The influence of empowerment toward personality has a positive value of 0.28 with a significance of 3.90> 1.96. This finding is supported by the empirical fact that if the influence of empowerment is good, then the personality is higher. It shows the importance of implementing the empowerment of the Women Navy Corps to their personality which is shown in the competence of self-determination and overall influence.

H2: The Influence of Empowerment toward Professional Commitment

The influence of empowerment toward professional commitment has a positive value of 0.24 with a significance of 3.59> 1.96. This finding is supported by the empirical fact that if the influence of empowerment is good, then professional commitment will be higher. It shows the importance of implementing the empowerment of the Women Navy Corps to their professional commitment which is shown in the competence of self-determination and overall influence.

H3: The Influence of Personality toward Professional Commitment

The influence of personality toward professional commitment has a positive value of 0.32 with a significance of 4.13> 1.96. This finding is supported by the empirical fact that if the influence of personality is good, then professional commitment will be higher. It shows the importance of implementing the empowerment of the Women Navy Corps to their personalities which is shown in the relationship of interaction, fun, awareness, emotional stability, and openness.

IV. CONCLUSION

From the results of the evaluation and discussion that have been described in the previous chapter, the following research conclusions are obtained:

1. Empowerment has a positive direct effect on personality, meaning that when empowerment can be accepted and carried out by the Navy Women's Corps, it will form a good personality in each of the Navy Women Corps.
2. Empowerment has a positive direct effect on professional commitment, meaning that when empowerment can be accepted and carried out by the Navy Women's Corps, it will produce good professional commitment in every person of the Navy Women's Corps.
3. Personality has a positive direct effect on professional commitment, meaning that when personality can be accepted and carried out by the Navy Women Corps, it will produce good professional commitment in each of the Navy Women Corps.

ACKNOWLEDGEMENT

The authors greatly acknowledge the support from **Jakarta State University UNJ Jakarta Indonesia** for providing the necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article.

REFERENCES

Bandono, A. D. I., Suharyo, O. S., & Riono. (2019). Applied fuzzy and Nasa TLX method to measure the mental workload. Journal of Theoretical and Applied Information Technology, 97(2), 476–489.

Bandono, A., Bastari, A., & Suharyo, O. S. (2020). Effectiveness Naval Collaboration Flexible Learning (NCFL) Model in Increasing Learning Outcomes The Indonesian Naval Technology College. International Journal of Progressive Sciences and Technologies, 23(2), 334-342.

Bandono, A., Rahman, A., & Suharyo, O. (2020). The Application Model of Naval Collaboration Flexible Learning (NCFL) in the Indonesian Naval Technology College: A Case Study. International Journal of Progressive Sciences and Technologies, 23(2), 498-505.

Bastari, A., & Suharyo, O. S. (2020). Analysis of The Implementation of Occupational Safety Program Efforts to Improve Work Productivity With Fault Tree Analysis Approach. International Journal of Progressive Sciences and Technologies, 23(2), 628-633.

Bateman Snell. 2002. Management Competing in the New Era. 5th ed.

Colquitt, Jason A., Jeffery A. Lepine, and Michael Wesson. 2012. Organizational Behavior: Improving Performance and Commitment in the Workplace 3rd Edition. McGraw-Hill Education; 3 Edition. https://doi.org/10.1016/B978-0-12-375000-6.00263-9.

Daft, Richard L. 2010. Management. Ninth.

Farrukh, Muhammad. 2015. “Learning Organization And Competitive Advantage-An Integrated Approach.” Economic and Social Society 5 (4): 7–773.

Govender, S., and S. B. Parumasur. 2010. “The Relationship between Employee Motivation and Job Involvement.” South African Journal of Economic and Management Sciences. https://doi.org/10.4102/sajems.v13i3.102.

Griffin, R; Moorhead, Gregory. 2014. “Organizational Behavior: Managing People and Organizations: Ricky W. Griffin, Gregory Moorhead.” Cengage Learning, 132.

Hendri Kistianus, Devie. 2015. “Pengaruh Servant Leadership Terhadap Employee Empowerment, Organizational Culture Dan Competitive Advantage Pada Universitas Di Surabaya.” Akuntansi Bisnis Universitas Kristen Petra Business Accounting Review 3 (2).

James L Gibson. 2012. Organizational: Behavior, Structure, Processes. 14th ed. New York.

Jennifer M. George, Gareth R. Jones. 2011. Understanding and Managing Organizational Behavior, 6th Edition. Academy of Management Journal. https://doi.org/10.2307/30040635.

John R. Schermerhorn, Jr., James G. Hunt. 2002. Organizational Behavior. Texas Tech University.

Luthans, Fred. 2006. Perilaku Organisasi. 10th ed. Andi Yogyakarta.

Luthans, Fred. 2011. Organizational Behavior: An Evidence-Based Approach.

M.M, Muh Said, Suradi Tahmir, and Juanda Nawawi. 2016. “Learning Organization Models.” Mediterranean Journal of Social Sciences. https://doi.org/10.5901/mjss.2016.v7n2s1p172.

Mahajan, Ms. Kriti. 2015. “An Empirical Study of Job

Involvement and Personality Traits." International Journal of Scientific Research 4 (1).

Mohammad Kamali et al. 2017. "Studying the Relationship between Organizational Learning and Organizational Commitment of Staffs of Well-Being Organization in Yazd Province." Evidence-Based Health Policy, Management & Economics Journal 1 (3).

Nugroho, S. H., Madhakomala, R., & Gunawan, K. (2019). The system dynamic model for policy evaluation of navy personnel on the state-duty aspect. International Journal of Scientific and Technology Research, 8(12), 228–236.

Nugroho, S. H., Madhakomala, R., & Gunawan, K. (2019). Analysis and scenario of navy performance allowance policy using system dynamic model. International Journal of Scientific and Technology Research, 8(12), 1140–1147.

Nugroho, S. H., Sukandari, B., Suharyo, O. S., & Bandono, A. (2020). The application of Nasa-Tlx methods to the analysis of Mtf navy personnel allocation. International Journal of Scientific and Technology Research, 9(3), 6172–6179.

Nugroho, S. H., Sukandari, B., Bandono, A., & Sri Suharyo, O. (2020). The applications of model bayesian networks for analysis and preventive actions on maritime security operations. International Journal of Scientific and Technology Research, 9(3), 3000–3006.

Newstrom, John W. 2007. Organizational Behavior Human Behavior of Work. Twelfth.

Newstrom. 2011. Organization Behavior Human Behavior at Work. Thirteenth.

Ozlem Yenidogan, Hiner Sencan. 2017. "The Effect Of Organizational Learning On Organizational Commitment In Accommodation Sector." International Journal of Commerce and Finance 3 (1): 27–40.

Robbins, Stephen P, and Mary Coulter. 2002. "Management." Pearson.

Robbins, Stephen P, Timothy A. Judge. 2013. Organizational Behavior. Edited by Pearson. 15th ed.

Robbins, Stephen P, Timothy A. Judge. 2013. Organizational Behavior. Edited by Pearson. 15th ed.

Robert Kreitner, Angelo Kinicki. 2010. Organizational Behavior. Ninth. New York.

Robert Kreitner, Angelo Kinicki. 2010. Organizational Behavior. Ninth. New York.

Sedarmayanti. 2007. Manajemen Sumber Daya Manusia. PI Refika Aditama.

Steven L McShane, Mary Ann Von Glinov. 2010. Organizational Behavior Emerging Knowledge and Practice for the Real World.

Suharyo O.S., Djauhar Manfaat, Haryo D Armono, (2017), Establishing the Location of Naval Base Using Fuzzy MCDM and Covering Technique Methods: A Case Study, International Journal of Operations and Quantitative Management, IJOQM, Vol. 23, Issue 1, pp 61-87.

Yadav, Savita, and Vinita Agarwal. 2016. "Benefits and Barriers of Learning Organization and Its Five Discipline." Journal of Business and Management.