ISSN
2443-2415

PROCEEDING

ICMST 2019

INDONESIA NAVAL TECHNOLOGY COLLEGE

INTERNATIONAL CONFERENCE ON MARITIME SCIENCE AND TECHNOLOGY

The 3rd ICMST - STTAL

FIELD :

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

SURABAYA AUGUST 1th , 2019

PROCEEDING

INDONESIA NAVAL TECHNOLOGY COLLEGE

POSTGRADUATE INTERNATIONAL CONFERENCE

"The 3rd International Conference on Maritime Science and Technology"

Field :

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

SURABAYA AUGUST 1th , 2019

POSTGRADUATE STUDIES PROGRAM
INDONESIA NAVAL TECHNOLOGY COLLEGE STTAL

Proceeding

Indonesia Naval Technology College
Postgraduate International Conference

International Conference on Maritime Science and Technology
ICMST 2019

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

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 Arie Marbandi

Section of Publication/Programme
Lieutenant Commander Cahyanto
Lieutenant Fa'iq Mumtaz M

Section of Proceeding
Lieutenant Commander Cahyanto
Lieutenant Fa'iq Mumtaz M

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 Hadi Safrudin
Lieutenant Commander Kuncoro
Lieutenant Commander Supriyono
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 2019.

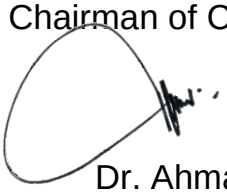
On behalf of the Conference Committee, We would like to formally invite you to attend The STTAL Postgraduate International Conference on Maritime Science and Technology ICMST 2019 on Thursday, August 1th 2019

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 August 1th, 2019.

Surabaya August 1th, 2019
Chairman of Commite,



Dr. Ahmadi
Captain Navy

STTAL POSTGRADUATE

The 3rd International Conference on Maritime Science And Technology ICMST 2019

SPEAKERS :

1. **PROF. ANTHONY GERARD POOLMAN** - *(Naval Postgraduate School NPS-USA)*
2. **PROF. NORMAN WAYNE PORTER** - *(Naval Postgraduate School NPS-USA)*
3. **PROF. DR. BUDI SANTOSO W** - *(ITS Surabaya)*

CALL FOR PAPER

On the Fields of :

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

The Paper should be submitted at :
Email : pascasarjana_sttal@sttal.ac.id
Website : http://seminarpasca-sttal.ac.id/

Time And Place :
Thursday, August 1th, 2019
STTAL Postgraduate Building
Morokrembangan Surabaya Indonesia

Information/Registration :
(Telp/WA)
Suharyo 089643889567
Cahyanto 081327738520
Faiq 081357168175

FREE CHARGE

All presented papers will be published on the online Proceeding of ICMST 2019 – ISSN : 2443-2415
Indexed by Google Scholar, SINTA, IPI Dikti.

SCEDHULE

International Conference on Maritime Science and Technology
ICMST 2019

Held in STTAL Surabaya, Bumimoro-Morokrembangan, : On Thursday, August 1th , 2019

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

08.00 - 08.30	Registration
08.30 - 08.32	Opening
08.32 – 08.35	National Indonesia Anthem
08.35 – 08.37	Pray
08.37 - 08.45	Welcome Speech by Commander of STTAL
08.45 - 09.00	Photo Session
09.00 - 09.20	Break
09.20 - 12.00	**International Conference** / **Seminary** **Speaker** I : Professor Norman Wayne Porter (Naval Post Graduate School – NPS USA) **Speaker** II : Professor Anthony G. Poolman (Naval Post Graduate School – NPS USA) **Speaker** III : Professor Dr. Budi Santoso W. (ITS Surabaya)
12.00 - 13.00	Break
13.00 - 16.00	**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*
16.00 – 16.15	Closing

TABLE OF CONTENTS

SPEAKERS

FIELD I : OPERATION RESEARCH

FIELD II : LOGISTICS MANAGEMENT

FIELD III : POLICY AND STRATEGY

SPEAKER 1

System Dynamics for Planning and Design

Prof. Norman Wayne Porter,
CAPT, USN (ret)

ABBREVIATED BIO

Naval Postgraduate School

- Executive Director, CORE (social network analysis) Lab; Director, Littoral Operations Center; Senior Lecturer, Defense Analysis and Systems Engineering Departments

Military

- Naval Intelligence, Surface Warfare, Strategic and Operational Planning (1986-2014)
- 28 years total service, 14 years combined service overseas
- Served in US Navy, Joint, NATO, and Coalition tours
- Recent Tours
  - Special Assistant for Strategy for Chief of Naval Operations, N00Z (2005-2007)
  - Assistant Chief of Staff, Intelligence, and Deputy Operations Officer for US and Coalition Navies in the Persian Gulf (2007-2008)
  - Special Assistant for Strategy for Chairman of the Joint Chiefs of Staff (2008-2011)
  - Chair, Systemic Strategy and Complexity, Naval Postgraduate School (2011-2014)

Academic

- MS in Computer Science, MS in Joint C4I Systems Technology (NPS, 1999)
- PhD in Information Sciences (system dynamics modeling) (NPS, 2014)

Systemic Strategic Thinking and Planning

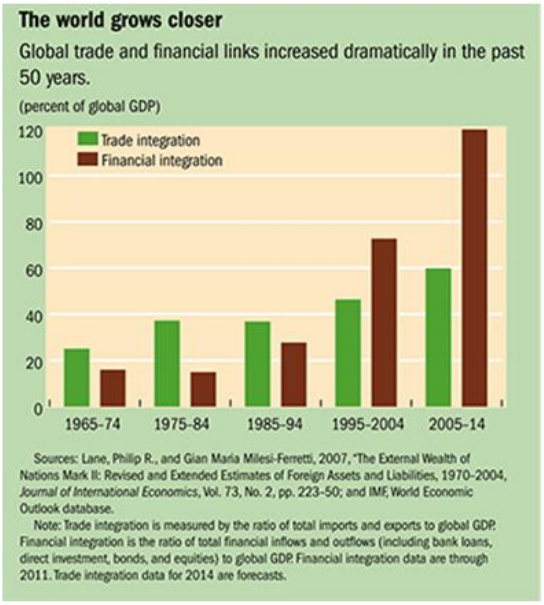
Maritime Security in a New Era of Technology

1

Today's Strategic Environment

- **Complex** and Uncertain
- Interconnected and **Interdependent**
- Exponential Advances in **Enabling and Disruptive Technologies**
- A new era of **anthropogenic (human) effects** and **resource consumption**

Indonesia is a Nexus for this strategic convergence



4

Opportunities for Convergence

- Countering threats to **sovereignty and freedom of navigation**
- **Countering Terrorism** and External Threats to Critical Infrastructure (e.g. oil platforms)
- **Countering Piracy** and transnational criminal **trafficking**
- **Fisheries** protection and **sustainability**
- Natural **disaster warning and response**

All of these have a role in Global, National and Regional ***Security and Prosperity***

5

Strategic Considerations

- **Global phenomena** apparent in **regional manifestations**
- Complex and adaptive system of **systems in competition**
- Must be addressed through **interagency and international** partnerships
- Requires **integrated** C2, ISR, Comms, and assets of **all Services** and **Inter Agency** Departments

None of the threats we face are **solely maritime**

6

Maritime Security and Strategy

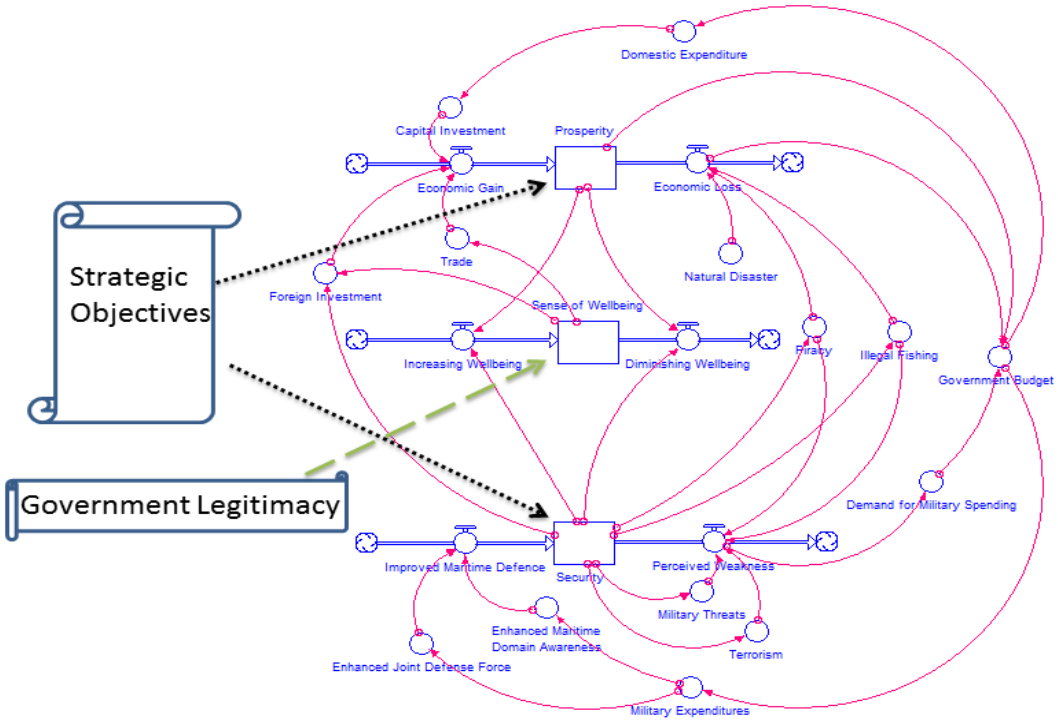
Maritime Strategy and Domain Awareness

- **Networked: Air, Sea and Land** - Inclusive
- **Fusion of multi-sensor**, **multi-purpose** platforms
- Must support **strategic, operational, and tactical** objectives
- Must be **dynamic**, **flexible**, **robust**, **and timely**

The complex Maritime Domain can be viewed within the context of system dynamics

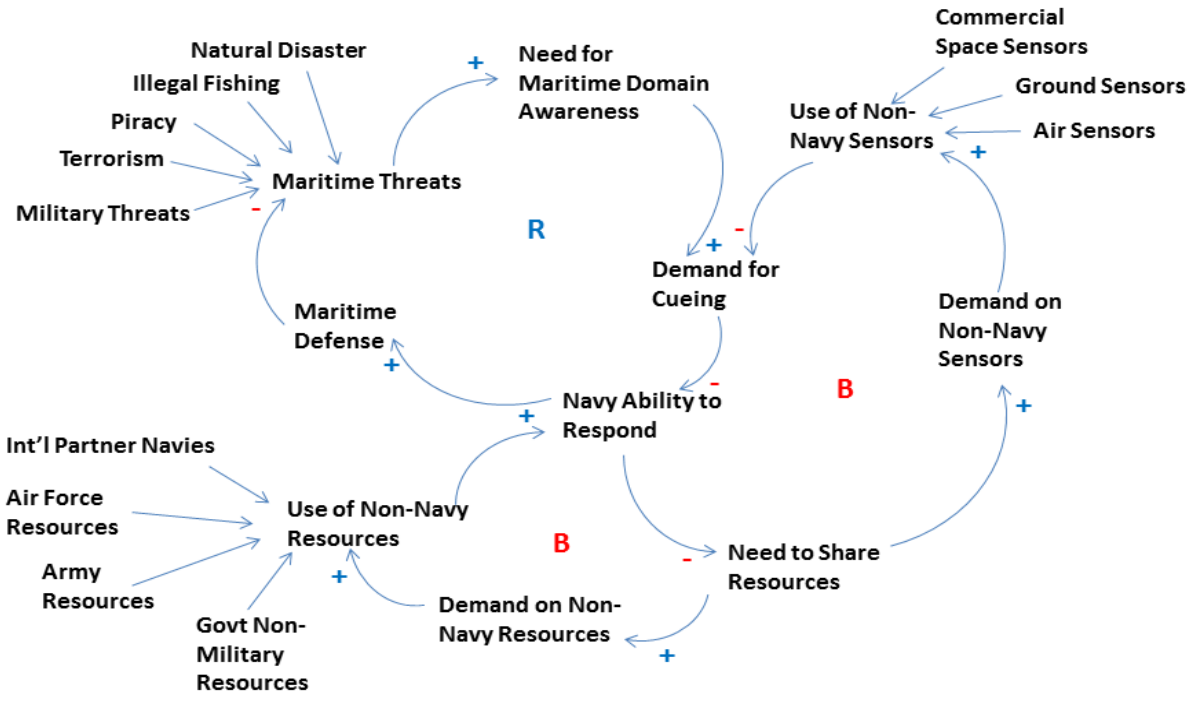
7

National / Maritime Strategy Stock and Flow Diagram



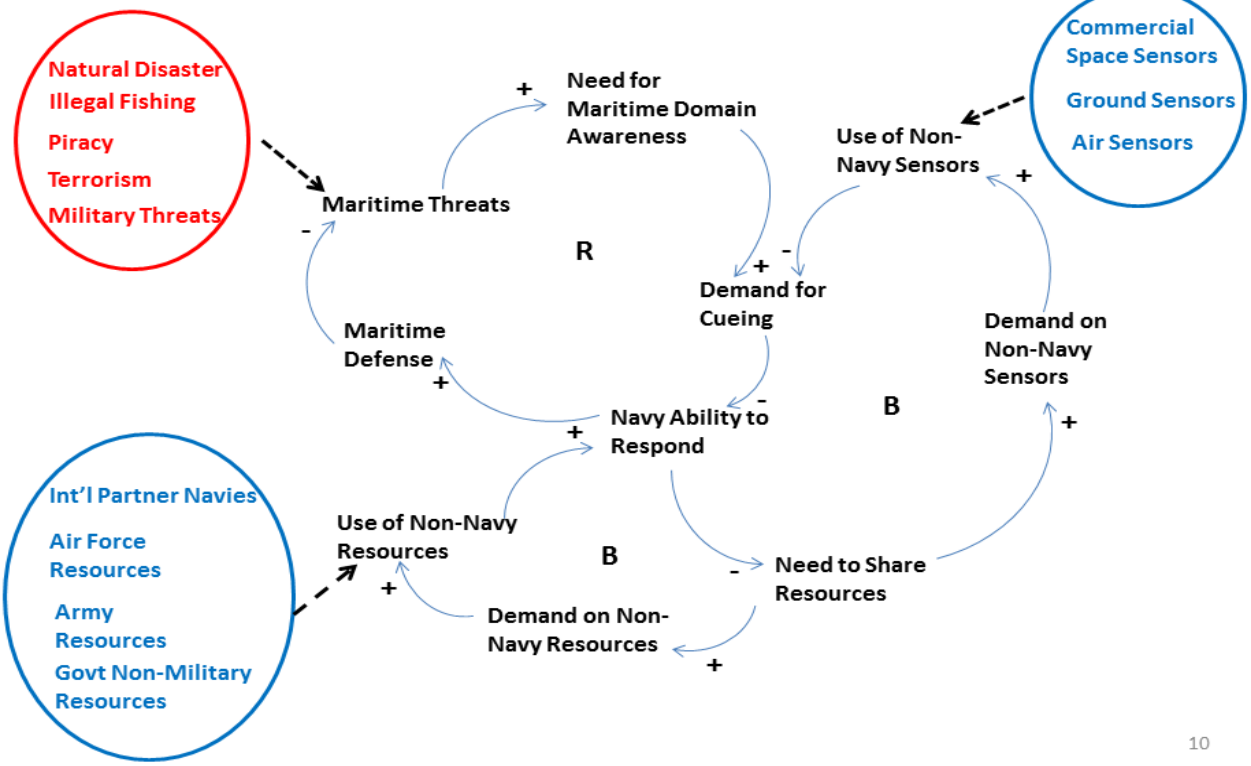
8

Maritime Defense Causal Loop Diagram



9

Maritime Defense Causal Loop Diagram



10

NPS Littoral Operations Center

Questions or Comments?

11

SPEAKER 2

System Dynamics for Planning and Design

Prof. Anthony Pollman

ABBREVIATED BIO

Naval Postgraduate School

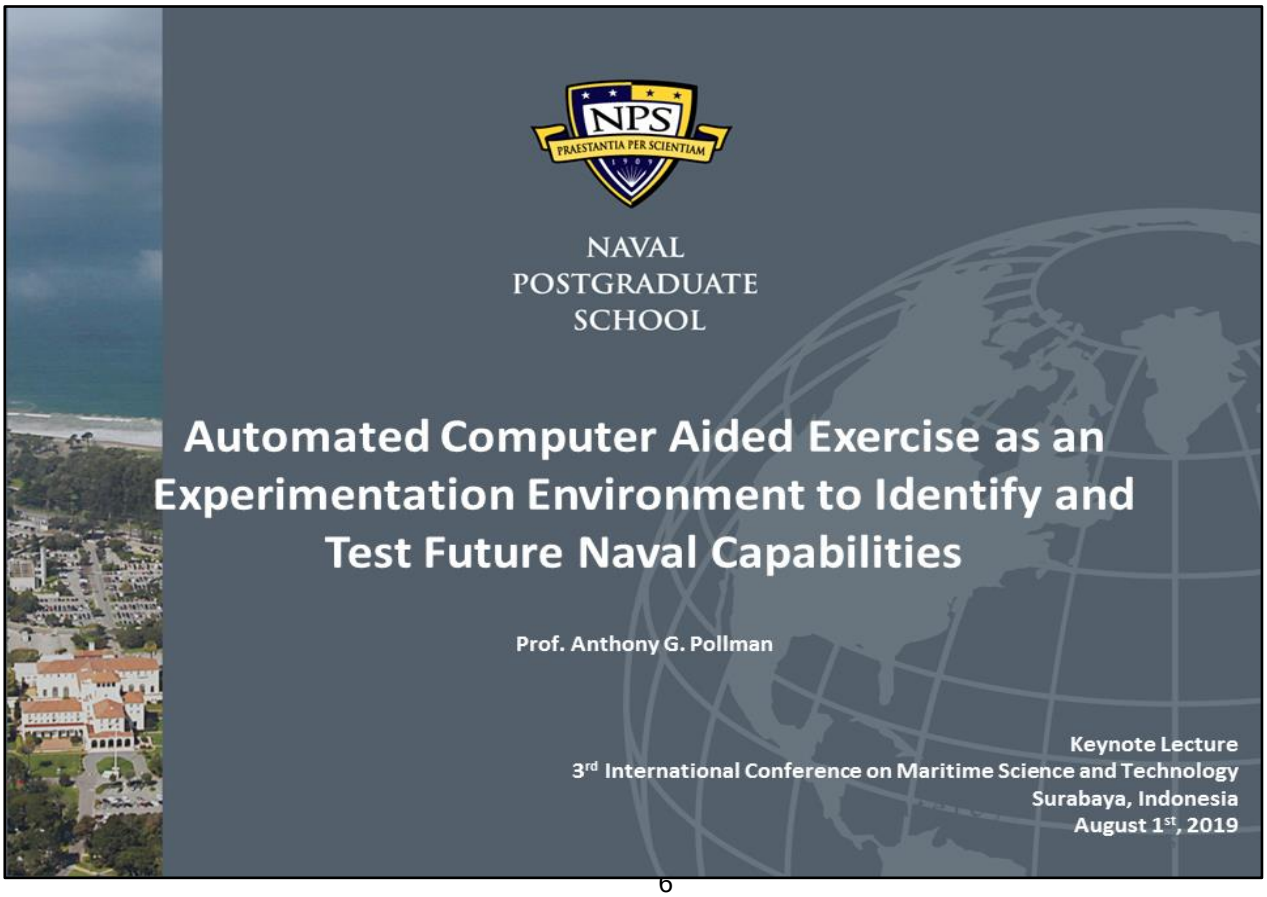
- He is an Assistant Professor in the Systems Engineering Department and the Deputy Director of the Littoral Operations Center at the Naval Postgraduate School, Monterey, California.
- He holds a B.S. and M.S. in Nuclear Engineering from Purdue University, a Ph.D. in Mechanical Engineering from the University of Maryland-College Park, and an Executive MBA from NPS.
- Dr. Pollman teaches courses in System Dynamics, Sensors, and Mathematical Modeling.

Military

- He is retired Marine and veteran of both Iraq and Afghanistan. In his spare time, he is a partner in a closely held real estate company & a closely held agriculture company.

Academic

- He is the author of over 30 papers, and his research interests include process modeling and simulation, operational energy, autonomous systems, and radiation detectors.
- His academic awards include:
  - The Mills Medal for Service that had a conspicuous impact on the Naval Services from the Naval Postgraduate School,
  - The Clements Award for Excellence in Education from the U.S. Naval Academy,
  - The Meritorious Service Award from the Marine Corps Association,
  - The Annual Essay award from the U.S. Naval Institute.
- Member of the American Society of Mechanical Engineers, American Nuclear Society, International Council on Systems Engineering, the Marine Corps Association, the U.S. Naval Institute, and Engineers Without Borders.



NAVAL POSTGRADUATE SCHOOL

Agenda

- **Mission Engineering & Analysis (MEA)**
- **Integration & Operations Support System (IOSS) Development**
  - **EXERCISE Cobra Gold (CG) - a Computer Aided Exercise (CAE) using Joint Theater Level Simulation (JTLS)**
  - **Data collection**
  - **Software development**
  - **Automated play**
  - **Experimental design**
  - **General construct for developing an IOSS from other CAEs**
- **Applying the IOSS to Examine Future Capabilities in CG**
  - **Opportunities**
  - **Process for conducting studies**
  - **Data farming and analyses**
- **Conclusions**

2

WWW.NPS.EDU

NAVAL POSTGRADUATE SCHOOL

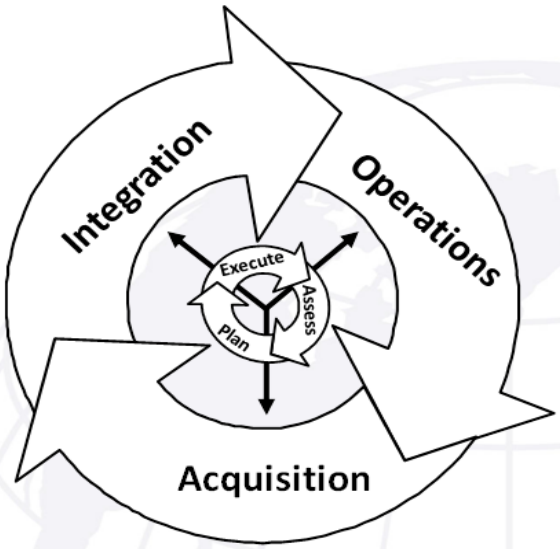
Introduction to MEA

Mission Engineering (ME)

- Deliberate planning, analyzing, organizing, and integrating of operational and system capabilities to achieve mission outcomes
- Systems of Interest: the mission
- Timescale: initiation to mission accomplishment
- Three major processes:
  - Acquisitions
  - Integration
  - Operations

Mission Engineering & Analysis (MEA)

- High-level methodology that combines ME with SE/SA to inform ME transitions that can address engineering and non-engineering problems
- Systems of Interest: the mission
- Timescale: initiation to mission accomplishment
- Three major processes:
  - Plan
  - Assess
  - Execute



***Current Contribution*: development and application of an integration & operations support system (IOSS) to implement MEA**

NAVAL POSTGRADUATE SCHOOL

IOSS Development: EXERCISE Cobra Gold

Integration and Operations Support System (IOSS)

- Working scenario based on Cobra Gold 2018

EXERCISE Cobra Gold 2018

- Multinational (U.S., Thailand, and numerous regional partners)
- Multi-domain (sea, air, land)
- Multi-mission (peace enforcement, maritime interdiction, kinetic operations, humanitarian assistance, …)
- Computer assisted exercise
- Contained necessary elements for an analyst to investigate performance of current, new, or envisioned systems

Exercise Driver: Joint Theater-level Simulation – Global Operations (JTLS-GO)

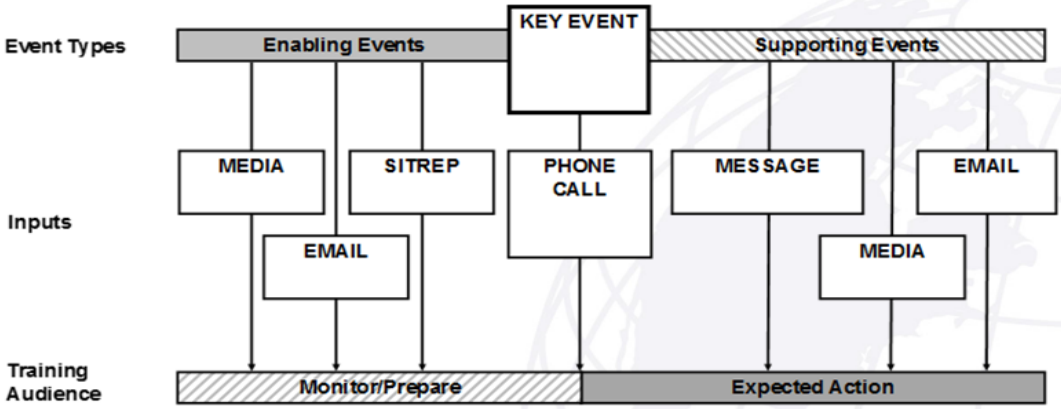
- Served as exercise driver
- Interactive, internet-enabled
- Originally designed for development and analysis of joint operations, it models multi-sided operations with logistics, SOF, and intelligence support; 35 years of use
- Today, primarily used as a theater-independent training support model

4

WWW.NPS.EDU

NAVAL POSTGRADUATE SCHOOL

IOSS Development: Data Collection



5

WWW.NPS.EDU

NAVAL POSTGRADUATE SCHOOL

IOSS Development: Software Development

Automating JTLS play required development of software to:

- Create a game from a scenario.
- Configure the game.
- Start web services.
- Start the CEP.
- Send a start game order to the OMA.
- Systematically and periodically collect and parse messages for metrics of interest, anecdotal information, and simulation time.
- Post-process game output (primarily from JTLS messages) and convert pertinent data into a usable format.

6

WWW.NPS.EDU

NAVAL POSTGRADUATE SCHOOL

IOSS Development: Automated CAW Play

Tracing game conditions to game orders…

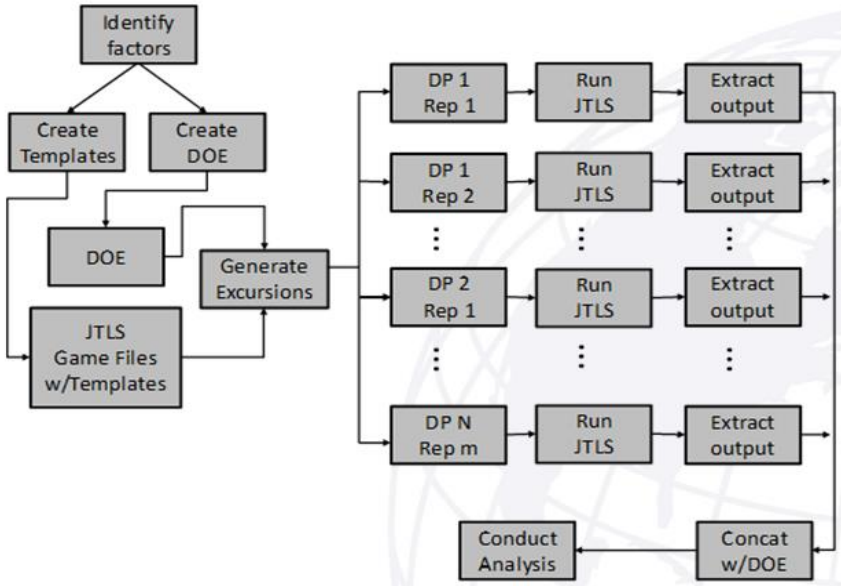
Operational Condition →				Audience Actions →				Translated JTLS Orders →				JTLS Repositories			
Conditions				Actions				JTLS Orders				Data Sources			
A	B	C	D	1	2	3	4	i	ii	iii	iv	a	b	c	d
X	X		X		X				X	X	X		X	X	
		X					X				X		X		

7

WWW.NPS.EDU

NAVAL POSTGRADUATE SCHOOL

IOSS Development: Experimental Design



8

WWW.NPS.EDU

NAVAL POSTGRADUATE SCHOOL

General Construct for Developing IOSS from CAE

Step 1. Select "farmable" simulation
- A. Determine if simulation code allows external input.
- B. Understand process for complete game initialization.

Step 2. Select suitable CAE.
- A. Ensure that exercise is conducive to address research questions.
- B. Verify organizations can accept required orders and entities.

Step 3 Collect CAE data and scenario.
- A. Attend CAE if possible and record player activities.
- B. Acquire CAE scenario and database.

Step 4. Select proper time period.
- A. Capture operations with opportunities to insert new systems.
- B. Determine "Turn" intervals.

Step 5 Inject new capability or system.
- A. Model the new system or capability.
- B. Assign to appropriate simulation organizations.

Step 6. Manually create orders at each Turn.
- A. Develop vignettes within scenario for new system to operate.
- B. Determine system actions at each Turn of the game.

Step 7 Transform HITL into a non-HITL CAW.
- A. Automate game setup.
- B. Automate Player actions and orders.

Step 8. Prepare for analysis.
- A. Collect simulation data.
- B. Build analysis tools and products.

9

WWW.NPS.EDU

NAVAL POSTGRADUATE SCHOOL

Using IOSS: Future Capabilities in CG

CG18 Day	Observed Events	Emerging Issues	Unmanned System Capability
Day 2	SAMs shoot down 2 x P-3C during the aircrafts' patrol missions.	Decrease in the MNF ISR capability will require diversion of other assets.	Unmanned Aerial Systems (UAS)
Day 2	The USS ABC is ordered to shadow MV XYZ; requires closing speed ≥ 32 knots.	USS ABC speed insufficient. Delayed actionable intelligence; require other assets.	UAS, Unmanned Underwater Vehicle (UUV)
Days 2 & 3	Series of theater ballistic missiles are launched against MNF at regular intervals. Air defense radars inoperable.	Degraded air defense. System is "blind." No ability to target incoming missiles.	UAS

10

WWW.NPS.EDU

NAVAL POSTGRADUATE SCHOOL

Using IOSS: Future Capabilities in CG

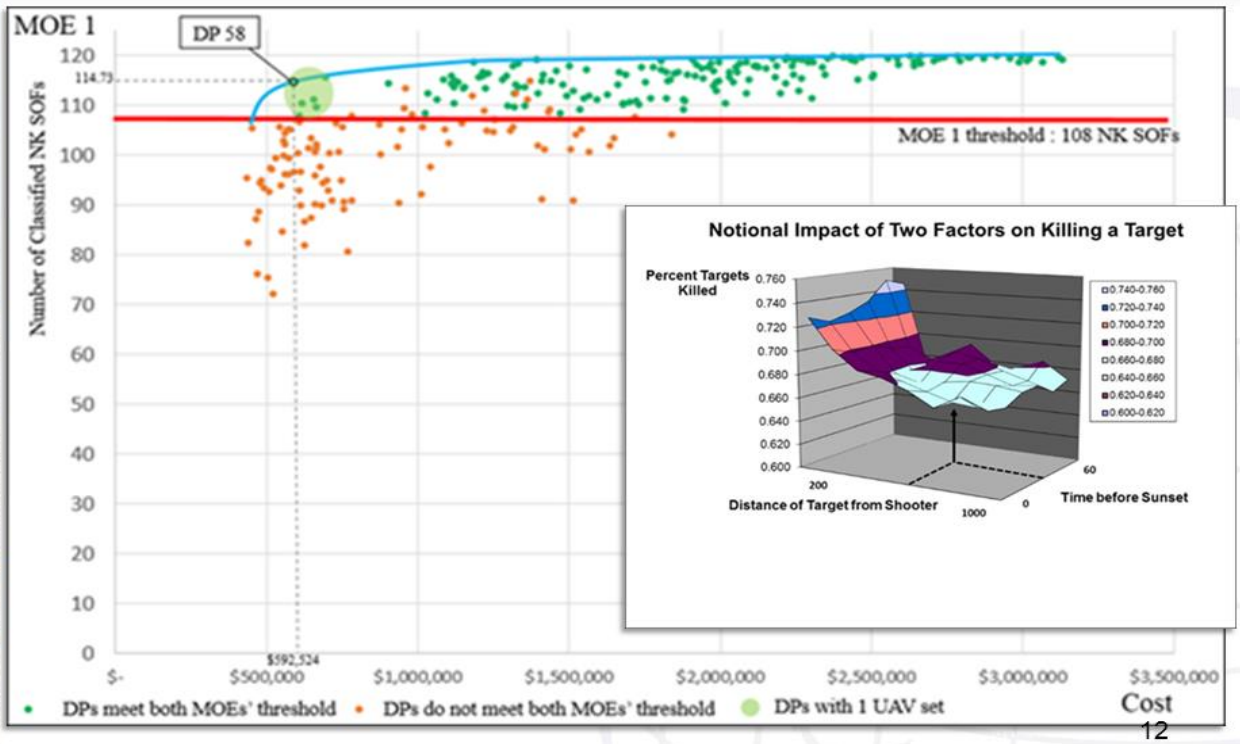
- **Study of future UAS/UUV capabilities would follow MSBSE and MBSE approaches in which experimentation is central**
- **Modify JTLS unit and system prototypes to model future UAS/UUV capabilities**
- **Cobra Gold 2018 is a ready made environment to study operations and vignettes for future UAS/UUV capabilities**
- **Computer experimentation and efficient design create a comprehensive picture of the variables, interactions, and outcomes**

11

WWW.NPS.EDU

NAVAL POSTGRADUATE SCHOOL

Using IOSS: Future Capabilities in CG



12

WWW.NPS.EDU

NAVAL POSTGRADUATE SCHOOL

Conclusions & Summary

- The IOSS is a fundamental, but critical step in building analytic support tools for MEA
- Constructing the IOSS was a major effort
- The IOSS is a toolset that can provide analytically derived evidence to support decisions
- The utility of IOSS resides in the analytic rigor that it facilitates
- A notional implementation of IOSS to study future capabilities for the Navy's N9 highlights its value

13

WWW.NPS.EDU

NAVAL POSTGRADUATE SCHOOL

Discussion

14

WWW.NPS.EDU

SPEAKER 3

System Dynamics for Planning and Design

Prof. Dr. Budisantoso Wirjodirdjo

ABBREVIATED BIO

Academic

- Sarjana, Institut Teknologi Bandung,Bandung 1978
- Master of Engineering, Asian Institute of Technology, Bangkok, Thailand, 1985
- Doktor, Universite de Rennes I, Rennes, Perancis, 1993
- Aktivitas Pelayanan Pendidikan di ITS Guru Besar 3
- Mengajar pada Program Sarjana : Riset Operasional I, Riset Operasional II, Permodelan Sistem, Ekonomi Industri, Teori Konstrain,
- Mengajar pada Program Pascasarjana: Riset Operasional Lanjut (Program Magister), Sistem Dinamik (Program Magister,dan Doktor), Metodologi Riset (Program Doktor), Kapita Selekta (Program Doktor), Analisis Pengambilan Keputusan

Piagam Penghargaan

- Dwidya Satya Utama, pengabdian selama 30 tahun sebagai PNS pada ITS, 10 Nopember 2009;
- Dwidya Satya Madya, pengabdian selama 25 tahun sebagai PNS pada ITS, 10 Nopember 2004;
- Dwidya Satya Perdana, pengabdian selama 20 tahun sebagai PNS pada ITS, 10 Nopember 1999;
- Satyalancana Dwidya Sistha, sebagai guru/instruktur pada Lemdik ABRI, 15 Juni 1998;
- Satyalancana Dwidya Sistha, sebagai guru/instruktur pada Lemdik ABRI, 08 Agustus 1986;

Keanggotaan Organisasi Profesi

- Anggota Ikatan Sarjana Teknik dan Manajemen Industri (ISTMI)
- Anggota Dewan Pembina Badan Kerjasama Pendidkan Teknik Industri Indonesia (BKSTI) 2002 – sekarang;

ITS Institut Teknologi Sepuluh Nopember

SYSTEM THINGKING IN COMPLEX PROBLEM : TREND IN POLICY PLANNING METHODOLOGY

Budisantoso WIRJODIRDJO 1

What is Policy?

How should we think about "policy"?

- **What is policy?**
- Broad definition of policy that includes legislation
- Wise, expedient, or prudent conduct or management
- A principle, plan, or course of action, as pursued by a government, organization, individual, etc.
- The act or process of setting and directing the course of action to be pursued by a government/public & private institution ,, etc.

Webster's

- **Policy-making is**
- Not a linear, rational process … but dynamic, complex
- Not only technical … but political
- Influenced by research … as well as strategic advocacy
- Holistic approach ……..

Budisantoso WIRJODIRDJO 3

The objective Policy

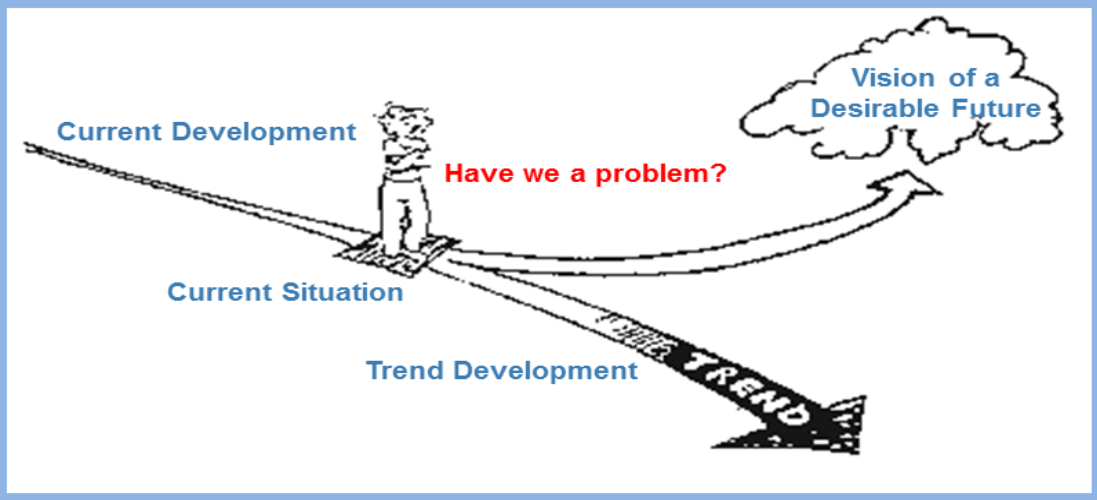
- What do we want to do with the policy?
- Aim to **influence local, national and global policy processes** in order that
  - decision-making and planning processes, and
  - policy dialogue and debates
  - at the relevant national, regional, international levels

Budisantoso WIRJODIRDJO 4

Why do we need policy?

- Policy could be considered as reference
- Policy can be considered as environment which is created to be favorable situation
- The scope of policies at the relevant national, regional, or international levels

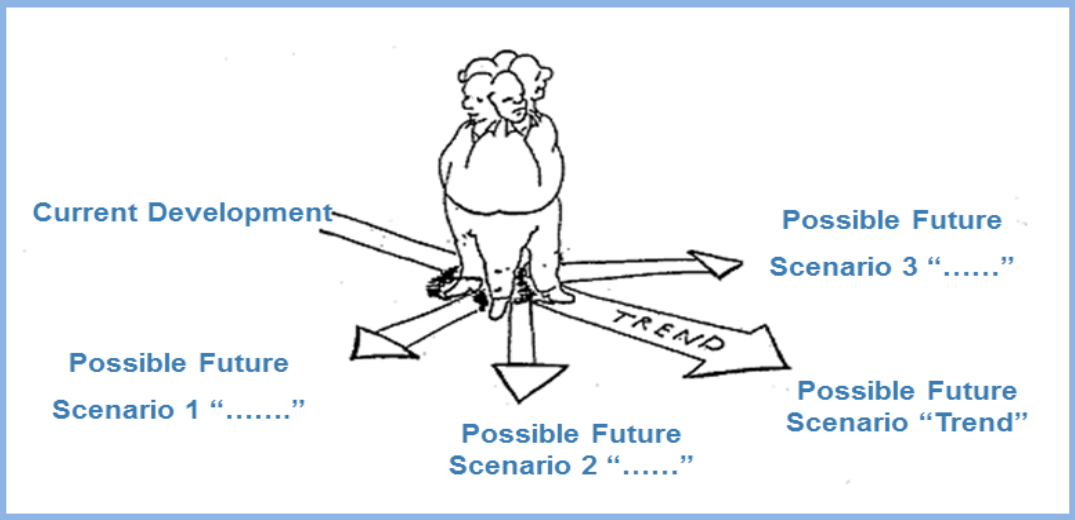
POLICY FORMULATION



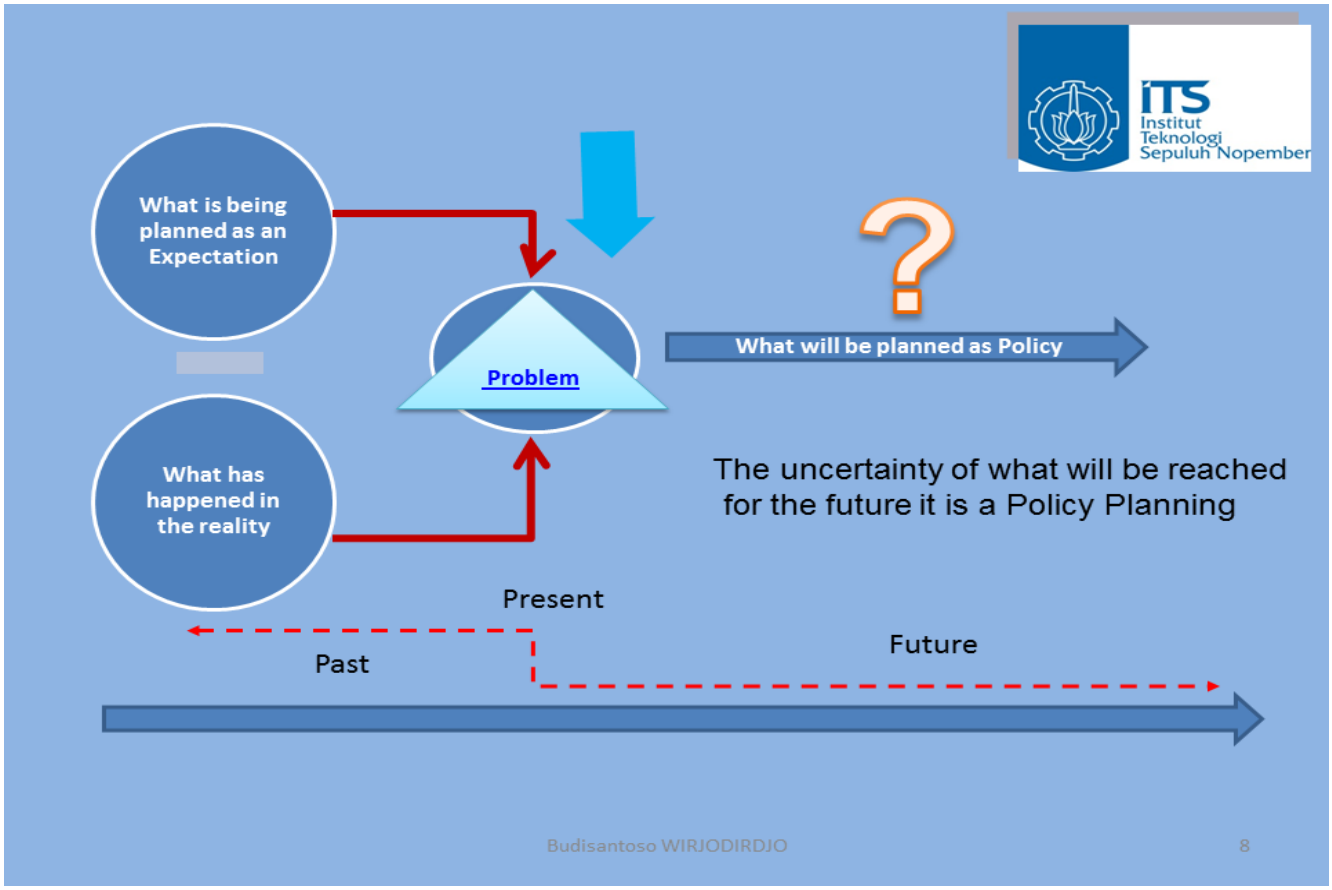
(Drawing: DIETIKER, LOOSER 1985)

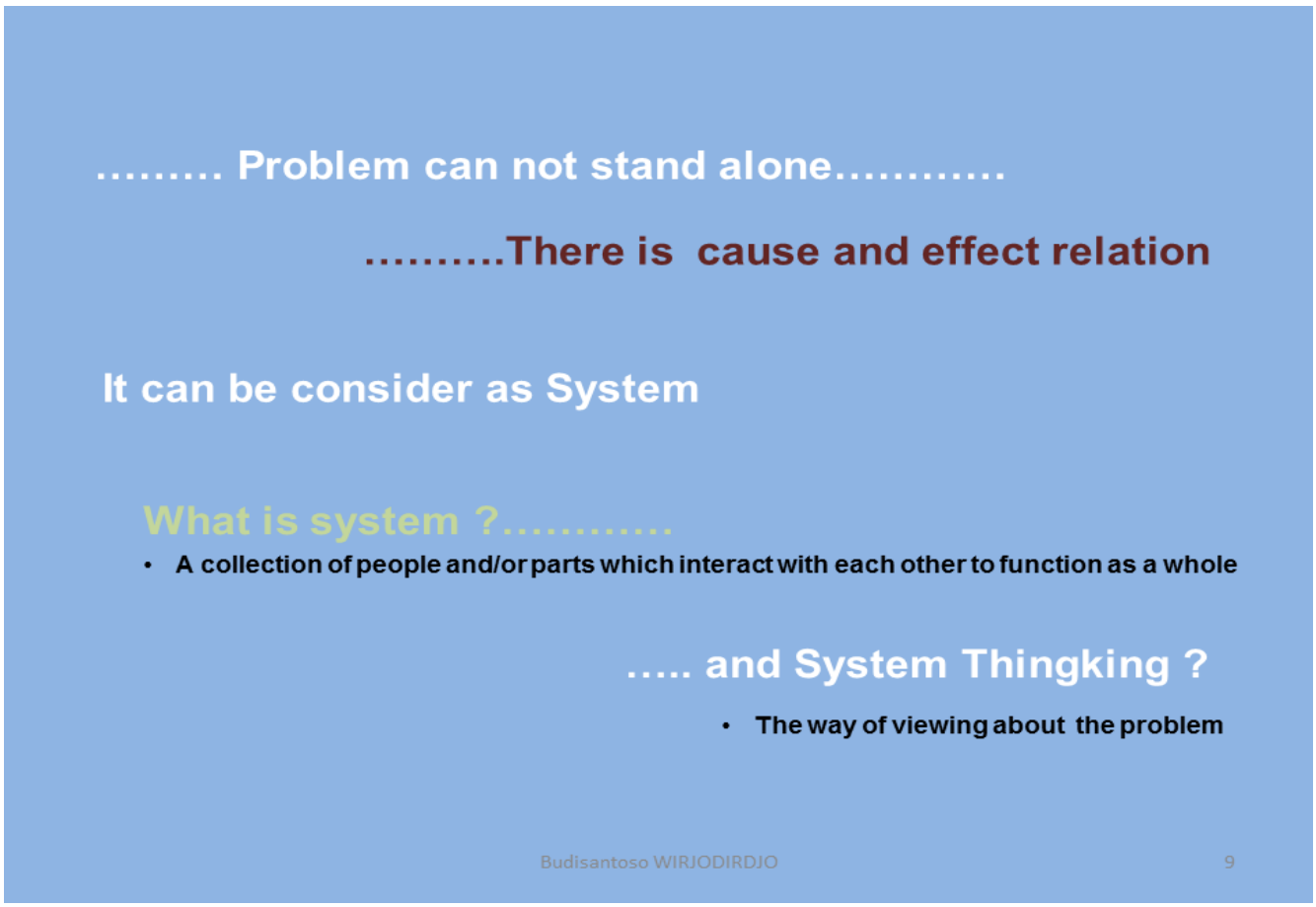
Budisantoso WIRJODIRDJO 6

WHICH SCENARIO DO WE WANT TO FOLLOW?
WHAT IS THE "RIGHT" POLICY FORMULATION ?



Budisantoso WIRJODIRDJO 7


ITS
Institut Teknologi Sepuluh Nopember
What is being planned as an Expectation
What has happened in the reality
Problem
What will be planned as Policy
The uncertainty of what will be reached for the future it is a Policy Planning
Present
Past
Future
Budisantoso WIRJODIRDJO
8


..... Problem can not stand alone.....
.....There is cause and effect relation
It can be consider as System
What is system ?.....
• A collection of people and/or parts which interact with each other to function as a whole
..... and System Thingking ?
• The way of viewing about the problem
Budisantoso WIRJODIRDJO
9

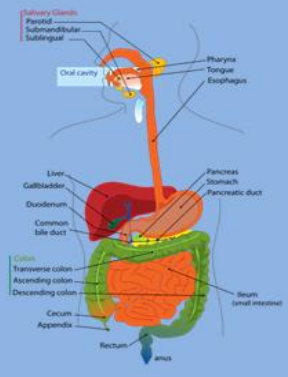
Problem in the real world is Complex System

10 properties of System (Cilliers1998):

- ✓***Large number of elements***
- ✓***Rich, non-linear, local and recurrent interactions***
- ✓***Have history***
- ✓***React based on local knowledge.***
- ✓***Usually open, far-from-equilibrium***

Budisantoso WIRJODIRDJO 10

Examples of Systems



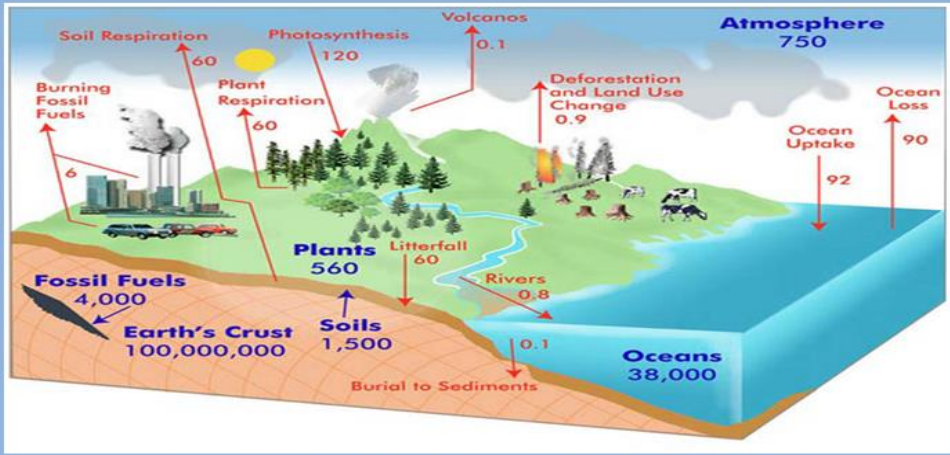
Digestive

Forest

Community

Budisantoso WIRJODIRDJO 11

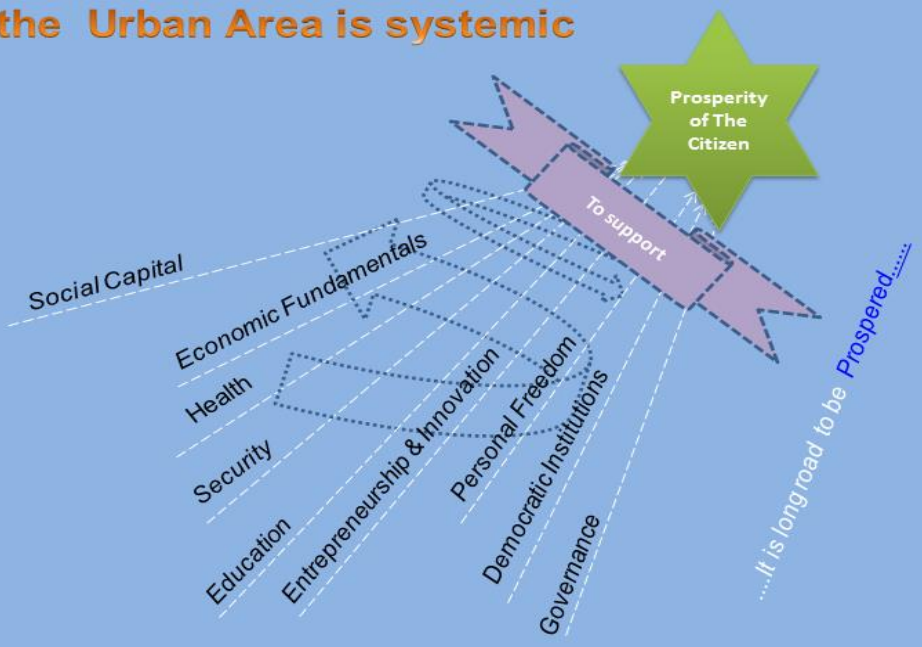
Flood is considered a systemic problem



Quantitative Modeling & Industrial Policy
Analysis Laboratory ITS, Surabaya

Budisantoso WIRJODIRDJO 12

Proseperity in the Urban Area is systemic problem

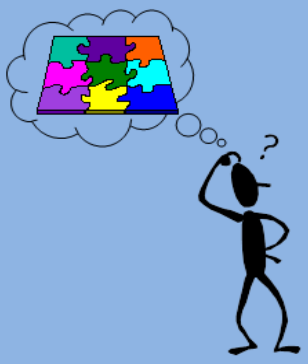


Many aspects must be considered as criteria measurement.....

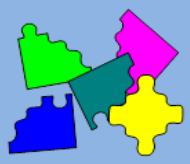
Budisantoso WIRJODIRDJO 13

Systems Thinking

Learning to see the world systemically
Encourages us to see the whole as well as the parts.



WHOLE ≠ Σ PARTS
⇒ Holistic Thinking

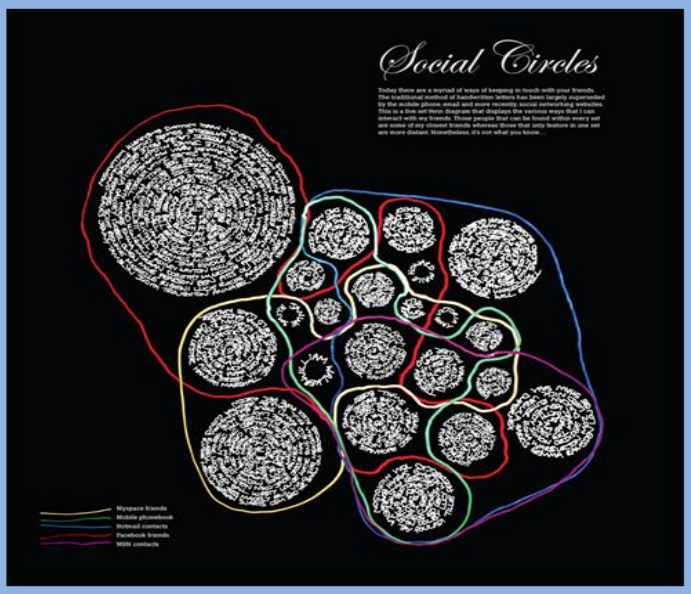


Multiple (often) restricted views

Budisantoso WIRJODIRDJO 14

Systems Thinking…

Helps us explore interdependencies and looking for patterns.



Budisantoso WIRJODIRDJO 15

Systems Thinking…

Helps us understand feedback structures that change systems over time.

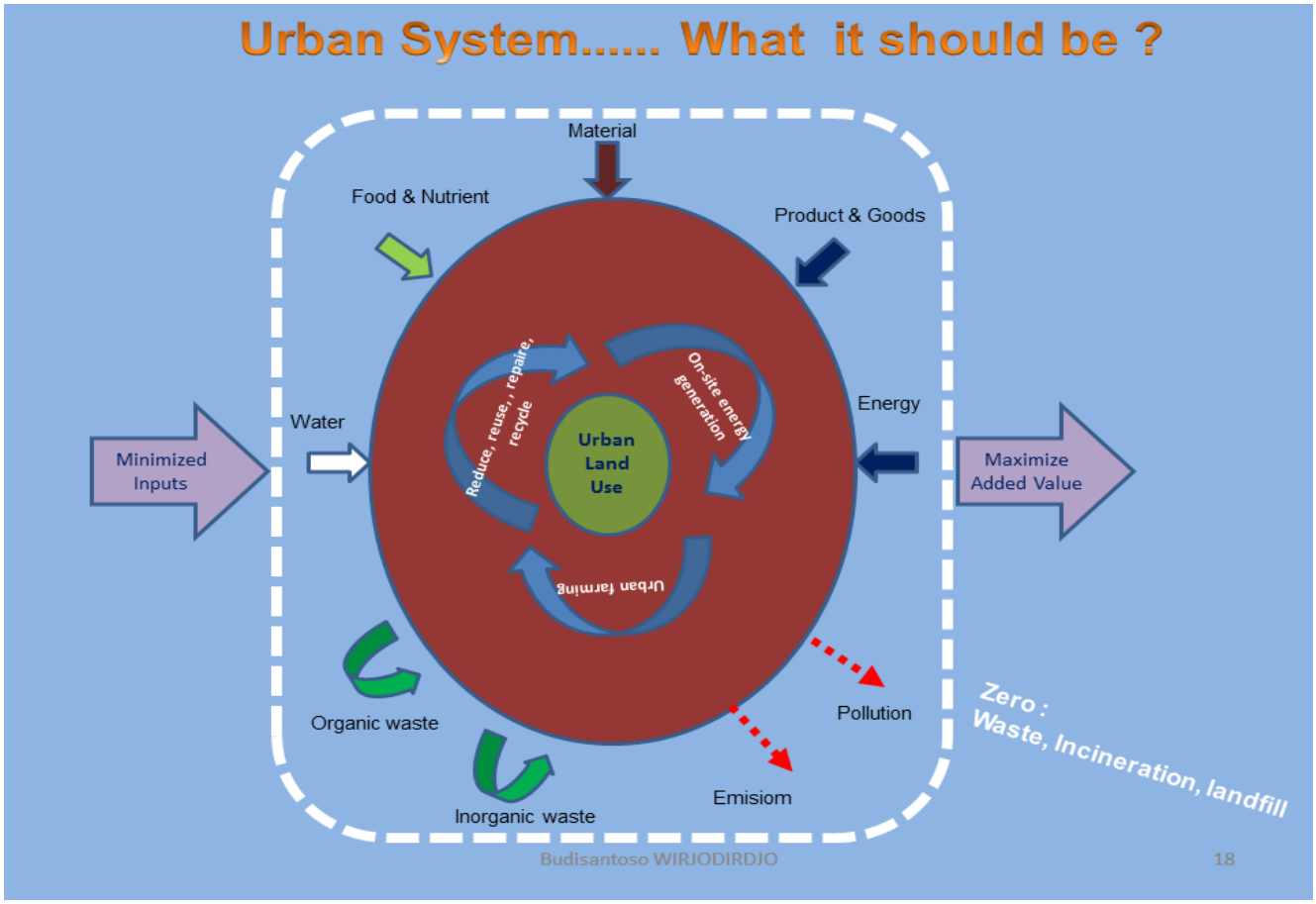
River Fractal - Héctor Garrido

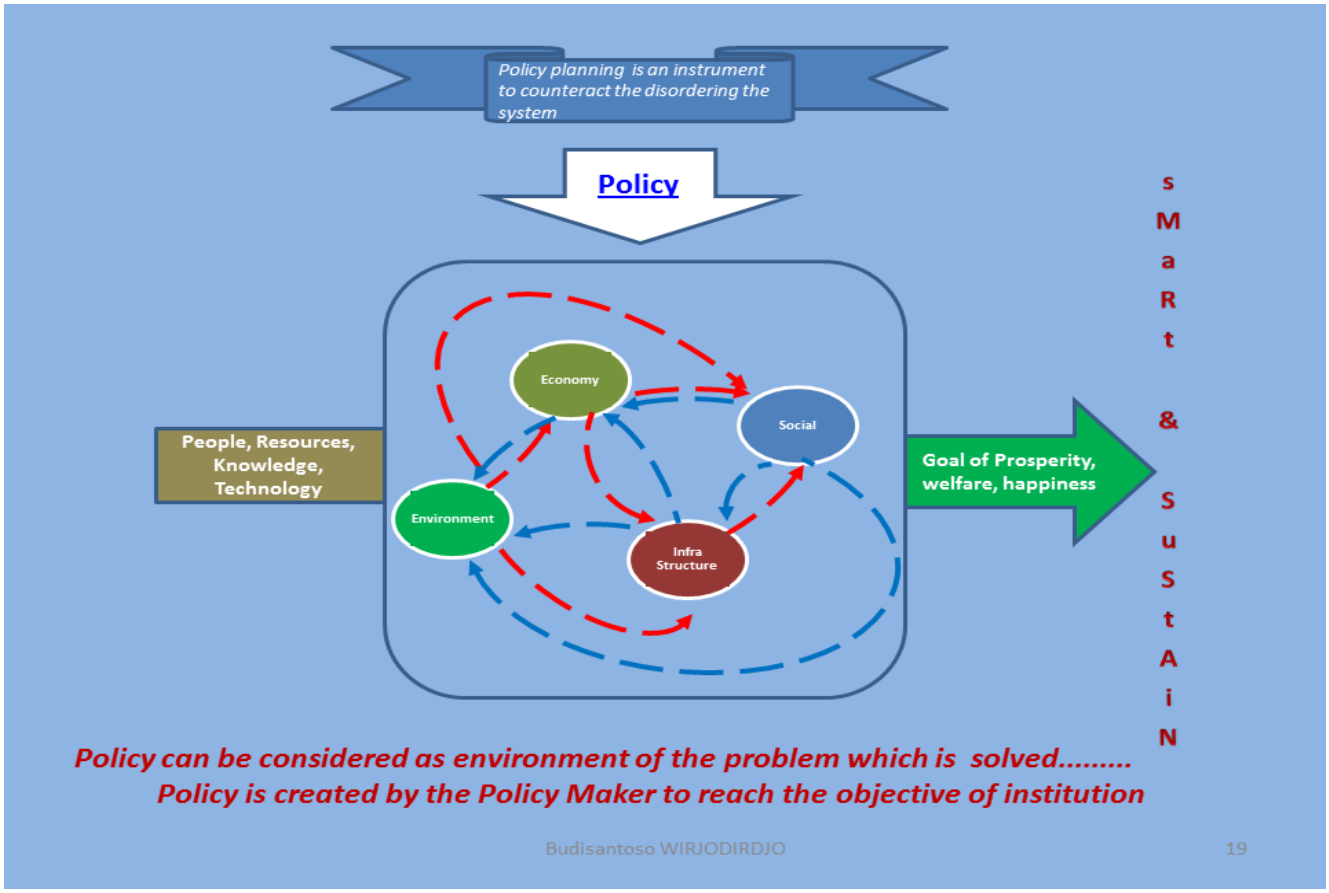
Budisantoso WIRJODIRDJO 16

SYSTEM THINKING APPROACH

Traditional analysis	Systems thinking
Traditional analysis focuses on the separating the individual pieces of what is being studied; in fact, the word "analysis" actually comes from the root meaning "to break into constituent parts.	Systems thinking, in contrast, focuses on how the thing being studied interacts with the other constituents of the system—a set of elements that interact to produce behavior—of which it is a part.

Budisantoso WIRJODIRDJO 17


Urban System..... What it should be ?
Material
Food & Nutrient
Product & Goods
Water
Energy
Minimized Inputs
Maximize Added Value
Reduce, reuse, , repaire, recycle
On-site energy generation
Urban Land Use
Urban farming
Organic waste
Pollution
Zero : Waste, Incineration, landfill
Inorganic waste
Emisiom
Budisantoso WIRJODIRDJO
18


Policy planning is an instrument to counteract the disordering the system
Policy
People, Resources, Knowledge, Technology
Economy
Social
Environment
Infra Structure
Goal of Prosperity, welfare, happiness
SMaRt & SuStAiN
Policy can be considered as environment of the problem which is solved.....
Policy is created by the Policy Maker to reach the objective of institution
Budisantoso WIRJODIRDJO
19

SYSTEMS THINKING TOOLS

Causal Loop Diagrams

- **A useful way to represent dynamic interrelationships**
- **Provide a visual representation with which to communicate that understanding**
- **Make explicit one's understanding of a system structure - Capture the mental model**

Budisantoso WIRJODIRDJO 20

Components of Causal Loop Diagrams

Variables - an element in a situation which may act or be acted upon
- Vary up or down over time (not an event)
- Nouns or noun phrases (not action words)

Links / Arrows - show the relationship and the direction of influence between variables

S's and O's - show the way one variable moves or changes in relation to another
- **S** stands for "**same** direction"
- **O** stands for "**opposite** direction"

 or **B** - **Balancing feedback loop** that **seeks equilibrium**

 or **R** - **Reinforcing feedback loop** that **amplifies change**

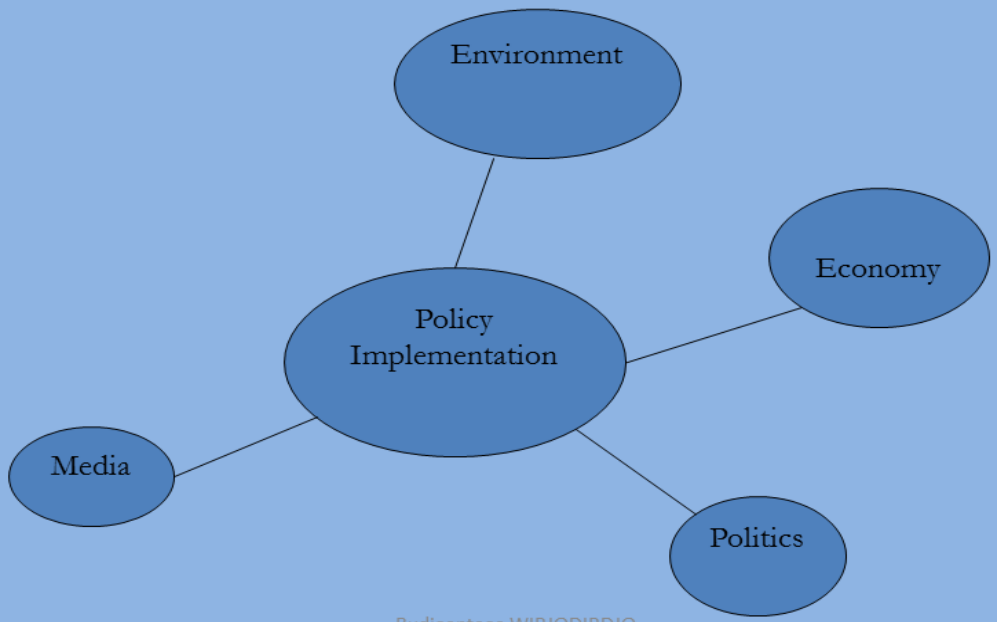
Budisantoso WIRJODIRDJO 21

Policy Planning Methodology Development

Past	Present	Future
• Sectoral Orientation • Simplification to avoid complexity • Static Object • Optimalization	• Inter Sectoral & Systemic • Accomodate the Complexity • Dynamic Object • Behavior	• Inter Sectoral & Systemic • Multi Discipline approach & Theory of Complexity • Dynamic Object • Behavior • .....?

Budisantoso WIRJODIRDJO 22

Factors Affecting Policy Implementation



Budisantoso WIRJODIRDJO 23

The History of Methodology in Policy Planning

- Analisa Input-Output Analysis
- Computable Generale Equlibrium
- System Dynamic
- Cellular Automata
- Agent Base Modeling

Budisantoso WIRJODIRDJO 24

Conclusions

- ✓ The problem which is to be solved are interrelated to each others. These could not be stood alone.
- ✓ Sectoral orientation in the policy planning are felt to be insufficient to accommodate the problems which is more and more complex.
- ✓ Policy analysis and policy planning methodology at present tends to the system thinking, compexity and multi diciplinary approach.
- ✓ The development of Information Technology enable a policy planner to extend the scope of policy to be planned.
- ✓ There is no any perfect policy planning methodology. Each has its own advantages & its weakness. The most important for policy maker: how to minimize unexpected benefit and to maximize positive impact of the policy

Budisantoso WIRJODIRDJO 25


Thank you
Budisantoso WIRJODIRDJO
26

FIELD I

OPERATION RESEARCH

PRELIMINARY STUDY FOR ITSUNUSA AUV BALLAST SYSTEM BASED EXPERIMENTAL IN FRESH WATER

Teguh Herlambang[1], Subchan[2], Hendro Nurhadi[3]

[1] Information System Department – University of Nahdlatul Ulama Surabaya (UNUSA)
teguh@unusa.ac.id
[2] Department of Mathematics, FMKSD ITS, Indonesia
subchan@matematika.its.ac.id
[3] Department of Mechanical Engineering, Vocational Faculty, ITS, Indonesia
Center of Excellence for Mechatronics Industrial Automation (PUI-PT MIA-RC ITS)
*hdnurhadi@me.its.ac.id (*Coresponding Auhor)*

ABSTRACT

Unmanned submarine commonly called Autonomous Underwater Vehicle (AUV) is one of underwater mapping robots. AUV is an underwater vehicle which can automatically move in water, and it is controlled by humans on vessel. To build an AUV requires a hard effort because many equipment units play important roles for the operation of AUV, one of which is an active ballast. Calculations for the making and benchmarks of an active ballast system are still very rare. Active ballast is a set of equipment, functioning to fill its tanks with seawater and to empty sea water from the tanks. These tanks are made to keep a submarine in ballance and to funtion as the active ballast system of the submarine. so that it can dive and float as desired. This paper is an experimental study of a tube resembling AUV with fresh water in plastic bottle to obtain ballast volume in AUV.

Keywords: *ITSUNUSA AUV, Active Ballast, Experimental Study*

1. INTRODUCTION

Underwater vehicle technology has a significant role for archipelago nations such as Indonesia. Since its territory has a larger water area than a land area, underwater technology is needed for its natural resources exploration and protection or maintaince. So, an automatic underwater vehicle (AUV) is needed [1,2]. AUV is a vehicle driven through water with a propulsion system, controlled and driven by an onboard computer with six degrees of freedom (DOF) maneuver so as to be able to carry out its determined tasks totally by itself. The advantages of AUV are not only for marine resources exploration but also for underwater mapping and underwater defense system operation [3,4,5].

Many components play important roles in the AUV operation. One of them active ballast. Active ballast is an equipment set used to fill air into the tank and to empty air out of the tank on AUV. Both the tanks are intended to keep AUV in ballance and to function as active burden on AUV so that it can either dive or float as desired. Considering the importance of the active ballast component on AUV, an empirical model of active ballast is required for the control or more accurate estimation of the AUV motion. This paper is about an experimental study carried out on a tube resembling AUV with both fresh water to obtain ballast volume in AUV.

2. Material and Method

2.1. Autonomous Underwater Vehicle

Basically, there are two ways to sink a submarine, namely by diving dynamically and statically. Many submarine models use static and dynamic methods when diving and such models are generally used by all military submarines. Figure 1 shows a flooding and blowing process in an active submarine ballast

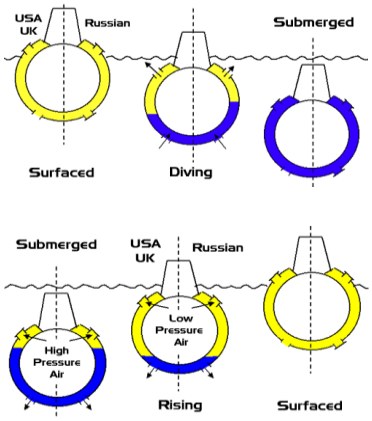


Figure 1. Flooding and Blowing of Ballast Systems

If viewed from the Law of Archimedes which states that an object that is partially or completely submerged into a liquid will experience an upward force which is the same as the weight of the liquid it displaces, an object completely or partially submerged in a fluid will get the weight to lift up that is equal to the weight of the fluid being transferred. The amount of upward force according to Archimedes's Law is written in the equation:

$$FB = \rho \, v \, g$$

With FB is the upward force (N), V = the volume of the immersed object (m3), ρ = the density of the liquid (kg / m3) and g = gravity acceleration (N / kg)

The Profile and Specification of ITSUNUSA AUV are shown and listed in Figure 2 and Table 1.

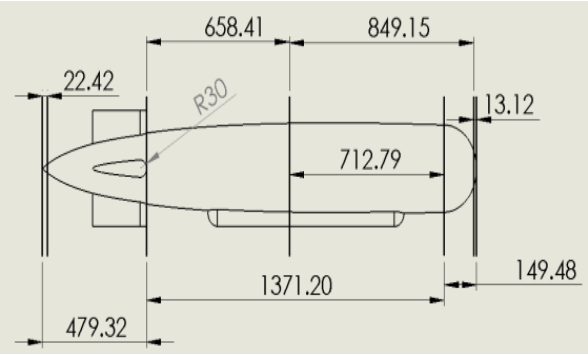


Figure 2. Profile of ITSUNUSA AUV [9,10]

Table 1. Specification of ITSUNUSA AUV [9,10]

Weight	16 Kg
Overall Length	2000 mm
Beam	300 mm
Controller	Ardupilot Mega 2.0
Communication	Wireless Xbee 2.4 GHz
Propulsion	12V motor DC
Propeller	3 Blades OD : 50 mm
Speed	3.1 knots (1.5m/s)

2.2. Ballast System Testing

The ballast system testing uses several tools and materials such as artificial ponds, fresh water, seawater, funnels, measuring cups, rulers, cutters, glue, stopwatches, 0.6 liter plastic bottle, 1 liter plastic bottle and 1.5 liter plastic bottle. The following is a picture of an artificial pool for the experiment as in Figure 3.

Figure 3. Experimental pool

The making of the ballast model begins with a 3-dim plastic bottle cut according to the needs of 0.6 liters, 1 liter and 1.5 liters using a hacksaw. After having the appropriate size, 2 holes with a diameter of 1 cm are made for a hose of 1 cm to fix each. The purpose of making 2 holes is for the first hole to fill the water and for the second hole to get the air out of the plastic bottle. Then the gluing of the pipes with the hoses is done using gun glue. Test material with plastic bottle is shown in Figure 4.

Figure 4. plastic bottle Active Ballast

Once the test equipment and materials are ready, the simulation is then carried out. This trial simulation is carried out using pools with fresh water. Water filling is carried out in stages according to the data determined to see the depth of the plastic bottle. The provision of load in the experiment was done by filling the water through a funnel connected to a hose installed in a plastic bottle. Depth measurements are carried out using a meter and ruler to the experimental pools used as shown in Figure 5.

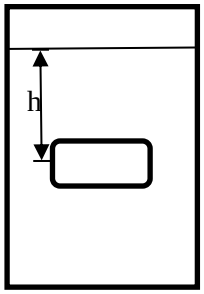


Figure 5. Depth measurements

From the experiment, the desired data are obtained, namely the depth of the bottle filled with freshwater and the time taken to fill the plastic bottle in stages.

Table 1. Data of platic bottle with Freshwater

Volume	0,6 liter		1 liter		1,5 liter	
	Depth (cm)	Time (s)	Depth (cm)	Time (s)	Depth (cm)	Time (s)
1/4 part	2.5	9,5	1,7	12,6	1,5	13,2
2/4 part	3	9,9	3,5	13,4	3,5	13,9
3/4 part	3.7	9,1	4,5	38,8	4,8	11,3
full	40	50	40	63	40	18,7

3. RESULT AND DISCUSSION.

From the results of the interpolation calculation from the experimental data the detailed depths can be observed when water filling is done. Based on the collected data then calculation of buoyant forces is made in accordance with Archimedes' law to find out the relationship between the experiments using Archimedes's law. The amount of buoyant force is formulated as follows:

$$Fa = \rho air\ Vb\ g$$

With the data interpolation, the graph can be obtained from each experiment using plastic bottle of different water conditions, namely fresh water and sea water. With this graph, it is easy to see the difference of each calculation data. The intended graphical results are as follows:

Graph of plastic bottle experimental da**ta**

- Freshwater

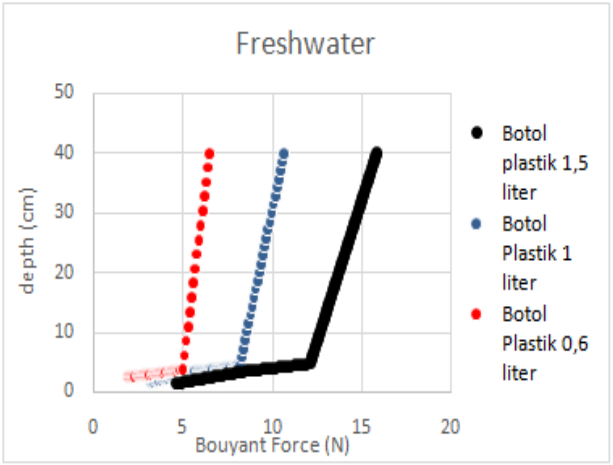


Figure 6. The graph of freshwater coming into plastic bottle

From the graph results it can be observed that there is an increase at some point. The increase occurs when the volume of the immersed object or the volume of filled water filled is ¾. To determine the formula of the empirical equation, division is made to each graph in accordance with the difference in the increase in the curve. The determination of the equation is done using the following linear equation formula:

From the calculation using the formula above, comes up the equation of each increase in curve for the graph as follows:

$$\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$$

From the calculation using the formula above, comes up the equation of each increase in curve as of the graph as follows:

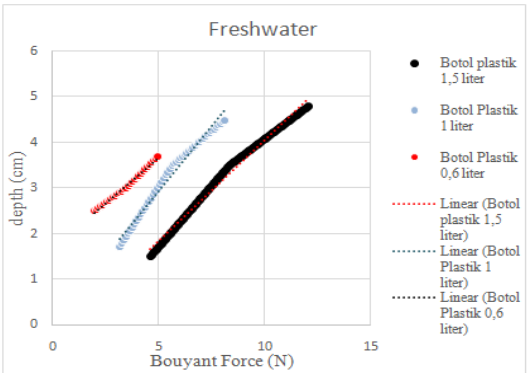


Figure 7. Graph of freshwater entering plastic bottle ≤ 3/4 volume.

From Graph of freshwater entering plastic bottle ≤ ¾ volume, the linear equation is as follows:

- plastic bottle 0.6 liter y = 0.4x + 1.6716
- plastic bottle 1 liter y = 0.56x + 0.1388
- plastic bottle 1.5 liter y = 0.44x - 0.3448

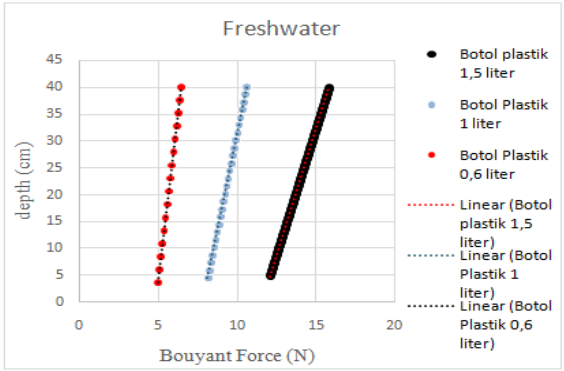


Figure 8. Graph of freshwater entering plastic bottle ≥ 3/4 volume.

From Graph of freshwater entering plastic bottle ≥3/4 volume, the linear equation is as follows:

- plastic bottle 0.6 liter y = 24.2x - 116.09
- plastic bottle 1 liter y = 14.2x - 111.06
- plastic bottle 1.5 liter y = 9.3867x - 108.68

From the graphs of the results of experimental data, it results in curves that look relatively the same from each experiment. The changes in depth increase occur at the point ≥ 3/4 of the volume of water is filled into the plastic bottle. From the experiment, this can be used as depth parameter, that is, when the volume of water enters the ballast tank.

From the analysis of experimental data, the results can be used to establish the parameter for active ballast making. These parameters are listed in the table below as follows:

Table 2 List of Standard deviation of experimental data results

No	Type of tool	Parameter of active ballast		
		Time (second)	Volume (m^3)	Depth (cm)
1	Plastic Bottle 0.6 liter	78.5	0.00019	18.473
2	Plastic Bottle 1 liter	127.8	0.000323	18.419
3	Plastic Bottle 1.5 liter	57.1	0.000484	18.417

Table 2, it can be seen that in each experiment there is a standard deviation that functions as a means of finding out the values scattered at each point.

Based on the standard deviation data of the depth, by comparing those of the freshwater medium and those of the sea water one, it shows different results. The resulted standard deviation of the fresh water medium is higher than that of the seawater, indicating that the depth of fresh water has more various increases in value when there is a gradual filling process compared to that of the sea water. In its filling, the time the seawater takes to fill the active ballasts is relatively shorter than that the fresh water takes. Then experimental data was calculated with regression equation.

The regression equation obtained can be written as follows:

$$\hat{Y} = b_0 + b_1X_1 + b_2X_2 + \cdots + b_pX_p \quad (1)$$

of which :

$\hat{Y}$: estimation of variable Y

b_p : estimation of parameter β_p

X_{1i} : value of variable X_1 for the observation of i

X_{pi} : value of variable X_p for the observation of i

Y_i : value of variable Y for the observation of i

n : number of data

Bottle with a volume of 0,6L in fresh water from the available data obtained :

$$n = 46;$$
$$\sum_{i=1}^{n} X_{1i} = 0{,}01725\,;$$
$$\sum_{i=1}^{n} X_{2i} = 761\,;$$
$$\sum_{i=1}^{n} Y_i = 440{,}5\,;$$
$$\sum_{i=1}^{n} X_{1i}^2 = 0{,}0000072795\,;$$
$$\sum_{i=1}^{n} X_{2i}^2 = 19268{,}8617\,;$$
$$\sum_{i=1}^{n} X_{1i}Y_i = 0{,}2194750\,;$$
$$\sum_{i=1}^{n} X_{2i}Y_i = 13446{,}26330\,;$$
$$\sum_{i=1}^{n} X_{1i}X_{2i} = 0{,}342255\,;$$

Based on the equation (1), the linear regression equation model can be shown as follows:

$$Y = \beta_0 + \beta_1\, Volume + \beta_2 time + \varepsilon \qquad (2)$$

To get a small residual, the regression equation model can be estimated by using the least squares method. By using the formula in equation (2)), the equation as follows is obtained

$$46b_0 + 0{,}01725b_1 + 761b_2 = 440{,}5$$
$$0{,}01725b_0 + 0{,}0000072795b_1 + 0{,}342255b_2 = 0{,}2194750$$
$$761b_0 + 0{,}342255b_1 + 19268{,}8617b_2 = 13446{,}26330$$

So these are obtained:

$$b_0 = -6{,}99785$$
$$b_1 = 5635{,}79$$
$$b_2 = 0{,}87409$$

Based on equation (2) the regression equation obtained is as follows:

$$\hat{Y} = -6{,}99785 + 5635{,}79\, X_1 + 0{,}87409\, X_2$$

Whereas by the application of the Minitab software the results as shown in Figure 9 are obtained.

Regression Analysis: Kedalaman versus Volume; Waktu

The regression equation is
Kedalaman = - 7,00 + 5636 Volume + 0,874 Waktu

Predictor	Coef	SE Coef	T	P	VIF
Constant	-6,99785	0,08339	-83,92	0,000	
Volume	5635,8	303,9	18,54	0,000	2,484
Waktu	0,874092	0,003349	261,03	0,000	2,484

S = 0,173633 R-Sq = 100,0% R-Sq(adj) = 100,0%

Figure 9. Results of multiple linear regression from 0.6 Liter freshwater bottle

Whereas for 1 liter plastic bottle, to get a small residual, the regression equation model can be estimated by using the least squares method. By using the formula in the equation (2.2) - (2.4), the equation is obtained as follows:

$$76b_0 + 0{,}04750b_1 + 2287{,}80b_2 = 742{,}1$$
$$0{,}04750b_0 + 0{,}0000333450 + 1{,}7025345b_2 = 0{,}6138180$$
$$2287{,}80b_0 + 1{,}7025345b_1 + 90662{,}8950b_2 = 34890{,}38020$$

So as the following are obtained:

$$b_0 = -0{,}495177$$
$$b_1 = -28488{,}57$$
$$b_2 = 0{,}9323107$$

Based on equation (2.5) the regression equation obtained is as follows:

$$\hat{Y} = -0{,}495177 - 28488{,}57\, X_1 + 0{,}9323107\, X_2$$

And for 1.5 liter plastic bootle, to get a small residual, the regression equation model can be estimated by using the least squares method. By using the formula in the equation (1) the equation is obtained as follows:

$$1125b_0 + 1{,}054174b_1 + 15428{,}835b_2 = 10876{,}098$$
$$1{,}054174b_0 + 0{,}0011065120b_1 + 14{,}724999b_2 = 13{,}4370179$$
$$15428{,}835b_0 + 14{,}724999b_1 + 214623{,}4686b_2 = 166068{,}78308$$

So as the following are obtained:

$$b_0 = -61{,}92289$$

$$b_1 = 18413{,}577$$

$$b_2 = 3{,}9619473$$

Based on equation (1) the regression equation obtained is as follows:

$$\hat{Y} = -61{,}92289 + 18413{,}577X_1 + 3{,}9619473X_2$$

4. CONCLUSION

Based the results of the experimental analysis above, it can be concluded that:

1. The submarine is in a sinking state when the volume of water filled is 3/4 of the volume of the active ballast tank.
2. The regression equation of 0.6 liter is $\hat{Y} = -6{,}99785 + 5635{,}79\ X_1 + 0{,}87409\ X_2$
3. The regression equation of 1 liter is $\hat{Y} = -0{,}495177 - 28488{,}57\ X_1 + 0{,}9323107\ X_2$
4. The regression equation of 1.5 liter is $\hat{Y} = -61{,}92289 + 18413{,}577X_1 + 3{,}9619473X_2$

5. ACKNOWLEGMENT

High appreciation to the Ministry of Research and High Education (Kemenristekdikti), Republic of Indonesia for the fund for my research conducted in the year of 2018. And appreciation to The Center of Excellence for Mechatronics and Industrial Automation (PUI-PT MIA-RC ITS) Kemenristekdikti, Republic of Indonesia.

REFERENCE

[1] Herlambang, T., Nurhadi H and Subchan., 2014. "Preliminary Numerical Study on Designing Navigation and Stability Control Systems for ITS AUV", *Applied Mechanics and Materials*, Trans Tech Publications, Switzerland. Vol. 49, pp. 420-425

[2] Herlambang, T., Djatmiko E.B and Nurhadi H., 2015, "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.*

[3] Ermayanti, E., Aprilini, E., Nurhadi H, and Herlambang T, 2015, "Estimate and Control Position Autonomous Underwater Vehicle Based on Determined Trajectory using Fuzzy Kalman Filter Method", *International Conference on Advance Mechatronics, Intelligent Manufactre, and Industrial Automation (ICAMIMIA)*-IEEE Surabaya Indonesia, 15 – 16 Oct 2015.

[4] Herlambang, T., Djatmiko E.B and Nurhadi H., 2015 "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.

[5] Oktafianto, K., Herlambang T, Mardlijah and Nurhadi H., 2015, "Design of Autonomous Underwater Vehcle Motion Control Using Sliding Mode Control Method", *Proc. of International Conference on Advance Mechatronics, Intelligent Manufactre, and Industrial Automation,* IEEE , ICAMIMIA 2015, Surabaya, Indonesia, pp. 184-187, Oct 15 – 17.

OPTIMIZATION OF THE EQUAL COURIER WORKLOAD WITH DETERMINATION OF SCHEDULE AND DISTRIBUTION ASSIGNMENT OF GOODS USING HEURISTIC METHODS

Artya Lathifah, Hikmah Sekarningtyas

Logistics Engineering Department, Universitas Internasional Semen Indonesia

Abstract

The increasing business of buying and selling online in Indonesia, has made companies engaged in freight forwarding services always make improvements to compete to win the market. One of the businesses carried out by the company is the provision of extra services for goods delivery activities, where the courier must prioritize the accuracy and speed of time in the service to each demand location. At present, the location is handled by the courier based on the direction of the foreman, where each courier handles one ward. For couriers who get locations with little shipping demand, then within 5 hours of delivery is complete. However, for couriers who get kelurahan with a lot of shipping demand, the shipping time reaches more than 8 hours. This creates a difference in the number of working hours for each courier, so that the workload is uneven, with the salary received by the courier is the same every month. If this is allowed, then the courier work regulations are less than optimal, because they feel that they are not being applied fairly. From the above description, the solution to the problem of workload inequality between couriers can be given through improvements to the assignment scheduling of goods delivery activities using the Simulated Annealing (SA) method. From these calculations, the results obtained that SA can be used in determining the optimal route for the creation of equal distribution of workload with a decrease in gap reaching 68% of existing conditions. There are 26 routes formed from SA, so 26 couriers will distribute goods every working day. The unscheduled courier on that day does not need to distribute goods, because all the destination points have been handled properly.

***Keywords**: Simulated Annealing (SA), Assignment Schedule, Goods Distribution, Equal Workload*

1. INTRODUCTION

Today many types of companies that have stood in the middle of people's lives, both companies engaged in industry, manufacturing and service industries. In general, the company is established have the same goal which is to meet the needs and interests of each customer. The existence of a company has to rely on the public response to products and services produced and is also related to the distribution activities of the company (Fuadiyah, 2018). Nasution (2004) explained that the distribution is a marketing activity to accelerate and facilitate the delivery of goods to customers. Distribution processes effectively and efficiently has become another indicator in achieving customer satisfaction (Pujawan and Mahendrawathi, 2017). The increasing competition between companies engaged in the same type of field, the company will be required to be able to improve services in the distribution of goods distribution activities. One company that is always striving to provide the best service in the distribution of goods by providing a selection of the products featured services that the company offers to customers is PT XYZ.

This company is a company engaged in the services sector, which is a delivery service of goods delivered by land, sea or air. The Company was established in addition to aim to reduce logistical costs, it is expected the company can provide service guarantees delivery in accordance with the company motto on time every time, the distribution range includes 5 sub-districts in South Surabaya that consists of 24 wards. In the distribution activity, the company has 27 couriers are ready assigned to deliver goods to the customer site antaran by dividing the couriers into 5 groups formed based on the number of districts in the handling by the DC (Delivery Center) company, ie as many as five

districts.

Currently, the online shopping becomes familiar and not so strange in the middle of people's lives. This is evidenced and justified by the Association of Indonesian Internet Service Provider (APJII), based on the results of a survey on penetration and behavior of Internet users in Indonesia in 2016 showed that as many as 98.6% of the population in Indonesia using the internet as a place to offer, seek, selling and buying goods or services.

This resulted in the increasing need for courier services. And to compete for the market, then the company which is engaged in courier services need to improve the service continuously.

One of the efforts given by the company to maintain customer satisfaction is the provision of additional services to the delivery of goods. In this case, the courier must give priority to timeliness and finished goods must be delivered and reaches the maximum receiver in accordance with the time limit until the last date of the goods promised in every kind of product delivery service chosen by the sender when transacting. Given that the sooner guarantee the delivery time, the more expensive the sender will have to pay. This resulted in hours of work each different couriers, between 5 hours to 10 hours in one day. Differences in working hours and the least affected of many goods are delivered to the eraser urban villages in the handling by each courier. For courier who get a little village with demand delivery, then within 5 hours of the delivery is completed. However, for a courier to get the village to demand delivery and more each day, the total delivery time reaches 7.5 hours to 10 hours. This resulted in the inequality of the workload among each courier. If it is allowed, then the courier job performance will be less than the maximum because they feel unfairly treated.

From the above description, a solution to the problem of inequality between courier workload can be provided through improved scheduling assignment on every courier. Assignment schedule is an important activity in a company, including in companies that are engaged in services so that companies can utilize resources efficiently crew (Rusdiansyah et. Al., 2007). It is very important for the benefit of the company, the level of service to its ability to compete in the market.

A technique that can be used for planning optimal scheduling, namely the technique of Operational Research (Medard et al., 2007). With the approach optimization that can be used to solve scheduling problems of workers, among others, using a mathematical method (engineering large scale linear programming and integer programming), as well as methods of Artificial Intelligent (Simulated Annealing, Neural Networks, Fuzzy Logic and Genetic Algorithms) (Kerati et al. , 2002). In this case, the research focuses on the use of Simulated Annealing (SA) in the determination of the assignment schedule a courier company. Simulated Annealing algorithm is an appropriate method to be applied in the job scheduling problems and some other problems (Santosa and Willy, 2011).

2. RESEARCH METHOD

2.1 Simulated Annealing

Simulated Annealing (SA) includes an algorithm that mimics the physical behavior of the steel cooling process in which the steel was originally experienced heating to a certain temperature and then cooled slowly (Santosa and Willy, 2011). Another meaning of Simulated Annealing the search technique random using the analogy of how the cooling iron and freeze into energy structure crystallization minimum (annealing) and find the minimum value for the system as a whole, form the basis of optimization techniques to problems of combinatorial and other issues (Santosa, 2017).

Simulated Annealing Methods mimic the

gradual cooling process of steel / metal boiling, to reach the minimum value function in the minimization problem. Where, annealing itself has a meaning as a solid material melting process and cooled slowly to reduce the temperature (Santosa and Willy, 2011). Particles of material trying to compose himself during the cooling process. This cooling process is done by determining the parameters similar to the temperature, then controlled again by using the concept of probability Boltzmann distribution. Probability Distributions Boltzmann states that energy (*E*) of a system in thermal equilibrium at temperature T a distributed probabilistically, referring to the formula:

$$\boldsymbol{P}\ (\boldsymbol{E}) = \boldsymbol{e}^{(\Delta E/kT)} \quad \textbf{.....(2.1)}$$

Where: P (E) = Opportunity reached the energy level E

k = Boltzmann constant

T = Temperature

AE = The difference in energy levels before and after the change of energy

Equation 2.1 has the intention that at high temperatures, the system has a probability of nearly uniform on the interval [1, 0] to be in any status. While at low temperatures, the system will have a low probability on the status of high energy. This suggests that if the process of finding solutions to follow the Boltzmann probability distribution convergence simulated annealing algorithm which can be set by adjusting the temperature *T*.

2.2 Step of the Simulated Annealing Algorithm

Steps Simulated Annealing algorithm is used to solve problems in the study, namely the determination of the schedule and assignment courier will be described in accordance with Figure 2.1. The following is an explanation of Figure 2.1.

1. Simulated Annealing determination of parameters such as the adjustment to the initial temperature (T_0) where $T_0 = T$, the final temperature (T_f), the value of alpha (α).

2. Initial Generation Solution or initial route selection, as the initial solution is now denoted by *X* (*Xb*) in the process of SA, previously formed using NN.
   - Current best initial solution (*X*) denoted by Xbest (*Xb*)
   - The objective function of X (obj (*X*)) denoted by Fbest (*Fb*)

3. Determination of new solutions (*Y*) resulting from previous solutions fixes *X* and based on the value of *p*. Where, *p* is the result of random values that appear randomly after random generation (*r*), with a *p*-value of 0<*p*<1.

The new solution (*Y*) is meant to be done Swapping Muttation, Flipping Mutation or Sliding Mutation. The new solution is also known as iteration 2.

- *Swapping Muttation* do if $p \leq 0{:}33$
- *Flipping Mutation* done if $p \leq 0.66 \leq 0{:}34$
- *Sliding Mutation* do if $p \geq 0.67$

4. The evaluation of each objective function value of *X* (obj(*X*)) and compared. The evaluation was done by the formula Δ = Obj (*Y*) - Obj (*X*).

- If Δ ≤ 0, then the value of objective *Y* is better than *X*, therefore *X* is replaced by *Y*.
- If Δ > 0, will likely replace *X* to *Y* with the first step of making a random value (*r*) and then do the calculations using current formula e (-Δ / *KT*). The results of these calculations a value of *r* < *e* (-Δ / *KT*). If the value of r <e (-Δ / *KT*), then change the value of *X* into *Y*. If not, then accept *X* is still the best solution and return to Step 3.

5. Doing Annealing Schedule with decreased initial temperature (T_0) using the formula $T = \alpha \times T$.

α is a constant for lowering the control parameter by value.$\alpha < 1$.

6. Ending algorithm T0 when the current temperature is lower than the final temperature (T_f) or the current best solution *X*best not be further improved as much as N (Non-improving) the temperature reduction in a row.

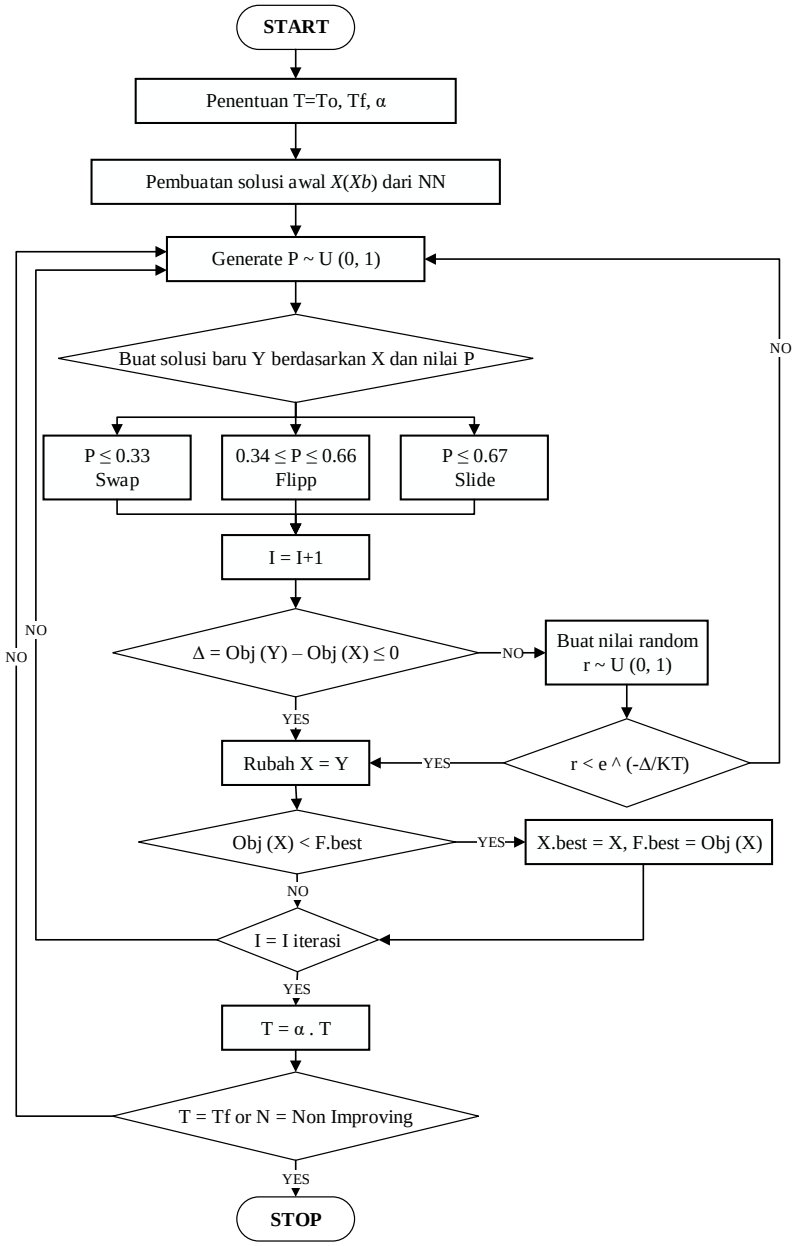


Figure 2.1 Forecast Simulated Annealing

3. PROBLEM DEFINITION

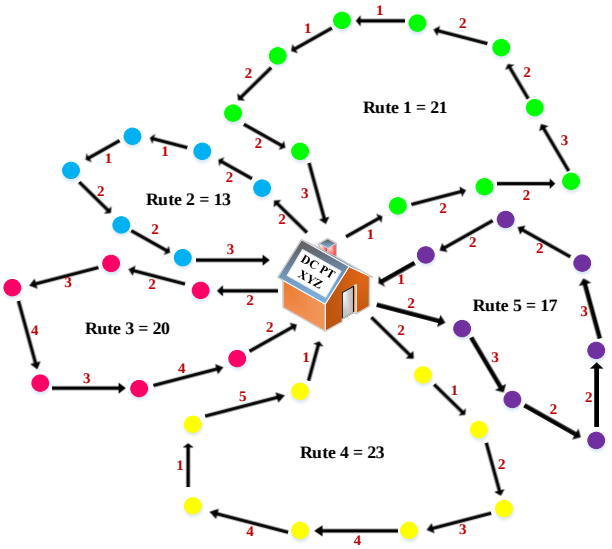
PT XYZ will deliver the goods to the customer into a shipping destination. Courier conduction region is a region in the handle as well as areas that have been designated as the conduction region companies with the purpose of sending in 5 districts comprising 24 villages.

In this activity, the delivery, the company has 27 couriers are ready to be assigned to deliver goods to the customer site antaran by dividing the couriers into 5 groups formed based on the number of districts in the handling by the DC (Delivery Center) company. While the number of members of the group formed in accordance with the number of villages from each district that are handled by the company, covering an area antaran District of Mount Anyar (4 villages), District Rungkut (6 villages), Wonokromo (4 villages), District Tenggilis Mejoyo (5 villages) and the District Wonocolo (5 villages).

Problems this time, hours of work each different couriers, between 5 hours to 10 hours in one day. Differences in working hours and the least

affected of many goods are delivered to the eraser urban villages in the handling by each courier. For courier who get little village with demand delivery, within 5 hours of the delivery is completed. However, for a courier to get the village to demand delivery and more each day, the total delivery time up to 8 hours to 10 hours. This resulted in the inequality of the workload among each courier. If it is allowed, then the courier job performance will be less than the maximum because they feel unfairly treated.

Figure 3.1 Illustration of Problems



4. RESULT AND DISCUSSION

4.1 Validation Enumeration

Results enumeration data by 1 DC 4 Node. The following Table 4.1 which is a distance matrix of a problem.

Table 4.1 Matrix Distance from Enumeration (Km)

Ke \ Dari	DC	RW1	RW2	RW3	RW4
DC	0	10	15	20	10
RW1	10	0	30	25	15
RW2	15	30	0	10	20
RW3	20	25	10	0	5
RW4	10	15	20	5	0

From Table 4.1, which is a table that contains a set distance in the form of a matrix. The table presents the distance between the first depot to 4 points of interest, which is where the data is converted into a matrix as presented in Table 4.2 below:

Table 4.2 Matrix Time of Enumeration (Minutes)

Ke \ Dari	DC	RW1	RW2	RW3	RW4
DC	0	15	22.5	30	15
RW1	15	0	45	37.5	22.5
RW2	22.5	45	0	15	30
RW3	30	37.5	15	0	7.5
RW4	15	22.5	30	7.5	0

From Table 4.2 above, it will get all of the possibilities that exist (enumeration result), which may be formed in each service from depot to each destination. The results of the enumeration will be presented in Table 4.3.

Hasil Enumerasi (Semua Kemungkinan)							Total Waktu
1 =	DC	RW1	RW2	RW3	RW4	DC	97.5
2 =	DC	RW1	RW2	RW4	RW3	DC	127.5
3 =	DC	RW1	RW3	RW2	RW4	DC	112.5
4 =	DC	RW1	RW3	RW4	RW2	DC	112.5
5 =	DC	RW1	RW4	RW3	RW2	DC	82.5
6 =	DC	RW1	RW4	RW2	RW3	DC	112.5
7 =	DC	RW2	RW1	RW3	RW4	DC	127.5
8 =	DC	RW2	RW1	RW4	RW3	DC	127.5
9 =	DC	RW2	RW3	RW4	RW1	DC	82.5
10 =	DC	RW2	RW3	RW1	RW4	DC	112.5
11 =	DC	RW2	RW4	RW1	RW3	DC	105
12 =	DC	RW2	RW4	RW3	RW1	DC	112.5
13 =	DC	RW3	RW1	RW2	RW4	DC	142.5
14 =	DC	RW3	RW1	RW4	RW2	DC	142.5
15 =	DC	RW3	RW2	RW4	RW1	DC	112.5
16 =	DC	RW3	RW2	RW1	RW4	DC	127.5
17 =	DC	RW3	RW4	RW1	RW2	DC	127.5
18 =	DC	RW3	RW4	RW2	RW1	DC	127.5
19 =	DC	RW4	RW1	RW2	RW3	DC	127.5
20 =	DC	RW4	RW1	RW3	RW2	DC	112.5
21 =	DC	RW4	RW2	RW3	RW1	DC	112.5
22 =	DC	RW4	RW2	RW1	RW3	DC	157.5
23 =	DC	RW4	RW3	RW1	RW2	DC	127.5
24 =	DC	RW4	RW3	RW2	RW1	DC	97.5

Table 4.3 Results of Enumeration

From Table 4.3, it can be seen that there are 24 possibilities that may arise when deciding on new solutions in the SA. Total time (in minutes) produced also varies at every possibility.

4.2 Validation SA

I. RuteNew of incoming NN ≤ 130 minutes

RuteNew = DC - RW4 - RW3 - RW2 - RW1 - DC = 97.5 minutes

II. Conducting the process of SA

Stage 1:

Simulated Annealing parameters:

- The initial temperature (T_0) where T0 = T_1 =

2C

- The final temperature (T_f) = 0.4˚C
- Alpha (α) = 0.2

Iteration 1

[1]. Determination of new solutions (*Y*) resulting from previous solutions fixes *X* and based on the value of *p*.

Let *p* = 0.7, we conducted Sliding Mutation on these preconceived.

S Previous (*X*) = DC - **RW4** - RW3 - RW2 - RW1 - DC = 97.5 minutes

New Routes (*Y*) = DC - RW3 - RW2 - **RW1 - RW4** - DC = 127.5 minutes

[2]. Checking the maximum time on routes that form, that each route is the maximum time ≤ 128 minutes.

New Routes (*Y*) have a total travel time of ≤ 128 minutes is 127.5 minutes, then continue with the procedure SA to step 3.

[3]. The evaluation of each objective function value of *X* (obj (*X*)) and compared. The evaluation was done by the formula AE = Δ = Obj (*Y*) - Obj (*X*).

S Previous (*X*) = DC - RW4 - RW3 - RW2 - RW1 - DC = 97.5 minutes

New Routes (*Y*) = DC - RW3 - RW2 - RW1 - RW4 - DC = 127.5 minutes

Δ = Obj (*Y*) - Obj (*X*) = 127.5 minutes - 97.5 minutes = 30 minutes

Δ ≥ 0. So, the first step undertake the manufacture of random values (*r*), with *r* = 0.6.

Subsequently perform calculations using formulas, with unknown *e* = 2.7, *k* = 1 and *T* / T_0 = 2C, then $e^{-(\Delta E/kT)}$

$$\boldsymbol{P\ (E) = \ e^{-\left(\frac{\Delta E}{kT}\right)} = 2.7^{-\left(\frac{30}{1*2}\right)} = 3x10^{-7}}$$

The calculation result is *r* >, then go back to step [1] to enter into iteration 2 and the *X* is still the best choice.$e^{-(\Delta E/kT)}$

Iteration 2

[1]. Determination of new solutions (*Y*) resulting from previous solutions fixes *X* and based on the value of *p*.

Let *p* = 0.1, we conducted Swapping Mutation on these preconceived.

S Previous (*X*) = DC - **RW4** - RW3 - RW2 - RW1 - DC = 97.5 minutes

New Routes (*Y*) = DC - **RW1** - RW3 - RW2 - RW4 - DC = 112.5 minutes

[2]. Checking the maximum time on routes that form, that each route is the maximum time ≤ 128 minutes.

New Routes (*Y*) have a total travel time of ≤ 128 minutes is 112.5 minutes, then continue with the procedure SA to step 3.

[3]. The evaluation of each objective function value of *X* (obj (*X*)) and compared. The evaluation was done by the formula AE = Δ = Obj (Y) - Obj (*X*).

S Previous (*X*) = DC - RW4 - RW3 - RW2 - RW1 - DC = 97.5 minutes

New Routes (*Y*) = DC - RW2 - RW3 - RW4 - RW1 - DC = 112.5 minutes

Δ = Obj (*Y*) - Obj (*X*) = 112.5 minutes - 97.5 minutes = 15 minutes

Δ ≥ 0. So, the first step perform generating random values (*r*), eg *r* = 0.4.

Subsequently perform calculations using formulas, with unknown *e* = 2.7, *k* = 1 and *T* / T_0 = 2C, then $e^{-(\Delta E/kT)}$

$$\boldsymbol{P\ (E) = \ e^{-\left(\frac{\Delta E}{kT}\right)} = 2.7^{-\left(\frac{15}{1*2}\right)} = 5.53x10^{-4}}$$

The calculation result is *r* > *e* (-Δ / *KT*), then go back to step [1], route *X* is still the best option and try to decrease the temperature decrease to go to Stage 2.

[4]. Doing Annealing Schedule with decreased initial temperature (T_0) using the formula *T* = *α* x *T*

$T2 = \alpha \times T1 = 0.2 \times 2 = 0.4$ ° C

And terminate the algorithm if T_0 is lower than the final temperature (T_f) or the current best solution *X*best not be further improved as much as N (Non-improving) the temperature reduction in a row.

4.3 Existing Condition

There are 27 couriers are active in the distribution of goods every day. Each courier has a conduction region respectively. Conduction region is divided into 27 routes, according to the number of villages that are handled by the company. Each route have travel time respectively and tend to be uneven. The purpose of the total travel time is uneven is known that among the one route that others have a time difference of up to 5 hours. It is caused by demand antaran every village is different. Resulting in hours of work each courier is also different every day, which reached 5 hours to 10 hours each weekday.

4.4 Results SA

In the process of calculation using the SA, the generation of the Initial Solution or early elections, as the initial solution is now denoted by *X* is taken from the first previously formed through Nearest Neighbor. Total travel time on each of these should not be more than 7 hours. However, if after the process SA, and obtained a total of route travel time to less than 6.33 hours (less than 40 minutes from a maximum total working hours), then the addition of a new point on the route at this time, from the point of service thereafter. The addition of these points must still meet the requirements of the restriction of the total working time ≤ 7 hours and vehicle load capacity limit that must not be more than 200 items in all deliveries.

And it can be seen that by the calculation process Initial Solution SA with the generation or the beginning of NN route selection, has been formed as many as 26 routes. Overall the service is able to handlev218 RW (Rukun Warga) with a total travel time on each route almost have the same load, ie, with an average total travel time is 6.65 hours.

Table 4.4 Results of Simulated Annealing Process

RUTE Ke-	KODE RUTE	URUTAN RUTE SIMULATED ANNEALING																	TOTAL WAKTU (Jam)
1	A	DC	43	42	41	44	45	46	32	33	34	35	36	37	38	39	40	DC	6.57
2	B	DC	51	52	50	49	48	47	DC										6.55
3	C	DC	53	54	55	56	57	58	DC										6.47
4	D	DC	82	81	80	79	78	77	76	75	74	73	DC						6.59
5	E	DC	95	93	94	89	90	91	87	88	83	84	86	85	DC				6.84
6	F	DC	**182**	96	102	101	100	99	98	97	DC								6.95
7	G	DC	189	188	187	185	184	183	190	191	**204**	DC							6.48
8	H	DC	**209**	198	197	199	200	201	202	203	207	206	205	DC					6.88
9	I	DC	194	193	208	218	217	216	215	214	213	212	211	210	DC				6.48
10	J	DC	65	61	60	59	1	2	3	4	5	6	7	8	9	DC			6.56
11	K	DC	141	17	18	19	24	23	22	21	20	**26**	DC						6.93
12	L	DC	**103**	31	30	29	28	27	DC										6.62
13	M	DC	**114**	168	167	166	92	104	DC										6.71
14	N	DC	111	112	113	115	116	117	118	119	120	121	122	123	DC				6.43
15	O	DC	175	174	173	DC	DC												6.4
16	P	DC	148	181	180	179	DC												6.56
17	Q	DC	68	15	14	13	12	11	10	25	DC								6.93
18	R	DC	16	62	63	64	66	67	69	70	71	72	150	DC					6.46
19	S	DC	132	133	134	136	137	138	139	140	DC								6.5
20	T	DC	178	177	176	DC													6.72
21	U	DC	165	164	163	162	161	160	159	158	157	156	**192**	DC					6.97
22	V	DC	**126**	**124**	169	170	171	172	DC										7
23	W	DC	125	127	128	129	130	131	135	**151**	DC								6.35
24	X	DC	**108**	152	153	154	155	147	146	DC									6.82
25	Y	DC	105	106	107	109	110	196	195	186	DC								6.12
26	Z	DC	149	145	144	143	142	DC											7
RATA - RATA WAKTU TEMPUH																			**6.65**

4.5 Analysis of Results Calculation

The analysis in this research is done by comparing the results between these existing conditions with the results of calculations using the

method of Simulated Annealing. Comparisons are made with the search gap at total travel time on its second based on the total maximum working hours between courier ie for 7 hours. The result can be seen in Table 4.5 below

Table 4.5 Results of average Gap Between Existing Condition with calculations SA

RUTE Ke-	KODE RUTE	JAM KERJA REAL (Jam)	WAKTU TEMPUH EKSISTING (Jam)	EKSISTING		WAKTU TEMPUH SA (Jam)	SA	
				GAP	ABS		GAP	ABS
1	A	7	4.67	-2.33	2.33	6.57	-0.43	0.43
2	B		6.4	-0.6	0.6	6.55	-0.45	0.45
3	C		4.71	-2.29	2.29	6.47	-0.53	0.53
4	D		7.34	0.34	0.34	6.59	-0.41	0.41
5	E		6.62	-0.38	0.38	6.84	-0.16	0.16
6	F		6.55	-0.45	0.45	6.95	-0.05	0.05
7	G		6.48	-0.52	0.52	6.48	-0.52	0.52
8	H		6.37	-0.63	0.63	6.88	-0.12	0.12
9	I		6.62	-0.38	0.38	6.48	-0.52	0.52
10	J		7.06	0.06	0.06	6.56	-0.44	0.44
11	K		8.1	1.1	1.1	6.93	-0.07	0.07
12	L		4.76	-2.24	2.24	6.62	-0.38	0.38
13	M		5.6	-1.4	1.4	6.71	-0.29	0.29
14	N		8.13	1.13	1.13	6.43	-0.57	0.57
15	O		4.84	-2.16	2.16	6.4	-0.6	0.6
16	P		5.97	-1.03	1.03	6.56	-0.44	0.44
17	Q		6.1	-0.9	0.9	6.93	-0.07	0.07
18	R		5.33	-1.67	1.67	6.46	-0.54	0.54
19	S		6.17	-0.83	0.83	6.5	-0.5	0.5
20	T		9.73	2.73	2.73	6.72	-0.28	0.28
21	U		6.4	-0.6	0.6	6.97	-0.03	0.03
22	V		5.8	-1.2	1.2	7	0	0
23	W		6.72	-0.28	0.28	6.35	-0.65	0.65
24	X		7.58	0.58	0.58	6.82	-0.18	0.18
25	Y		6.36	-0.64	0.64	6.12	-0.88	0.88
26	Z		5.23	-1.77	1.77	7	0	0
RATA-RATA GAP					1.09			0.35

Based on table 4.5, the average yield gap value of the total travel time of each route the existing condition with the condition of the route that uses the SA based on total hours worked up in general, is that the average value gap SA is smaller than the average value gap condition existing. The decline has reached 68% of the existing condition.

This means that the results of SA s better to be implemented into the company for the first reason is that it can be said that the total travel time generated by the SA method tends to almost the same between each route. So this will have an impact on the prevalence of the workload received by courier. The second reason is that the total travel time produced by the method of SA nearing maximum working hours courier. So this will make the company does not lose money in wages or salary to a courier because according to the hours of work and performance of each courier duty.

Thus, it can be concluded, with the use of the SA method in finding the best router is highly recommended in this matter. Given the results given, then the two sides ie companies and couriers have feedback that equally benefit both.

This decision was strengthened by the presence of T-test statistical tests conducted by the authors based on the gap from existing conditions and methods SA assuming α = 5% = 0:05. Test T-Test is used to test the "Effectiveness These Workload SA in Equity". Thus, H0 and H1 on T-test test this:

WITHOUT H0 = Workload route WITH SA = Workload SA These

H1 = Workload WITHOUT SA ≠ Workload WITH SA These

Thus, the test results can be seen in the bell curve (normal disribusi) are presented in Figure 4.2 below.

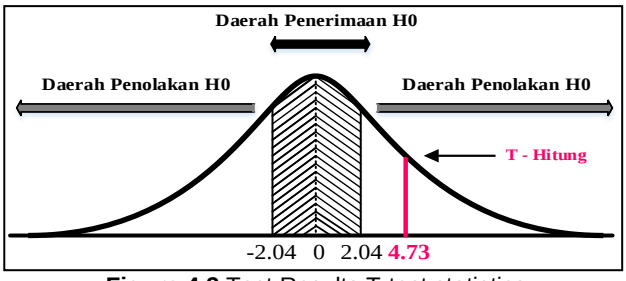


Figure 4.2 Test Results T-test statistics

Based on the results of a normally distributed curve or bell curve is that the results of t value is 4.73. This value is higher than the value of t table is 2.04. Accordingly, it is a big influence on the outcome. Where, in the decision of T-test statistical test is to reject H0 and accept H1, which means that the workload without the SA results will not be the same as the workload when using the SA. In another sense is that determining the route using current SA, is highly effective in work load equalization courier.

5. CONCLUSION

From the calculation and analysis has been done, it can be deduced as follows:

SA may be used in determining the optimal route for the creation of equitable distribution of workload to decrease the gap reached 68% of the existing condition. The total number of routes that form is as much as 26 routes. The workload of each courier in the distribution of goods, overall almost equal to the average total working time courier to penditribusian is 6.65 hours. Total working time courier in one day reached 7.65 hours. Each courier have 1 times the day off (outside Sundays) for not conducting the distribution of goods within 27 working days (1 month) .which have perishable goods caracteristics.

REFERENCES

Indonesian Internet Service Providers Association. (2016). *Survey of Penetration and Internet User Behavior in Indonesia*.https://apjii.or.id/ (Accessed at 10:15 pm, on February 11, 2019).

Surabaya Central Statistics Agency. (2017). *Number of RT RWs in Surabaya by Village.* https://surabayakota.bps.go.id (Accessed at 13:23 pm, dated February 6, 2019).

Fuadiyah, Maulidauyun. (2018). *Particle Swarm Optimization (PSO) Algorithm and Its Application in Capacitated Vehicle Routing Problems (CVRP*). Thesis Mathematics Study Program. Sunan Kalijaga State Islamic University, Yogyakarta.

Kerati, S., Moudani, W.E.L., Coligny, M., Mora-Camino, F. (2002). "*A Heuristic Genetic Algorithm Approach for the Airline Crew Scheduling*", www2.lifl.fr/PM2O/Reunions/04112002/kerati.pdf.

Medard, C.P., Sawhney, N. (2007). "*Airline Crew Scheduling from Planning to Operations*", European Journal of Operational Research. European Journal of Operational Research, Volume 183 (3), pp. 1013-1027.

Nasution, M.N. (2004). *Transportation Management*. Jakarta: Galia Indonesia.

Pujawan, I.N., dan Mahendrawathi. (2017). *Supply Chain Management Edisi 3.* Surabaya: ANDI Yogyakarta.

Rusdiansyah, A., Mirenani, Yani D., Labiba, Z., Siswanto, N. (2007). *Modeling and Solving Problems of Pilot Scheduling with the Exact Method of Decomposition.* Journal of Industrial Engineering. Vol. 9, No.2. Desember 2007: 112-124.

Santosa, Budi. (2017). *Introduction to Metaheuristic Implementation with Matlab*. ITS. Tekno Sains: Surabaya.

Santosa, B., & Willy, Paul. (2011). *Metaheuristic Method Concept and Implementation*. Guna Widya: Surabaya.

Web Perusahaan. (2018). Profile and History. https://bit.ly/2REOV7I (Accessible at 12:11 pm, on February 19, 2019).

MATURITY LEVEL ASSESSMENT MANAGEMENT INFORMATION SYSTEM AT DIRECTORATE OF STUDENT IN ABC UNIVERSITY

Marissa Rizki Nur Hidayati

Universitas Internasional Semen Indonesia
Jln Veteran Gresik Jawa timur 61122

ABSTRACT

Information system services are currently one of the important needs of ABC University. The ABC University has SKEM information system service. This service is useful for carrying out a strategic role in developing the students' abilities in hard skills and soft skills. SKEM information system service involves many parties, which are the Rector, Directorate of Student, Academic Advisors and Students. Because the SKEM information system is one of the important needs of the University, this service still requires improvements to the documentation of governance and services, which have never been audited or measured. Assessing the maturity level aims to determine the feasibility and management capability of SKEM information system service. Assessing the maturity level of SKEM information system service uses the Control Objectives for Information and Related Technology (COBIT) 4.1 with the domain of the Deliver and Support (DS) 1. Domain DS 1 is to determine and manage service levels that have 6 processes, which are service level management framework, business service definitions, service level agreements, operating level agreements, monitoring and reporting the achievement of service levels and review of service level agreements and contracts. The results of the maturity level of SKEM information system service is 2.94, the value is included at level 3. Level 3, namely Defined, means that the organization has procedures that have been communicated to all stakeholders to be carried out in daily work activities.

Keywords : *COBIT; maturity level; service level*

1. INTRODUCTION.

Directorate of Student Affairs has an important assignment at the University of ABC of carrying out the surveillance and monitoring of students and even graduates of the University. Supervision and monitoring performed by Student at University alumni ABC using Tracer Study. Tracer Study Services serves to determine the alumni activities after graduating from the University as a current job even current basic salary.

Services for ABC University students are using the services of Information Systems Student Extracurricular Credit Units (skem) implemented since 2016. ABC University is determined to perform useful services skem information system to carry out a strategic role in developing students' ability maunpun hard skills soft skills. Therefore skem is a requirement of graduation (graduated).

Skem regulations established by the Rector and more details have also been arranged through the Rector Decree No. 010 / SK / 01-01 / 03:16. This skem points accumulated from the start to the semester 1 to semester where the students passed. Skem acquisition can also be a center of information to stakeholders about the picture of the ability of the student. Students must accumulate a value in accordance with the existing predicate.

Skem involves many parties and became one of the very important role for the implementation of the graduation requirements or graduated, so skem necessary to measure the level of maturity, especially in skem information system services. But at the University of ABC Tracer Study service, the Directorate of Student Affairs University of ABC is not willing to do assessment of the level of maturity, because still in the process develope and does not have the governance, especially in the service Tracer Study.

This value measurements using COBIT 4.1 with DS domain 1. Domain DS 1, which is about defining and managing service levels which are needed at this time. Measurement of the maturity value is intended to determine the feasibility or management capabilities. The author conducted research on the maturity value of information systems based on COBIT 4.1 skem because it has not carried out by any party.

The conclusion of the background of the formulation of the problem is what is the level of maturity of users on the service information system according Framwork skem COBIT 4.1 by using a domain DS 1?

The purpose of this study was to determine what the level of maturity at skem information system services using the COBIT 4.1 framework with DS domain 1. Therefore there are limits his research as follows:

a. This study focuses on the DS 1 COBIT 4.1 framework

b. ABC University have skem information system services that have been developed by faculty, students, staff to the vice chancellor.

c. Services skem information system has been implemented since 2016 but has not carried out the measurement of the level of maturity.

d. Outcomes of this study is an IT audit instrument, maturity value calculation using the COBIT 4.1 framework, especially DS 1.

In the explanation of the research restriction contained some previous researchers to be a reference that is measuring the feasibility of using information system services performed by the COBIT 4.1(Prabowo, Wirastuti and Kumara, 2017) stating that the student is still perceived lack of care on campus broadband services Telkomsel flash lounge Mahasaraswati University Denpasar and researchers (Purwati, 2014), Based on the results of his research is on monitoring in SIAKAD to correct any shortcomings or weaknesses in the system.

2. METHODOLOGY

In the study describes the method used in the stage of completion of this study is Control Objectives for Information and Related Tecnology 4.1 (COBIT) 4.1. COBIT 4.1 has 4 domains consisting of:

a. PO (Plan and Organize) having 10 processes therein.

b. AI (Acquire and implemen) having 7 process therein

c. DS (Deliver and Support) having 13 processes therein

d. ME (Monitor and Evaluate) having 4 processes therein

COBIT 4.1 has the size scale or maturity level, based on the rating listed in Table 1.

Table 1 Maturity Level

Index	level	Description	Criteria
0 to 0.49	0- Non-Existent	Organization is not at all concerned with the importance of IT in the management of management	-
0.50 to 1.49	Initial 1-	IT organizations have to apply in accordance with the needs of organizations without any prior planning or management of irregular	Availability of Information Technology
1.50 to 2.49	2- Repetable	The organization has grown in step perform management activities related to IT governance, but not yet well defined or formal so inconsistent	Availability of IT, IT Governance
2.50 to 3.49	3- Defined	The organization has procedures which have been communicated to all	Availability of IT, IT Governance, Implementing IT

Index	level	Description	Criteria
		stakeholders in the organization to be implemented in daily work activities	Governance
3.50 to 4.49	4- Managed	Organization monitor and measure compliance with procedures, take action on the process less effective.	Availability of IT, IT Governance, Implementing IT Governance, Monitoring
4.50 to 5	Optimized 5-	Organizations have implemented IT governance refers to the best practice	Availability of IT, IT Governance, IT Governance Implementing, Monitoring, Evaluation Report / Activity

Source: (Pradini and Andry, 2018)

1.1. Reseach Focus

This study focused on the assessment of the maturity level services skem on ABC University. These assessments using standard COBIT 4.1 framework using DS domain 1 and there are 6 processes therein contained in Table 2.

Table 2. Processes Domain DS 1

DS 1.1	Service level management framework
DS 1.2	The definition of service business
DS 1.3	Service level agreement
DS 1.4	Operating level agreements
DS 1.5	Monitoring and reporting of service level attainment
DS 1.6	Overview of service level agreements and contracts

Source: (ISACA, 2011)

Completion of the study measuring the level of maturity of information system services skem University ABC did with several steps that must be implemented. In the first stage is to study the case study skem information system services and obtain information on the current state of information system services skem.

The second stage of studying the COBIT 4.1 framework at this stage of the analysis of the current state of information it can be seen that the domain should be used is a suitable domain and still nobody at the University of ABC.

The third stage is the creation of documents audit instruments are based on the domains that have been selected. The instrument consists of a document audit audit process, audit and audit inspectors listing step.

Document audit instruments that have been made can be used for the next stage is the interview process. Stages after conducting interviews is the calculation of the level of maturity in information systems services skem University of ABC and can be seen in the results of the maturity level skem information system services.

3. RESULT AND DISCUSSION

The first stage of the calculation of the value of the maturity level of audit services skem information system that determines the scale of the audit instrument measures and calculates to find the value (N). Value (N) is the value of the level of maturity of a subdomain or sub-processes. The calculation of the value (N) in the subdomain DS 1.1 can be seen in Table 3.

Table 3. Maturity level subdomain DS 1.1

subdomains	Scale
DS 1.1.1	5
DS 1.1.2	5
DS 1.1.3	5
DS 1.1.4	3
Value	4:50

Results maturity level subdomain DS 1.1 is 4:50. Explanation of Table 3 is an explanation or details of the Handbook skem is appropriate Rector

Decree No. 010 / SK / 01-01 / 3:16 but students still often asked about skem. Service level management framework skem information system has been accommodated by the Rector Decree No. 010 / SK / 01-01 / 03:16. The calculation of the value (N) DS 1.2 subdomains are in Table 4.

Table 4. Maturity level subdomain DS 1.2

subdomains	Scale
DS 1.2.1	5
DS 1.2.2	2
DS 1.2.3	5
DS 1.2.4	3
Value	3.75

Values maturity level subdomain DS 1.2 is 3.75. Explanation of Table 4 is skem own information system services in accordance with established procedures, procedures which are owned only one of Handbook skem. Skem information system services then the resistance is not skem own information system services and data have been integrated flexible. On the verification skem not have procedures or reference procedures for verification. The calculation of the value of the maturity level subdomain DS 1.3 can be seen in Table 5.

Table 5. Maturity level subdomain DS 1.3

subdomains	Scale
DS 1.3.1	3
DS 1.3.2	3
DS 1.3.3	1
DS 1.3.4	3
Value	2:50

Values maturity level subdomain DS 1.3 is 2:50. Explanation of Table 5 is the Rector Decree No. 010 / SK / 01-01 / 03:16 has been approved and detailed in the Handbook skem but but the complete document IT governance is still incomplete owned and in the event of system downtime on services student information system skem Directorate does not have handlers manually. In the book there are explanations guide the new students and the graduation requirements that occur in the field that some students do not understand graduation requirements. Values maturity level subdomain DS 1.4 in Table 6.

Table 6. Maturity level subdomain DS 1.4

subdomains	Scale
DS 1.4.1	3
DS 1.4.2	2
Value	2:50

Values maturity level subdomain DS 1.4 is 2:50. Explanation of Table 6 is the maturity level is taken of the findings during the operational use of information systems services skem not have constraints and effective but some students still do not understand the categories of activities, the level of even type at skem information system services that exist on the submission form activity. 1.5 DS subdomain maturity level value can be seen in Table 7.

Table 7. Maturity level subdomain DS 1.5

subdomains	Scale
DS 1.5.1	2
DS 1.5.2	1
DS 1.5.3	2
DS 1.5.4	2
Value	1.75

Values maturity level subdomain DS 1.5 is 1.75. Explanation of Table 7 is the Directorate of Student Affairs carry out monitoring takes place only when yudisum skem information systems and services are not conducting the relevant stakeholders of the report does not even have a

monitoring procedure on skem information system services and have no achievement evaluation report skem information system services. 1.6 DS subdomain calculation of the level of maturity seen in Table 8.

Table 8. Maturity level subdomain DS 1.6

subdomains	Scale
DS 1.6.1	2
DS 1.6.2	1
Value	1:50

Values maturity level subdomain DS 1.6 is 1:50. Explanation in Table 8 does not have an agreement between the parties with the Directorate of Directorate Kemahasiswa-ICT SDMO not even have the activity report skem information system services.

After giving the scale and calculate the value of the level of maturity of each subdomain / sub-processes that will determine the outcome of the measurement of the maturity level domain DS 1 which can be seen in Table 9.

Table 9. Maturity Level Domain Values DS 1

subdomains	Value (N)	The weight of (B) (%)	Total (NXB)
DS 1.1	4:50	26%	1:19
DS 1.2	3.75	8.8%	0:33
DS 1.3	2:50	35.3%	0.88
DS 1.4	2:50	5.9%	0:15
DS 1.5	1.75	11.8%	0:21
DS 1.6	1:50	11.8%	0:18
Total		100%	2.94

Defined process which means that the organization has procedures which have been communicated to all stakeholders in the organization of the Head of Service at the Directorate of Student Affairs as monitors skem, Lecturer Guardian as verifier and students are responsible for proposing the activities to be implemented in daily work activities.

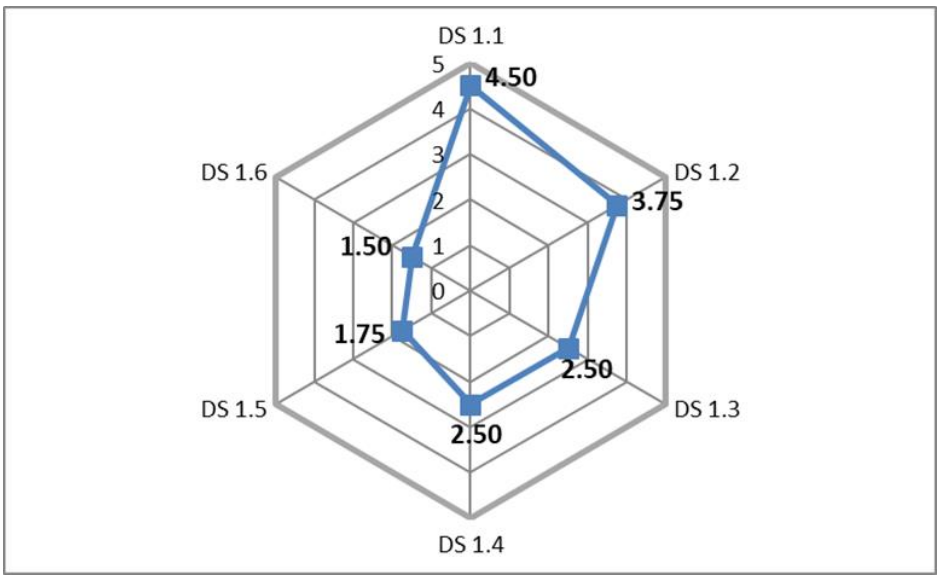


Fig.1. Radar Graph Domain DS 1

From the measurement of the level of maturity that has been done, there are findings and recommendations that can be seen paada Table 10.

Table 10. Findings and Recommendations

Subdoamin	Findings	Results Recommendation
DS 1.1	Most of the students do not understand the contents of the Handbook skem	To socialize for understanding Handbook skem
DS 1.2	Skem information system services have a document, a document which is owned namely Handbook skem	Make skem procedure that contains the filing activity
	Each Lecturer Guardian has different procedures for carrying out the verification skem, for service information system skem still do not have a procedure or verification procedures skem	Creating a verification procedure of activities
DS 1.3	Most of the students preparing for graduation requirements during the final semester due to a lack of understanding of students on graduation requirements	To disseminate understanding graduation requirements
	When the information system services skem experiencing system downtime, student affairs directorate has no manual handler	Make a submission form activity
		Make a list of activities form
DS 1.4	Students often incorrectly determine the activity category, type or level, because most of the students do not understand the explanation of the categories of activities, types and levels on skem	Socialization explanation of categories of activities, types and levels on skem
DS 1.5	Directorate of Student Affairs at skem information system services do not have a regular monitoring schedule on skem, monitoring is only done when graduated, but monitoring skem followed by Lecturer Guardian	Creating a monitoring procedure information system services skem
	Directorate of student achievement do not carry out regular reports skem information system services to relevant stakeholders	Conducting achievement report information system services skem
	Skem information system services do not have an evaluation report perperiode	Creating an evaluation report information system services skem each period
DS 1.6	According to the Directorate of Student Affairs information system services skem not include on the work program, the service does not have the information systems skem information system services activity report skem	Make achievement activity report information system services skem
	Party Directorate of Student Affairs Directorate-ICT SDMO not have a service level agreement information system skem	Make a written agreement between the Directorate of Student Affairs Directorate-ICT SDMO about service information system skem

4. CONCLUSION

Skem information system services are useful to perform a strategic role to develop the ability of students. Skem involve many stakeholders, including the Directorate of Student Affairs as the party that monitor skem. Lecturer Guardian also involved as a verifier proof or certificates owned by students and approved the submission has been filed. While students are responsible for filling, evocative document, to seek approval of Lecturer

Guardian. Skem also involved the Rector to establish policies that are called by the Rector. The importance of information system services will require implementation skem maturity value measurements. Measuring the value of the level of maturity using COBIT 4.1 framework. Domain supporting information system services skem domain ie DS-1, DS domain 1 which define and manage service levels, in which there are 6 process. The use of this domain because the DS 1 skem information system services still requires improvement of governance and service documentation has not yet been audited.

The result of the maturity level of service that is 2.94 skem information system included in level 3. Level 3 is Defined process which means that the organization has procedures which have been communicated to all stakeholders to be implemented in daily work activities. In a subsequent study is expected to investigators conducting the audit based on the domain in addition to Deliver and Support (DS) 1, which define and manage service level on COBIT 4.1, it is possible to use other framework such as COBIT COBIT 5 or 2019.

REFERENCES

ISACA, C. (2011) 'COBIT®4.1 Process Assessment Model', *IL, USA: ISACA*.

Prabowo, F., Wirastuti, D. and Kumara, I. N. S. (2017) 'Evaluasi layanan broadband campus dengan menggunakan framework cobit 4.1', (August). doi: 10.24843/MITE.2017.v16i02p06.

Pradini, T. and Andry, J. (2018) 'Audit Front Office Information Systems In World Hotel Using Cobit 4.1 FRAMEWORK, (January).

Purwati, N. (2014) *Audit Academic Information System Using Cobit Framework 4.1* (Case Study IBI Darmajaya)', 14(2).

THE EFFECT OF INDONESIAN BATTLESHIP ATTENDANCE LEVEL IN THE SEA WITH THE INDONESIAN BATTLESHIP CAPABILITY AGAINST SECURITY IN THE INDONESIAN SEA

Brillyandhi S [1], Benny Sukandari [2], Fa'iq Mumtaz M [3]

[1, 3] Indonesian Naval Technology College, STTAL Surabaya
[2] Sekolah Staf dan Komando Angkatan Laut, Seskoal Jakarta
E-mail: Brillyandhi@gmail.com

ABSTRACT

Indonesia is one of the countries where two-thirds of its territory is the sea, so that with the existence of the World Maritime Axis policy it is hoped that the security factor in the Indonesian sea becomes an important part that cannot be underestimated. The Republic of Indonesia Battleship (KRI) is one of the defense systems of the State which acts as a guardian of sovereignty and security in the Indonesian Sea as a matter that has been mandated in the Law. This paper discusses how the influence of the attendance of Indonesian Battleship in the sea and the capabilities possessed by Indonesian Battleship on the level of security in the Indonesian sea. The Indonesian Navy has the main task of developing the Ocean Force Strength. It is necessary to determine the right policies for how the development of power is carried out. Therefore, research is conducted on how much influence the attendance of Indonesian Battleship in the Sea and the capabilities possessed by Indonesian Battleship towards the level of security that occurred in the Indonesian sea. The attendance of Indonesian Battleship in the sea in this study will be measured by indicators in the form of operating patterns used with the number of existing Indonesian Battleships compared to the area covered, while those that show indicators of the capabilities of the Indonesian Battleship are the weapons systems and technology installed on Indonesian Battleship. This research is quantitative by using the multiple regression analysis method and the data collection techniques used are by conducting surveys and distributing questionnaires with a Likert scale towards implementing or guarding Indonesian Battleships as well as Indonesian navy leaders.

Keywords: *Indonesian Battleship, Multiple Regression, Indonesia seas Security, Indonesian Battleship Attendance Level, Capability Of Indonesian Battleship*

1. INTRODUCTION

Indonesia is the largest archipelago country in the world which has 17,508 consisting of large and small islands, with a national area of more than 5 (five) million km², of which two thirds of the area is waters. With a vast area of the sea, the level of security in the sea becomes very vulnerable and allows criminal acts to occur at sea (Siregar, 2008).

Indonesia based on UNCLOS The 1982 has three archipelagos sea lanes (ALKI) which are free to be used as transport routes by other countries for both trade and military interests, as a consequence of the archipelagic state. However, due to the existence of these sea lanes Indonesia also gained authority in controlling and securing all of its oceans, with the sea area being so extended that violations often occurred, this shows that the Indonesian sea territory was not fully overseen by the Indonesian Navy patrol boats (Santoso, 2014).

Indonesia is the country with the highest number of beaches and has border areas with neighboring countries, both on land and in the ocean so that it can be a vulnerability to security conditions in the Indonesian sea. This is evidenced by the number of violations that were carried out by foreign vessels by crossing the designated sea boundary. As well as other violations such as illegal fishing, piracy and piracy, shipping and smuggling violations such as illegal drug trafficking (Illicit drug trafficking), illegal migrants and people smuggling, arms smuggling.

With a variety of crimes occurring in the sea, the level of security at sea can be low due to too many acts of crime in the Indonesian sea. Therefore, the Indonesian Battleship as a Navy Alutsista which has a duty to carry out security in the sea needs to be improved both in capacity and quantity because based on the graph below the Indonesian Navy Indonesian Battleship managed to arrest criminals in the sea where the crime of illegal fishing was at the top and the year increase followed by criminal acts of piracy and shipping violations.

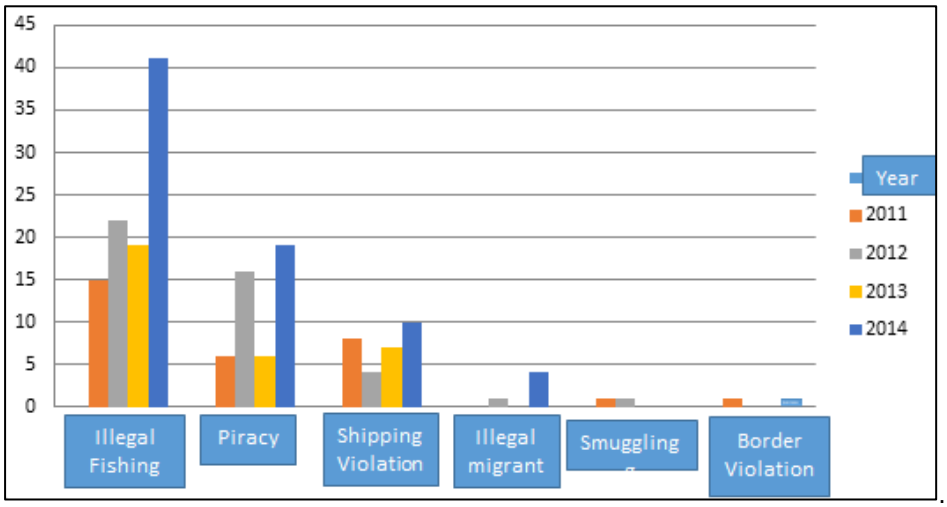


Figure 1: Indonesian Seas Violation

2. METODHOLOGY

2.1 INDONESIAN BATTLESHIP ATTENDANCE LEVEL IN THE SEA

Based on Theory (Alfred Thayer Mahan 1974) explains that sea power consists of Commercial Fleet, Navy and Base. Vital for national growth, prosperity and security. Basically, sea power consists not only of its naval power, but is a combination of a growing fleet with naval power as its protector from all activities on land and at sea that support both. So that it can be said that the attendance of Indonesian Battleships at sea is important to be able to provide protection and security for the merchant fleet at sea. Based on this theory, the Navy as part of the system of government of the Republic of Indonesia must be able to guarantee the continuation of the development of strengths and capabilities within the Navy. One of them is the right and reliable strength and ability of Indonesian Battleship defense equipment in dealing with various types of battles (Mahan, 1974).

Attributes in supporting the level of Indonesian Battleship attendance at sea will be represented by the number of Indonesian Battleships owned and the pattern of operations performed with the total questions in the questionnaire totaling 10 pieces.

2.2 THE INDONESIAN BATTLESHIP CAPABILITY

Ability according to the Indonesian Dictionary (KBBI) is derived from the word capable which means power (able, able, strong) to do something. Whereas ability means ability, the ability or strength to do something is related to the context of the next word. The ability discussed in this study is the ability of an Indonesian Battleship which is an organization consisting of several interrelated parts between one device and another and the relationship between the equipment and the user, namely the crew of the guardian. Moenir states that abilities or skills come

from capable basic words which in relation to tasks or work means being able to do tasks or jobs, so that the goods or services are produced as expected.

Based on the above understanding, it can be interpreted that to do a job requires the ability to be able to support and carry out the work so that it can achieve the desired goals based on existing provisions. Basically Ability is a combination of knowledge and skill, so the factors that influence the ability of an object are the Technology and System it has. Capability is a combination of theory and experience gained in practice in the field, including an increase in the ability to apply the right technology in order to increase work productivity.

Therefore, the capabilities of the Indonesian Battleship will be represented by the technology attributes used and the weapons system owned. The number of questions used in the questionnaire amounted to 10 pieces.

2.3 SECURITY IN INDONESIAN SEA

Based on Republic of Indonesia Law Number 37 of 1999 dated September 14, 1999 concerning Foreign Relations. Article 1 paragraph 2 explains that the Foreign Policy of the Republic of Indonesia is "Policies, attitudes and the steps taken by the Government of the Republic of Indonesia in relations with other countries, international organizations and other international legal subjects in order to face international problems in order to achieve national goals". Free and active foreign policy or foreign policy is inseparable from various developments in national and international conditions. Where one of the policies taken is to increase the role of Indonesia to maintain national security and contribute to creating world peace. Efforts to enhance Indonesia's role in maintaining national security and world peace.

J. G. Starke in his theory states that a sovereign country has territory, government, and citizens.[1] Mochtar Kusumaatmadja said that the state is sovereign because sovereignty is an essential characteristic of the state, and if it is said to be sovereign, it means that the state has the highest authority.[2] So as to maintain the territory that is owned, the level of security in the sea becomes a form of policy that must be implemented by the government to safeguard the sovereignty of Indonesia when referring to it based on the Law and the theory. The level of security will be represented using the number of violations that occur and the deterrent effect with 10 questions in the questionnaire.

2.4 Regression Analysis

Regression Analysis is used by researchers with the aim of knowing how much influence the value of the dependent variable if the value of the independent variable is changed (Sugiyono, 2004: 206). Regression is useful for analyzing between one with another variable conceptually having a causal relationship.

$$Y = a + bX$$

Values a and b can be obtained using formulas:

$$a = \frac{(\Sigma Y)\ (\Sigma X^2_1)\ (\Sigma X_1)\ (\Sigma X_1 Y)}{n\ \Sigma x^2_1 - (\Sigma x_1)^2}$$

$$b = \frac{n\ (\Sigma X_1 Y) - (\Sigma X_1)\ (\Sigma Y)}{n\ \Sigma x^2_1 - (\Sigma x_1)^2}$$

Dimana :

Y = Subject / Value in the predicted dependent variable

a = Value of Y If X = 0 (harga konstan)

[1] J.G. Starke, 1989, Introduction to International Law (An Introduction on International Law), Translated by Sumitro Danuredja and Lukas Ginting, Jakarta, Indonesian Persada Script, p. 143.

[2] Mochtar Kusumaatmadja, 1990, "Introduction to International Law", Bandung, Binacipta, p. 11.

b = Number of directions or regression coefficients, which indicate the number of increases or decreases in the dependent variable based on independent variables. If b (+) then there is an increase, and if (-) there is a decrease.

X = Subjects on independent variables have certain values.

Provisions :

If b = 0, then the independent variables do not affect the dependent variable.

If b> 0, then the independent variable does not affect the dependent variable.

If b> 0, then the independent variables negatively influence the dependent variable.

Furthermore, the results of the calculation of the correlation value between variables from the Regression analysis can be guided by the table below:

Table 1
Guidelines for giving Interpretation of the Correlation Coefficient

Internal Coefficient	Correlation Level
0,00 – 0,1999	Very Low
0,20 – 0,3999	Low
0,40 – 0,5999	Moderate
0,60 – 0,7999	Strong
0,80 – 1,0000	Very Strong

Source : Sugiyono (2004 : 183)

To find out whether the independent variable has a relationship with the dependent variable, it can be done using the t test with a significance level of 5%, then the test results are compared with the table. If t count is smaller than or equal to the table, then variable X does not have a relationship with variable Y while if t- table is greater than t-test then variable X has a relationship with variable Y.

2.5 Research Metodhology and Hypothesis

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:

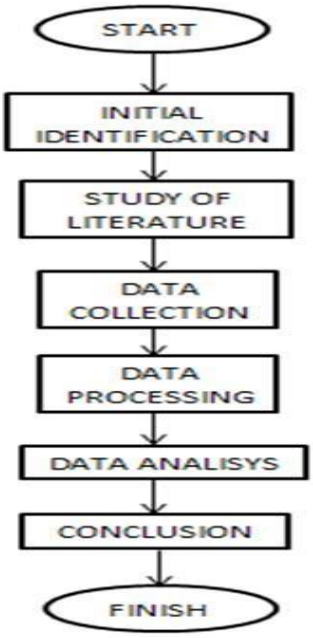


Figure 2: Research Metodhology

The hypotheses used in this study are as follows:

a. H0 = The level of attendance of Indonesian Battleship (X1) and the Capabilities of Indonesian Battleship (X2) Partially does not significantly affect the level of security at sea (Y).

Ha = Level of attendance of Indonesian Battleship (X1) and Capabilities of Indonesian Battleship (X2) Partially affects significantly to the level of security at sea (Y).

b. H0 = The level of attendance of Indonesian Battleship (X1) and Capabilities of Indonesian Battleship (X2) Simultaneously does not significantly affect the level of security at sea (Y).

Ha = The level of attendance of Indonesian Battleship (X1) and Capabilities of Indonesian Battleship (X2) Simultaneously has a significant effect on the level of security at sea (Y).

3. RESULT AND RESEARCH ANALYSIS

Questionnaires were distributed to 350 respondents who served in the Indonesian Navy's operating unit. After that the validation test for each variable is carried out. The following are the results of data validation of each variable.

Tabel 2. The Results Of Data Validation Of Each Variable.

Item	X1			
Question	R Table	R	Sig	Validity
1	0.096	24.63	0.00	Valid
2	0.096	6.28	0.00	Valid
3	0.096	2.76	0.01	Valid
4	0.096	26.86	0.00	Valid
5	0.096	27.59	0.00	Valid
6	0.096	23.66	0.00	Valid
7	0.096	24.25	0.00	Valid
8	0.096	25.46	0.00	Valid
9	0.096	27.99	0.00	Valid
10	0.096	26.65	0.00	Valid

Item	X2			
Question	R Table	R	Sig	Validity
1	0.096	23.33	0.00	Valid
2	0.096	21.38	0.00	Valid
3	0.096	20.38	0.00	Valid
4	0.096	20.73	0.00	Valid
5	0.096	24.72	0.00	Valid
6	0.096	22.06	0.00	Valid
7	0.096	15.09	0.00	Valid
8	0.096	16.61	0.00	Valid
9	0.096	23.10	0.00	Valid
10	0.096	22.74	0.00	Valid

Item	Y			
Question	R Table	R	Sig	Validity
1	0.096	27.21	0.00	Valid
2	0.096	25.90	0.00	Valid
3	0.096	26.23	0.00	Valid
4	0.096	24.95	0.00	Valid
5	0.096	25.19	0.00	Valid
6	0.096	23.18	0.00	Valid
7	0.096	27.02	0.00	Valid
8	0.096	24.51	0.00	Valid
9	0.096	2.08	0.04	Valid
10	0.096	24.73	0.00	Valid

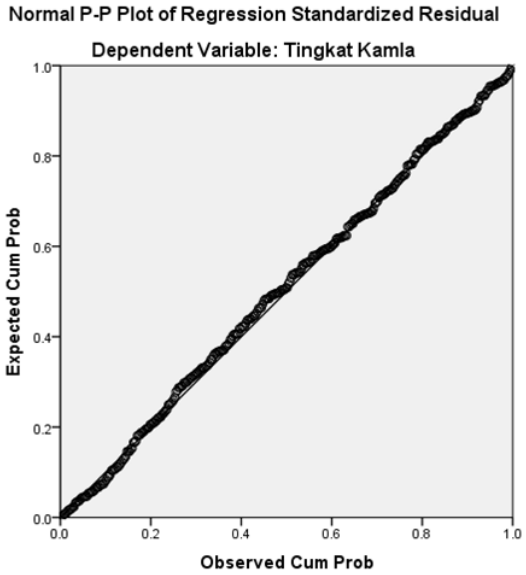
From the table 2, it can be concluded that the questions used in each variable are valid because the value of R obtained is greater than the R table used, this is also supported by a significant value smaller than the alpha value of 0.05.

After the validity test had been done, then the reliability test is carried out to find out that the data obtained is actually realiable. Then the results obtained as follows:

Table 3. the results obtained

Variable	Alpha Cronbach
X1	0.833
X2	0.835
Y	0.859

Based on the table 3, it can be concluded that the data obtained from the questionnaire are very reliable because it has a Cronbach alpha value above 0.6, so it can be continued with multiple regression analysis. Before the multiple regression analysis is carried out, the assumption test is needed, where multiple regression analysis can be done if the data has a normal distribution with proven through the normality graph below.



From the fig 3, the data spread well around the line so that it can be assumed that the data is normally distributed with this assumption that the normality test can be fulfilled. Furthermore, the multicollinearity test was carried out to prove that there was no linear relationship between the independent variables used, the results of the multicollinearity test were as follows:

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Variable X1	.369	2.708
	Variable X2	.369	2.708

Based on the above table by looking at the VIF values obtained from the two independent variables, because the two independent variables have a VIF value smaller than 10 which is equal to 2,708, it can be assumed that the two independent variables do not occur multicollinearity.

After testing the following assumptions, it can be continued with multiple regression analysis, to find out whether there is a real influence between the dependent variable and each independent variable, the T test is carried out with the following results:

Table 4. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.482	.836		4.167	.000
	Variable X1	.390	.036	.431	10.882	.000
	Variable X2	.529	.041	.513	12.961	.000

From the results of the test above, by looking at the significance value of each independent variable where for X1 variable has 0.00 significance value as well as for independent variables X2, so that because the significance value of each independent variable is smaller than alpha value that is 0.05 then conclusions can be obtained that partially the independent variable has a significant influence on the dependent variable, besides by looking at the Standardized Coefficients, the beta value of the X1 variable is 0.431 and the variable X2 0.513, where the variable X2 has a value greater than the value of X1, it can be said that all respondents believe that the influence of the capabilities possessed by Indonesian Battleship has a greater influence in increasing the level of security in the Indonesian Sea. then to find out the effect of the two independent variables together on the dependent variable can be seen by looking at the F test with the following results:

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	9825.598	2	4912.799	691.185	.000[b]
	Residual	2466.402	347	7.108		
	Total	12292.000	349			

The results of the F test above by looking at the significance values obtained are 0.000 which has a smaller value than the value of apha which is 0.05, so it can be concluded that the model or jointly the two independent variables have a significant influence on the dependent variable.

From the results of the t test and the F test above, it can be concluded that all respondents believe that there is a significant influence both partially and simultaneously between the attendance leve of the Indonesian Battleship in the sea and the capability possessed by the Indonesian Battleship to the level of security in the Indonesian sea where each variable both the level of attendance and capabilities possessed by the Indonesian Battleship are increased so that the level of security in the Indonesian sea will also increase. However, the value of the influence that is possessed by the variable X2, namely the ability of Indonesian Battleship has a greater value in increasing security in the Indonesian sea, this occurs because as technology advances, the need for technology to help improve capabilities is very important because of the direction increasing the procurement of Indonesian Battleship in the future, it is very important to pay attention to the Capability Factors possessed rather than just the quantity that is multiplied even though the number of Indonesian Battleship and the pattern of Operations also has an important role in improving Security in the Indonesian sea. Where by looking at the R squared value in the table below

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.894[a]	.799	.798	2.66604

Obtained an R square value of 0.799, it can be concluded that the model obtained has an influence of 79.9% on increasing security in the Indonesian sea. So that in order to increase security in the Indonesian sea it is necessary to pay attention to these two factors, namely the level of Indonesian Battleship attendance in the sea and the ability possessed by the Indonesian Battleship.

4. CONCLUSIONS

To increase Security level in the seas Of Indonesian, it is necessary for Indonesian Navy to increase the attendance of Indonesian Battleship in the seas and also the ability of the Battleship to. This is because Indonesia has a very wide sea so it requires the number of Indonesian Battleship and the right operating pattern to be able to monitor it. As well as the very rapid technological advancements nowadays and the evolving weapons system, the capabilities possessed by Indonesian Battleships are very important to be able to create deterrent effects in order to increase security in the Indonesian sea.

However, there are still other factors that can improve security in the Indonesian sea, which

cannot be explained in this research so it can be used as a better model for future researchers.

REFERENCE

AT. Mahan, 1960-1783, *The Influence of Sea Power Upon History, Twelfth Edition*, Boston, Little Brown and Company, p. 82.

J.G. Starke, 1989, *Introduction to International Law (An Introduction on International Law*), Translated by Sumitro Danuredja and Lukas Ginting, Jakarta, Indonesian Persada Script, p. 143.

Moenir, 1998, *Public Service Management*. Jakarta: Bumi Aksara, p. 116.18

Mochtar Kusumaatmadja, 1990, *"Introduction to International Law"*, Bandung, Binacipta, p. 11.

Sugiyono, 2004, *Business Research Methods,* Bandung, CV. Alfabeta.

Republic of Indonesia Law Number 37 Year 1999 dated September 14, 1999 concerning Foreign Relations.

THE WARSHIP KOLINLAMIL ASSIGNMENT SCHEDULE USES INTEGER PROGRAMMING MODEL

Agus Makhrowi[1], Benny Sukandari[1,2], Ahmadi[3]

[1,3] Sekolah Tinggi Teknologi Angkatan Laut, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia
[2] Sekolah Staf dan Komando Angkatan Laut, Seskoal, Jakarta
Email: makhrowi09@gmail.com

ABSTRACT

Scheduling is an assignment activity that deals with constraints. A number of events can occur in a period of time and location so that objective functions as close as possible can be fulfilled. In the hierarchy of decision making, scheduling is the last step before the start of an operation. Scheduling warship assignments in Kolinlamil are an interesting topic to discuss and find solutions to using mathematical methods. The process of the Kolinlamil warship assignment schedule was carried out to produce an annual shipbuilding schedule. This process not only requires fast follow-up, but also requires systematic and rigorous steps. Where the assignment schedule is a fairly complex combinatorial problem. While making the assignment schedule that is applied at this time is considered less accurate because it calculates the conventional method. The process of warship assignment schedule in this study using the Integer Programming model aims to obtain alternative scheduling operations. The schedule observed was 13 warships in carrying out N operations for 1 year (52 weeks). This research begins with determining the decision variables and limitations that existing constraints. Hard constraints include: maintenance schedule, time and duration of each task, warship class assigned to the task and the number of executing warships per task. While soft constraints are how long the warship performs its tasks in a row. The mathematical formulation of the Integer Programming model created consists of three measuring parameters, four decision variables, one objective function and seven constraint functions. Furthermore, determining the best scheduling alternatives is completed using the Microsoft Exel Solver computing program.

Keywords: *Scheduling, Integer Programming, Solver.*

1. INTRODUCTION.

Komando Lintas Laut Militer (Kolinlamil) is the main command in the field of development and operations. In the development field, Kolinlamil compiled and planned the development of warship (KRI) elemental strength programs, terminals and supporting facilities and infrastructure within the Kolinlamil range. Whereas in the operational field, Kolinlamil was tasked with preparing a plan and implementing a sea transportation program for all ranks of the TNI and Polri and other agencies. Sea transportation is administrative and strategic tactics which include transportation of personnel, equipment and supplies, and carrying out sea transportation assistance in all Indonesian waters. Kolinlamil warships can be operated both in times of war and peacetime in order to support national development and can be carried out individually or in formation.

The Kolinlamil annual operation plan was prepared with TNI Headquarters and Navy Headquarters. The planning of warship operations is adjusted between the number of personnel, material, and the area that will be the destination and class of the warship. So that the warship will be used in accordance with the needs of the task to be carried out, both in terms of class and the number of warships. Based on the annual operating plan, Kolinlamil in this case the Operations Staff (Sops) Kolinlamil made a schedule of assignments for the warship in one year (52 weeks) to support operations. This schedule is made for posting planned

operational tasks so that the ship is carrying out the operation and the ship carrying out the maintenance.

In order for all ships to be ready to carry out all planned operational tasks, both in terms of class of the ship and the amount needed, the operational and maintenance schedules need to be prepared and made before the operation. So that in making the warship assignment schedule and preparation needed to carry out operations, Sops Kolinlamil determines the class of the warship and the amount to be operated and always considers the ship maintenance schedule. In this case Sops coordinated with the Ship Maintenance Service (Disharkap) Kolinlamil as a warship maintenance schedule maker. The warship assignment schedule is made taking into account the ship maintenance schedule aimed at keeping the ship in top condition and ready to operate, so that all operational tasks run effectively and efficiently.

At present the creation of an operational assignment schedule still results in a program crash that results in violations of operating restrictions and rules. Among them resulted in a delay in the warship maintenance schedule and there is a violation of the maximum operating time constraints. There is a warship that has received a new order to carry out further duties when the warship has finished carrying out operations, even though it has exceeded the maximum deadline for the operation.

So that the warship assignment schedule is made by considering the limitations of infrastructure facilities that are faced in each task as well as the rules for carrying out warship operations. These limits and rules include: class of warships according to the needs of the task, maintenance of the warship according to schedule, start and duration of time to carry out specified tasks, one warship only performs one task at the same time and the maximum execution time of consecutive warship is 3 months (12 weeks).

This research has various references, including: (Solekan, 2016) conducted a research on the assignment of warships in Kolinlamil using the Binary Integer Programming (BIP) method aimed at minimizing penalties if violating the soft constraints (the length of operation of the ship in a row) that were completed using LINGO 11.0. (Šeda, 2007) uses the Mixed Integer Programming (MIP) method, by presenting mathematical models for permutation of flow shop scheduling and proposed job shop scheduling problems. (Hidayat, 2018) research that aims to get the best alternative in order to optimize the schedule of assignment plans for warship in order to produce JOG / JOP by developing an optimization model and applying the Integer Linear-Zero One Programming method.

The warship scheduling model is a fairly complex combinatorial problem with many variables so that it is difficult to process manually. Therefore the authors are interested in conducting research to create an Integer Programming model with completion using the Microsoft Exel computing program from the warship assignment schedule in Kolinlamil to get the best alternative scheduling solution. So as to get the best schedule by increasing infrastructure facilities owned by Kolinlamil, TNI AL or other agencies.

2. LITERATURE REVIEW.

2.1 Warship.

Warships are ships used for military or armed forces. Generally divided into aircraft carriers, combatant ships, patrol ships, transport ships, submarines and supporting ships.

At this time Kolinlamil operates various types of transport warships, including: *Landing Ship Tank* (LST), *FROSCH* / Angkut Tank Frosch (ATF), *Landing Platform Dock* (LPD), *COASTER* / Bantu Umum (BU) and Bantu Angkut Personel (BAP). The grouping of warships is intended to focus on the priority scale of the warship as needed to support,

according to the functions and capabilities of each warship (TNI-AL, 2005). In this study Kolinlamil has 13 warships, but there are 3 warships that can not be used because they are in conservation status.

2.2 Scheduling.

According to (Baker, 1974) scheduling is the allocation of resources to carry out a set of time-based tasks. Scheduling problem solving must at least answer two forms of questions, which are the resources that will be allocated to work on the operation and when each operation starts until completion. Scheduling is one of the important aspects of operations management because good scheduling will make the organization able to use its assets or resources more efficiently and have a positive effect on achieving its objectives (effective). In other words, resource utilization will be better when the organization can know when and how much capacity is still idle. With the same resources, the capacity of the organization becomes "bigger" with more output. From the potential benefits, organizations will be able to have a competitive advantage by doing good scheduling. Even this one scheduling concept can contribute to achieving better, faster, cheaper, and reliable services at the same time. A good schedule should be simple, easy to understand and can be implemented by the management or anyone who uses it. Scheduling rules should be strong enough, but have realistic goals, so they are flexible enough to solve unpredictable problems and allow for re-planning.

In this study classified into Middle-range planning level activities, namely in the span of 1-2 years. The scheduling approach used in this study is a forward scheduling approach, is when the job is scheduled for the moment of arrival, or when it is ready or at zero (time zero) and moves forward towards the due date in weeks. Where an operational task is scheduled when the warship 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.

2.3 Integer Programming (IP).

Integer Programming (IP) is Linear Programming (LP) with variables of type integer. The IP model is chosen for problems that are more difficult than the LP model. This is because there are many combinations of integer values that must be tested, and each combination requires a normal LP or NLP solution. With the main point of mind in IP is to formulate the problem clearly using a number of available information. And the next step is to translate the problem into a mathematical model.

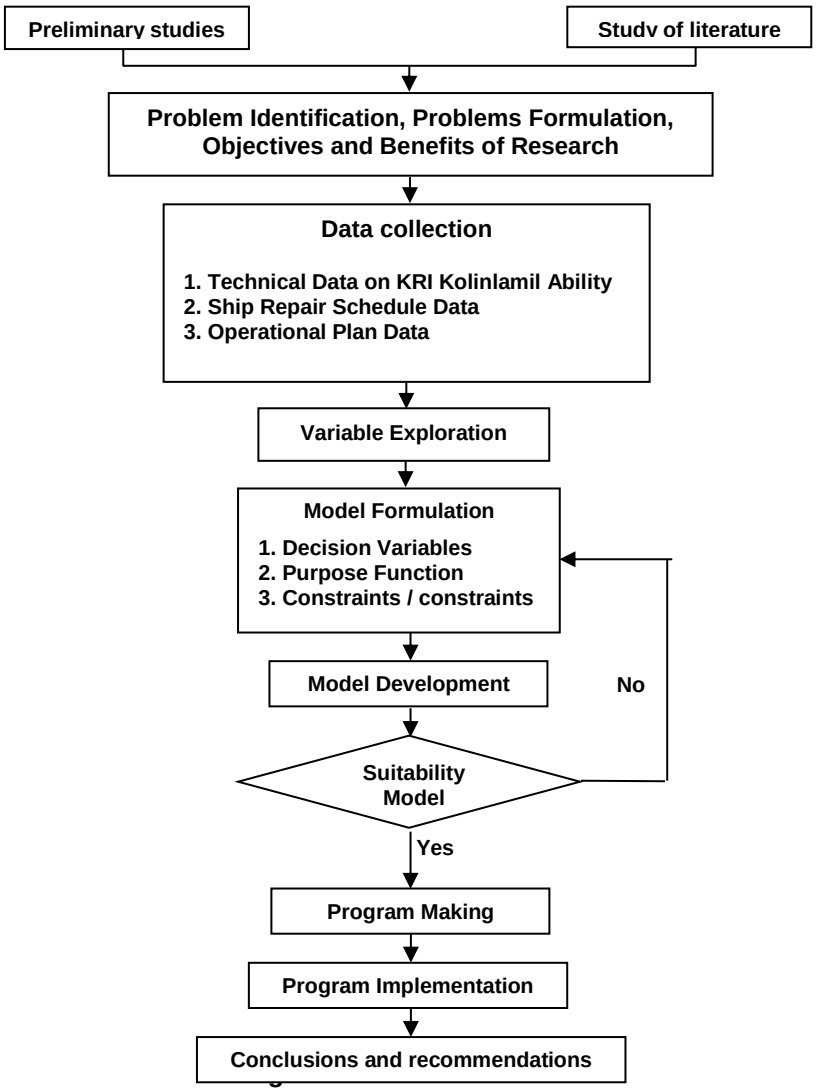
Optimal scheduling can be obtained by using the IP scheduling technique and using the Priority Dispatching Heuristic approach. The rules for the Priority Dispatching method are used to fulfill which tasks will be done first The rules for the Priority Dispatching method are used to fulfill which tasks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

3. RESEARCH METHODOLOGY.

This study uses a case study of the assignment schedule for the Kolinlamil warship. The research approach uses a quantitative approach by developing mathematical models and theories related to empirical observation. The approach of this research is to create an Integer Programming (IP) model to find the best alternative so that it gets more optimal scheduling.

3.1 Research Flow Chart.

This research was conducted based on the research methodology framework that can be seen:



3.2 Variable Exploration.

At this stage is carried out identification of influential variables by observing problems related to the model. Warship assignment model variables are as follows:

a. Indicator

i = Warships carrying out operations (1……13).

j = Operations performed (1……n).

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

b. Decision Variable

X_{ijk} = 1, If ship to-*i* is scheduled to carry out operations to-*j* on the first week.

= 0, If not.

c. Parameter

C_{ijk} = 1……13, ship priority to-*i* to carry out operations to-*j* on week to-*k.*

= 1000, if not prioritized and if it collides with the ship maintenance schedule on week to-*k*.

JK_j = The number of vessels in the operation task to-*j.*

3.3 Model Formulation.

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

a. The first step

This research method aims to optimize the assignment of 13 warships to each assignment with an IP optimization model which can be formulated as follows:

1) Decision Variable

The optimization decision variable of this study is the assignment of a warship or several warships to each operation task. The form of the decision variable is Binary 0-1 (zero-one). Result 0 means that ship to-*i* is not assigned to task to-*j* and result 1 means ship to-*i* is assigned to task to-*j*.

2) Purpose Function

Minimizing Z to get the highest priority warship in carrying out an operation task.

Minimize:

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

3) System Limitation Function (Constraint)

In operations planning there are several obstacles that must be faced, both hard constraints and soft constraints. These constraints include:

a) Class of warships carrying out operations. Warship class constraints that carry out operations mean that the warship carrying out each operation has a class of abilities or certain characteristics adapted to the needs of the operation task. In this study using the Priority Dispatching method.

b) Warship maintenance schedule constraints. Each warship must carry out maintenance, according to the warship maintenance schedule planned by Disharkap¸ which is the week of how maintenance starts and how long it takes.

c) Operating duty schedule constraints. Every operational task has been determined or planned from the TNI Headquarters and the Indonesian Navy Headquarters, namely the week of how the operation will start and how long it will take.

d) Constraints clashed operating schedule. Each ship only carries out one operation task at a time, in other words, the ship does not carry out more than one operation at a time.

e) Constraints on the number of warship needs in one operation. In carrying out one task the exercise operation sometimes requires more than one warship according to the training needs.

f) Constraints on the maximum execution time of the warship's operations in a row. Each warship 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 results of mathematical formulations the first step is then carried out computational calculations from the computer program Solver Microsoft Exel. The computer

program aims to obtain optimal results quickly from the data from the first step that has been obtained. And then implementing a computer program in the example case in completing the scheduling assignment of warship in Kolinlamil.

4. RESULT AND DISCUSS.

The IP model of the problem of this ship assignment schedule consists of objective functions and constraint functions. The objective function is a function that is used to formulate the objectives to be achieved, namely minimizing the priority of ships carrying out operations. Whereas the constraint function is a necessary limiting function with regard to the limited available resources, for example the number of ships, the time available, the ability of the ship, the task load and adjusted to the maintenance plan that will and should be done.

4.1 WARSHIP MAINTENANCE SCHEDULE.

In making maintenance schedules, each warship planned to carry out the repair / maintenance process on that week gives a large number, for example 1000. Whereas warships that did not carry out repairs / maintenance on that week were given number 1. The ship maintenance schedule can be seen in the following figure 2:

WARSHIP MAINTENANCE SCHEDULE (JOP)

					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
					JAN					FEB				MAR				APR					MAY				JUN			
					1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	1	2	3	4
WAR SHIP	LST	1	JKT	ABN	1	1	1	1	1	E	E	E	E	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		2		TRT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		3		TBO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	SBY	TBN	1	1	1	1	1	E	E	E	E	E	E	E	E	1	1	1	1	1	1	1	1	1	1	1	1	1
	ATF	5	JKT	TMO	1	1	1	1	1	E	E	E	E	E	E	E	E	E	E	E	E	E	1	1	1	1	1	1	1	1
		6	JKT	THG	1	1	1	1	1	E	E	E	E	E	E	E	E	1	1	1	1	1	1	1	1	1	1	1	1	1
		7	SBY	TGI	E	E	E	E	E	E	E	E	E	E	E	E	E	1	1	1	1	1	1	1	1	1	1	1	1	1
		8	SBY	TLP	1	1	1	1	1	1	1	1	1	E	E	E	E	E	E	E	E	E	E	E	E	E	1	1	1	1
	LPD	9	SBY	BAC	1	1	1	1	1	E	E	E	E	E	E	E	E	E	E	E	E	E	1	1	1	1	1	1	1	1
		10	JKT	BJM	1	1	1	1	1	1	1	1	1	1	1	1	1	E	E	E	E	E	E	E	E	E	E	E	E	E
	BU	11	JKT	MTW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	E	E	E	E	E	E	E	E
	BAP	12	JKT	KBI	E	E	E	E	E	E	E	E	E	E	E	E	E	1	1	1	1	1	1	1	1	1	1	1	1	1
		13		NSV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

		27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
		JUL					AUG				SEP				OCT					NOV				DEC			
		1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	1	2	3	4
1	ABN	E	E	E	E	E	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	TRT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	TBO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	TBN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	E	E	E	E	1	1	1	1	1	1	1	1
5	TMO	1	1	1	1	1	E	E	E	E	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	THG	1	1	1	1	1	1	1	1	1	E	E	E	E	1	1	1	1	1	1	1	1	1	1	1	1	1
7	TGI	1	1	1	1	1	1	1	1	1	E	E	E	E	1	1	1	1	1	1	1	1	1	1	1	1	1
8	TLP	1	1	1	1	1	1	1	1	1	1	1	1	1	E	E	E	E	E	1	1	1	1	1	1	1	1
9	BAC	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	BJM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	MTW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	KBI	1	1	1	1	1	1	1	1	1	1	1	1	1	E	E	E	E	0	1	1	1	1	1	1	1	1
13	NSV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0

KONSERVATION MEDIUM MAINT DOCKING MAINT OF DEPO

E = WARSHIP IN MAINTENANCE SCHEDULE = BIG NUMBER = 1000
1 = WARSHIP READY TO OPERATE

Figure 2. Matrix of Warship Maintenance Schedule
(Source: Maintenance schedule for warship Kolinlamil 2018)

4.2. Operational Plan Schedule.

In making the operational plan schedule, each operation assignment plan from the beginning to the end of the week's assignment is given a number 1. Whereas the warship does not carry out the operation in the week given the number 0. The operational plan schedule can be seen in figure 3 below:

			TASK IMPLEMENTATION TIME (WEEK)																																																	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
			JAN					FEB				MAR				APR					MAY				JUN				JUL					AUG				SEP				OCT					NOV				DEC			
			1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	1	2	3	4
TASK	1	A	1	1	1	1	1																																													
	2	B	1	1	1	1	1	1	1																																											
	3	C		1																																																
	4	D			1	1	1	1	1	1	1	1																																								
	5	E										1	1																																							
	6	F															1																																			
	7	G															1																																			
	8	H																1																																		
	9	I																1																																		
	10	J																				1																														
	11	K																				1																														
	12	L																					1	1	1	1	1	1																										
	13	M																					1	1																														
	14	N																					1	1	1	1																												
	15	O																								1	1	1	1																									
	16	P																								1	1	1	1	1	1	1	1	1																				
	17	Q																								1	1	1	1	1	1																							
	18	R																								1																												
	19	S																									1	1	1	1																							
	20	T																										1	1	1	1	1	1																					
	21	U																										1																										
	22	V																												1	1	1	1																					
	23	W																																	1	1	1	1	1	1														
	24	X																																		1																		
	25	Y																																				1																
	26	Z																																							1	1	1	1										
	27	AA																																							1	1												
	28	BB																																							1	1	1	1	1	1	1	1						
	29	CC																																							1	1												
	30	DD																																								1	1	1	1	1	1	1						
	31	EE																																									1	1	1	1	1	1	1	1			
	32	FF																																													1						
	33	GG																																																		1	1	1

Figure 3. Schedule of Operational Assignment Plan Matrix
(Source: Schedule of warship Operation Plan for Kolinlamil 2018)

4.3 Priority of Warships Carrying Out Operations.

Giving priority warship executing tasks means that the warship has a capability class or characteristics that are tailored to the needs of the operation task. In making priority warships planned to carry out operations, each warship in each task planned for the week is numbered according to priority. The main priority is given number 1 and so on up to the last priority number 10 according to the number of warships. Or given the number 1000 if the warship is not prioritized on the task. The results of data processing are presented in table 1 below:

PRIORITIES OF EVERY WAR SHIP TOWARDS TASK

					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
					JAN					FEB				MAR				APR					MAY				JUN				JUL					AUG				SEP				OCT					NOV				DEC			
					1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3		4	1	2	3	4	1	2	3	4	1	2	3		4	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	1	2	3	4
WAR SHIP	LST	1	JKT	ABN	5	5	5	5	5															8						9																9	9	9	9	9	9	9	9			
					6	6	6	6	6	6	6														1	1	1	1	1	1		9	9	9	9															2						
						5																			5	5											8	8	8	8	8	8												8	8	8
							4	4	4	4	4	4	4	4											5	5	5	5										9																		
														5	5													5	5	5	5									2																
																		2										6	6	6	6	6	6	6	6	6							1	1	1	1										
																		8										6	6	6	6	6	6										2	2												
																			5									9															8	8	8	8	8	8	8	8						
																			6										2	2	2	2											8	8												
																								2						5	5	5	5	5	5									5	5	5	5	5	5	5						
		2		TRT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		3		TBO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	SBY	TBN	6	6	6	6	6															9						8																8	8	8	8	8	8	8	8			
					5	5	5	5	5	5	5														2	2	2	2	2	2		8	8	8	8															1						
						4																			6	6											9	9	9	9	9	9												9	9	9
							5	5	5	5	5	5	5	5											6	6	6	6										8																		
														6	6													6	6	6	6									1																
																		1										5	5	5	5	5	5	5	5	5							2	2	2	2										
																		9										5	5	5	5	5	5										1	1												
																			6									8															9	9	9	9	9	9	9	9						
																			7										1	1	1	1											9	9												
																								1						6	6	6	6	6	6									6	6	6	6	6	6	6						
	ATF	5	JKT	TMO	1	1	1	1	1															4						6																7	7	7	7	7	7	7	7			
					4	4	4	4	4	4	4														3	3	3	3	3	3		7	7	7	7															5						
						9																			1	1											5	5	5	5	5	5												4	4	4
							6	6	6	6	6	6	6	6											2	2	2	2										6																		
														1	1													1	1	1	1									5																
																		5										2	2	2	2	2	2	2	2	2							3	3	3	3										
																		4										4	4	4	4	4	4										6	6												
																			2									6															4	4	4	4	4	4	4	4						
																			2										6	6	6	6											6	6												
																								5						2	2	2	2	2	2									1	1	1	1	1	1	1						
		6	JKT	THG	2	2	2	2	2															5						7																6	6	6	6	6	6	6	6			
					3	3	3	3	3	3	3														4	4	4	4	4	4		6	6	6	6															6						
						8																			2	2											4	4	4	4	4	4												5	5	5
							7	7	7	7	7	7	7	7											1	1	1	1										7																		
														2	2													2	2	2	2									6																
																		6										1	1	1	1	1	1	1	1	1							4	4	4	4										
																		5										3	3	3	3	3	3										5	5												
																			1									7															5	5	5	5	5	5	5	5						
																			3										5	5	5	5											7	7												
																								6						1	1	1	1	1	1									2	2	2	2	2	2	2						
		7	SBY	TGI	3	3	3	3	3															6						4																4	4	4	4	4	4	4	4			
					2	2	2	2	2	2	2														5	5	5	5	5	5		4	4	4	4															3						
						7																			3	3											6	6	6	6	6	6												6	6	6
							8	8	8	8	8	8	8	8											3	3	3	3										4																		
														3	3													3	3	3	3									3																
																		3										3	3	3	3	3	3	3	3	3							5	5	5	5										
																		6										2	2	2	2	2	2										3	3												
																			3									4															6	6	6	6	6	6	6	6						
																			4										3	3	3	3											4	4												
																								3						3	3	3	3	3	3									3	3	3	3	3	3	3						
		8	SBY	TLP	4	4	4	4	4															7						5																5	5	5	5	5	5	5	5			
					1	1	1	1	1	1	1														6	6	6	6	6	6		5	5	5	5															4						
						6																			4	4											7	7	7	7	7	7												7	7	7
							9	9	9	9	9	9	9	9											4	4	4	4										5																		
														4	4													4	4	4	4									4																
																		4										4	4	4	4	4	4	4	4	4							6	6	6	6										
																		7										1	1	1	1	1	1										4	4												
																			4									5															7	7	7	7	7	7	7	7						
																			5										4	4	4	4											5	5												
																								4						4	4	4	4	4	4									4	4	4	4	4	4	4						
	LPD	9	SBY	BAC	8	8	8	8	8															3						1																2	2	2	2	2	2	2	2			
					7	7	7	7	7	7	7														8	8	8	8	8	8		1	1	1	1															7						
						1																			8	8											3	3	3	3	3	3												2	2	2
							2	2	2	2	2	2	2	2											8	8	8	8										1																		
														8	8													8	8	8	8									7																
																		7										7	7	7	7	7	7	7	7	7							8	8	8	8										
																		3										7	7	7	7	7	7										7	7												
																			8									1															3	3	3	3	3	3	3	3						
																			9										7	7	7	7											1	1												
																								7						8	8	8	8	8	8									8	8	8	8	8	8	8						
		10	JKT	BJM	7	7	7	7	7															2						2																1	1	1	1	1	1	1	1			
					8	8	8	8	8	8	8														7	7	7	7	7	7		2	2	2	2															8						
						2																			7	7											2	2	2	2	2	2												1	1	1
							1	1	1	1	1	1	1	1											7	7	7	7										2																		
														7	7													7	7	7	7									8																
																		8										8	8	8	8	8	8	8	8	8							7	7	7	7										
																		2										8	8	8	8	8	8										8	8												
																			7									2															2	2	2	2	2	2	2	2						
																			8										8	8	8	8											2	2												
																								8						7	7	7	7	7	7									7	7	7	7	7	7	7						
	BU	11	JKT	MTW	10	10	10	10	10															10						10																10	10	10	10	10	10	10	10			
					10	10	10	10	10	10	10														10	10	10	10	10	10		10	10	10	10															10						
						10																			10	10											10	10	10	10	10	10												10	10	10
							10	10	10	10	10	10	10	10											10	10	10	10										10																		
														10	10													10	10	10	10									10																
																		10										10	10	10	10	10	10	10	10	10							10	10	10	10										
																		10										10	10	10	10	10	10										10	10												
																			10									10															10	10	10	10	10	10	10	10						
																			1										10	10	10	10											10	10												
																								10						10	10	10	10	10	10									10	10	10	10	10	10	10						
	BAP	12	JKT	KBI	9	9	9	9	9															1						3																3	3	3	3	3	3	3	3			
					9	9	9	9	9	9	9														9	9	9	9	9	9		3	3	3	3															9						
						3																			9	9											1	1	1	1	1	1												3	3	3
							3	3	3	3	3	3	3	3											9	9	9	9										3																		
														9	9													9	9	9	9									9																
																		9										9	9	9	9	9	9	9	9	9							9	9	9	9										
																		1										9	9	9	9	9	9										9	9												
																			9									3															1	1	1	1	1	1	1	1						
																			10										9	9	9	9											3	3												
																								9						9	9	9	9	9	9									9	9	9	9	9	9	9						
		13		NSV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 1. Priority Matrix of Each Warship Against Each Task

Priority of ships that have been made is faced with obstacles to schedule ship repairs and other constraints and assignment rules. The results of data processing are presented in the following table 2:

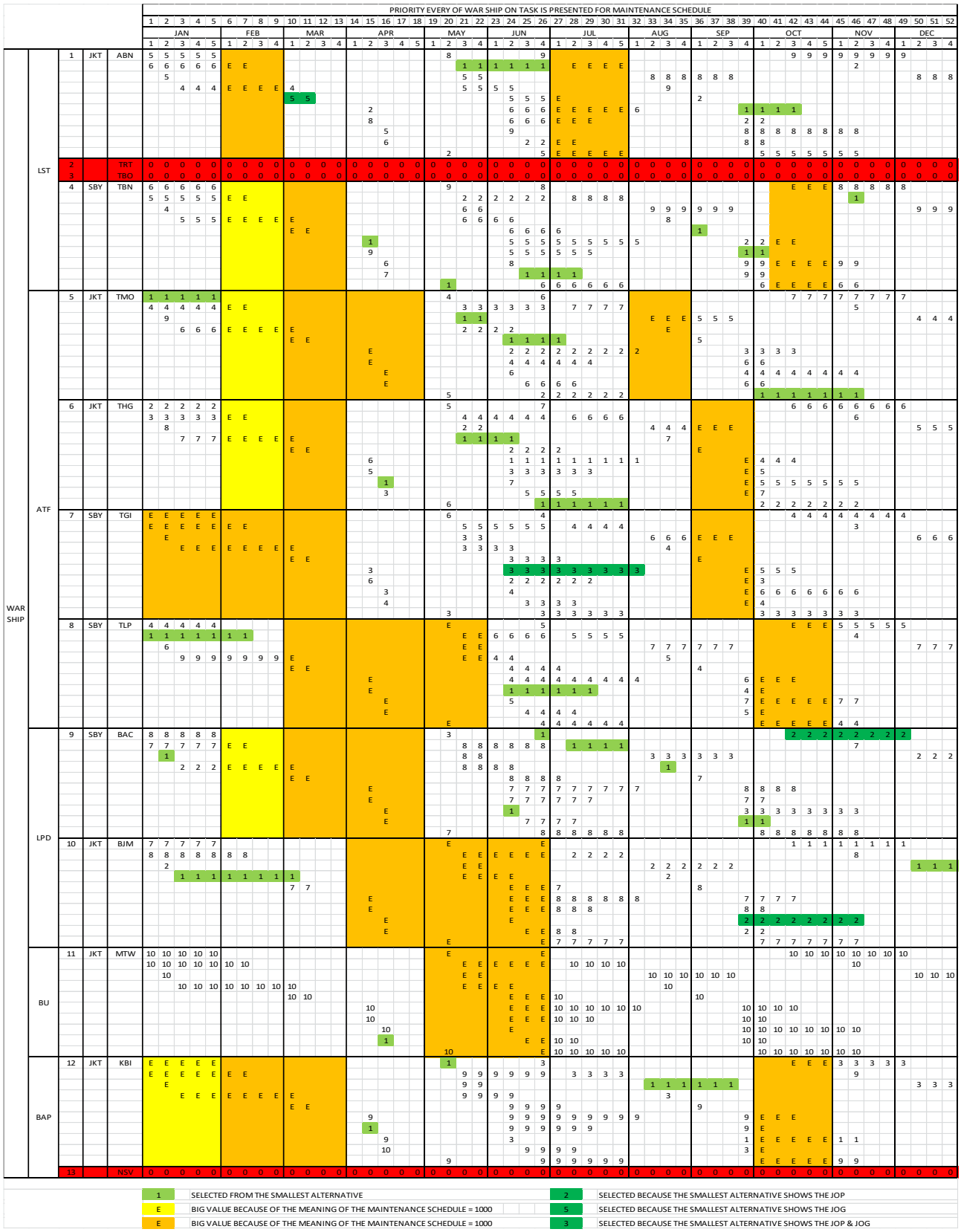


Table 2. Selected Warship Priority Matrix Results

4.4 The Final Result.

The final results of processing the scheduling of the activities of each warship for one year (52 weeks). The results of data processing are presented in table 3 below:

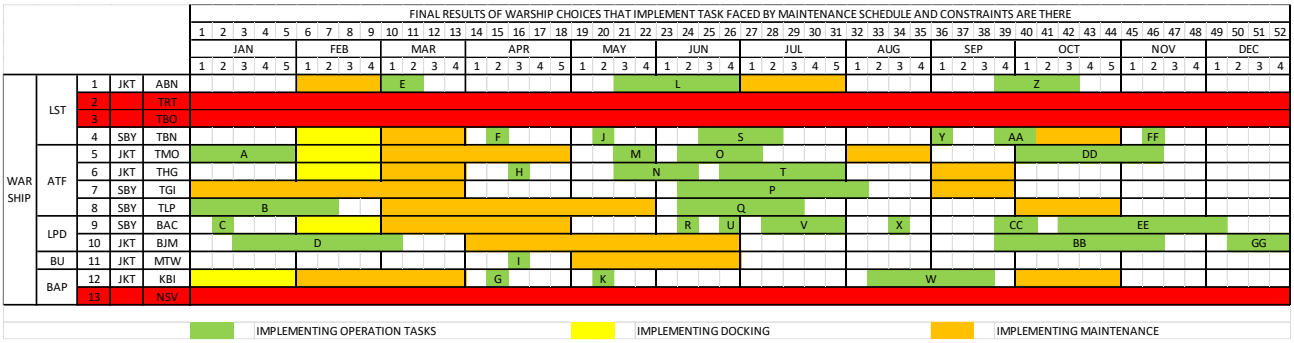


Table 3. Final Result Matrix of The Kolinlamil Warship Schedule

4.5 Model Validation.

Validation was carried out between the conceptual models made by the researcher on the scheduling of warship assignments in Kolinlamil at this time. Warship assignment scheduling currently occurs that the assignment schedule still violates the existing constraints, namely first on hard constraints (violating the warship maintenance schedule) and violating soft constraints (maximum length of the warship carrying out operations in succession). While the warship assignment schedule from the results of running modeling made by researchers can be used as an alternative to actualize. The model made has advantages compared to the existing schedule, namely scheduling ship assignments not violating hard constraints or soft constraints.

4.6 Sensitivity Analysis.

Scheduling of warship assignments in Kolinlamil use 13 warships (10 operating ships and 3 conservation status vessels), to carry out 33 operations and maintenance schedules for 52 weeks. Different patterns will occur if the warship in operation is reduced. The results after the changes are made are operating schedules and compared to the operating schedule with the total number of warships. In addition, analysis of changes / reductions in the number of warships operated. How many warships can be operated so that the results obtained remain optimal by not breaking hard constraints and soft constraints.

Scenario 1: warships are reduced by 1 unit from the LST class so that the warship operating as many as 9 warships, the results obtained by the ship can still carry out operations optimally.

Scenario 2: warships are reduced by 1 unit from the ATF class so that the warship operating as many as 9 warships, the results obtained by the ship can still carry out operations optimally.

Scenario 3: warships are reduced by 1 unit from the LPD class so that the warship operating as many as 9 warships, the results obtained by the ship can still carry out operations optimally.

Scenario 4: warships are reduced by 1 unit from the BU class so that the warship operating as many as 9 warships, the results obtained by the ship can still carry out operations optimally.

Scenario 5: warships are reduced by 1 unit from the BAP class so that the warship operating as many as 9 warships, the results obtained by the ship can still carry out operations optimally.

Scheduling of warship assignments using models made by researchers can be done with optimal results or in other words, there are no

obstacles that are violated when the number of warships is at least 9 units. But if there are only 8 warships in operation, there will be obstacles that will be violated.

5. CONCLUSIONS

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

a. Making a schedule of operations tasks in Kolinlamil by fulfilling all obstacles can be applied using IP.

b. Scheduling assignments of warship using the IP program are better at fulfilling all applicable constraints, because it produces a compromise schedule with all the related constraints and meets the applicable regulations.

c. The time needed for the preparation of the warship assignment schedule and the time of making several warship assignment schedule scenarios that still meet the applicable regulations, are more efficient than the scheduling of warship assignments currently carried out.

d. This warship assignment schedule model can be used as an alternative in scheduling warship operations in Kolinlamil.

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

a. The author only supports the warship assignment schedule and has not included operating costs, both logistical costs for the warship and logistics costs for guarding personnel and transported personnel, so this can be continued for the next research study to include these costs because by knowing the costs used then it can be searched for the most efficient cost in an operation.

b. The author also does not review the addition of operational assignments that can affect the existing and already made schedules. So that it can be known how many additional assignment limits can be imposed on Kolinlamil.

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 New 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. *Sience 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.

Kemenhan. (2014). *Peraturan Menteri Pertahanan Republik Indonesia no.12 Tentang Pokok-Pokok Pembinaan Material Pertahanan Negara.* Jakarta: Kementerian Pertahanan Republik 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 of KRI Assignments in Kolinlamil With The Binary Integer Programming Approach. Surabaya: Indonesian Naval Technology College.

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.

IMPLEMENTATION OF BALANCED SCORECARD (BSC) IN THE DEVELOPMENT STRATEGY OF FLEET KOLAT II TO FORM THE PROFESSIONALISM OF THE PRESERVATION OF THE ALUT SISTA

Arie Handito, I Made Jiwa Astika, Fa'iq Mumtaz M
Indonesian Naval Technology College, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia

ABSTRACT

The training and improvement of human resources in the Navy organination is carried out by the training command in each Kotama. In the environment of Fleet Command II, training for increased combat capability personnel was carried out by Kolat Fleet II which has the main task of preparing the human resources in the field of preservation of major equipment defence system (alutsista). In the context of achieving excellence in the field of practice as well as battles, each investigation of the alutsista is required to continuously improve professionalism, so that in its operation can conform to standardization, procedures and functions of the azasi. To support the success of the vision, mission and objectives of Kolat Fleet II, there is a management of quality improvement of human resources and development planning of various facilities and infrastructure in the field of training and integrated research to process the science transfer optimal knowledge. Research aims to identify factors that determine implementation and evaluate a balanced scorecard strategy as well as conducting an analysis of whether BSC has been understood and used well by leaders of makers decision as well as all personnel in achieving the strategy of the Kolat Fleet II organization. Data was taken from 10 respondents of the principal or officer and 15 strata of the member, followed by a thorough interview of five elected respondents. During this period, the performance parameters of Kolat Fleet II are based on training assessment activities implemented on the Navy warship elements that will carry out the operation task. The BSC method has the advantage of explaining the design that is consistent with the vision, mission and objectives of the Kolat Fleet II as well as considering the balance of four aspects: finance, stakeholders, internal processes and growth learning.

Keywords: *Balanced Scorecarad, non profit organization, development strategy*

1. INTRODUCTION

Every main command of coaching and operations in the Navy environment has the obligation to develop the training system effectively and efficiently. The situation should be taken seriously due to the ability and expertise in fighting every warship in the Fleet command II environment and also determine the success of the main task of Koarmada II. In addition, the incompetence of the exercise evaluation that is carried out also affects the intensity of the program implementation and type of exercise. In various operations and exercises that have been implemented Fleet Command II, acquired the fact that the capability of KRI combat is still not showing the ideal level. The condition is strongly perceived by the superiors of decision makers such as the Navy warship commander, where the ability of the supervisors still prioritize on the mastery of hard skills rather than soft skills. Hard skills are the accumulation of intellectual mastery and technical skills required to master the technology of the alutsista, while the soft skill is a nontechnical capability that can only be perceived results and impacts. Faced with the increasingly complex demands of tasks, then each Navy warship supervision is required to have the ability of combat according to standards and quality by integrating between hard skills and soft skills. The mastery of the combat ability and supervision of the tools certainly does not appear by itself, but must go through a stage of planned and continuous processes. As one of the training institutions, Kolat Fleet II is closely related to supporting factors such as: HR needs, technological advances, training programs and plans, supporting infrastructure and

operational budget support in performing basic tasks. Through the professionalism and capabilities and experience, will motivate the internal environment development process of Kolat Fleet II strategically. BSC is used in order to improve the implementation of the vision, mission and duty of Kolat Fleet II especially in the implementation of a feasibility training program in the Battle of Navy warship. Based on data from operating staff the Navy warship unit in the Fleet command II neighborhood of 2018, the indicator of the exercise intensity level and the operation's degree range is at a rate of 40 percent, which means that the implementation of the construction activities and the training of sailing readiness and fighting a The Navy warship unit is still not maximized and still far from the target number of 70 percent. From these conditions it takes a comprehensive effort to reach the maximum number, including with the arrangement of maintenance schedules integrated alutsista, preparing personnel and procurement of software in the form of documents and Navy warship manifest gradual. With the implementation of BSC as a strategy tool in the development of the organization, it is expected to all personnel of Kolat Fleet II from the strata of members to the officer (top management) to the individual level can have a measure of basic tasks that clearly according to the target that stakeholders are expecting.

2. LITERATURE STUDY

2.1 BSC In Organization

Basically, BSC is a performance measurement system that tries to change the vision, mission and strategy of an organization into a more realized goal and size. The financial and nonfinancial measures formulated in a BSC perspective are actually the derivation of the organizational vision and strategy. Thus, the measurement results with BSC are able to answer the question of how much organizational achievement level for the vision, mission and strategy that has been implemented. In nonprofit organizations, a management's quality assessment is not only aimed at improving services, but rather the identification process of areas that need improvement. BSC is used as a supporting tool for communication, motivation, and evaluating organizational strategies. With the implementation of BSC in nonprofit organization management can make the process of activities become more effective, but in the contrary, BSC cannot guarantee effective management when there is an inaccuracy of the derivation of vision and organizational strategy to In the four sizes of BSC perspectives. Another objective of of BSC in a nonprofit organization is the effective evaluation of the program's activities that are implemented so that the achievement of optimal results can be achieved by the object of the recipient. Trend measurement implementation of vision, mission and the basic task of a non-profit organization today is the out-come-based measurement, where measurement activities do not lie in the input processing to output only, but rather on the assessment of benefits and needs. In fact, conventional auditing that originally focused on the size of the process began to shift towards measuring the outcome (Quinlivan, 2000).

BSC can be implemented into profit and nonprofit organizations. In a profit organization, a financial perspective is the primary goal, while the nonprofit's customer perspective (stakeholder) is the primary goal. A financial perspective in profit organization can be a financial gain, while the nonprofit organization's financial perspective transforms into a financial responsibility regarding the effective use of resources and Efficient in order to meet the needs of the community (Pramadhany, 2011). Customer perspectives on nonprofit organizations are becoming more complex than profit organizations. Customers in nonprofit organizations can split into two types, which are

object recipients and service users. Service users are parties that provide the role and support of fund, energy and professional input to the organization. This group of customers does not receive direct services, but their satisfaction with the organizational performance determines for the smooth operation of the organization in the future. Whilst the satisfaction of a service receiver on some type of nonprofit organization may be irrelevant again to be used as an organizational performance measure. In profit organization, internal process becomes the main discussion, the condition is because the profit organization does not have a legal umbrella in the management of budget. The poor performance that occurs in a short period can directly implicates the programs that are running. Organisations need ongoing growth, adaptation and development. However, the learning and growth perspectives on non-profit organizations do not emphasize the competitive product or service innovations in the world of the market, but rather to the personnel development efforts.

There are five steps to take to implement the BSC approach into the public sector (Wahyudi, 1996): first, establishing a result oriented performance measurement balancing the achievement of targets from all four perspectives The. In this case it is necessary that three concrete steps are (1) defining or determining the most meaningful measurements for stakeholders that serve to direct their attention, (2) The commitment to the fundamental changes with Involving various parties and implementing a flexible system and determining clear direction for its implementation, monitoring, measurement and reporting, and (3) Paying attention to flexibility by concern that performance management is the process Maintain a balance between financial and non-financial measurements. Secondly, it establishes accountability at all levels of the organization. Accountability should be seen as the key to the success of each individual and can be realized by the leadership through good examples. This step must be supported by the realization to (1) sponsor performance measurements at all levels of the organization to be used as a basis in the implementation of reward and punishment, (2) ensure that personnel receive accurate information through effective information and communication channels and (3) warrant that the public must also obtain the same information as the basis of the public accountability. Third, collect, use and analyze the data obtained to be associated with the strategy planning process. The information collected data must include public feedback data, macro environment changes and organizational task data. The results of analysis of these data should be communicated to the public as one of the stakeholders. Fourth, linking the results of the analysis of information data into the process of drafting the work program follows its budget support. In this case it should be clearly indicated that the preparation of the program and the budget is in order to achieve the organizational mission set. Fifth, divide the leadership role. Although a military organization required a strong leader figure, it does not mean that all decision-making should be monopolized by the leader. Here it is necessary to decentralize in decision making but remain in the hierarchy and regulations to make the decision can be immediately responded. The leader's concern that subordinates will commit irregularities in decision making should be prevented through the process of vision and mission sharing and empowerment that has been done. Some of the causes of failure to implement BSC in local government in the United States and Canada, namely: lack of information built to support BSC, inadequate management of top support, management is too busy addressing problems simple, lack relation of BSC with reward for

employees and organizational resistance to change (Ching, 2004).

2.2 Strategy Management

In an effort to achieve a vision, a mission and a goal, every organization is always faced with a dynamic environment. Therefore, the sensitivity to environmental changes and the ability to adjust should be improved. Each organization requires a type of planning to create future conditions through the changes implemented. The mission vision statement of an organization is an ideal representation of future achievement, therefore it takes a communication tool that can be used to communicate strategic plans to all organizational personnel. The communication tools that can be used by the organization are Balanced Scorecard (Malina, 2001). BSC is an approach to strategy management (Kaplan, 2008). In the beginning, BSC was used to improve the executive performance measurement system, which was measured only from a financial perspective, then expanded into four perspectives, which was then used to measure the performance of the organization as a whole. Strategic management has helped the organization formulate strategies in a better direction by using a more systematic, logical and rational approach to various strategy options. It can be concluded that strategy management is a series of decision-making activities from the leadership following implementation and evaluation of such decisions. Strategy management can be defined as the arts and sciences to formulate, implement and evaluate cross-function decisions that enable the organization to achieve its objectives (Andriyanto, 2017). The strategic management process consists of three phases:

a. Formulation or strategy planning that includes the development of vision and mission, identification of opportunities and external threats, determination of internal strengths and weaknesses, long-term objectives, alternative formulation of strategies and selection of strategies that will Implemented.

b. Implementation of strategy that implies organization to set goals, create policies, motivate personnel and allocate resources. Strategy evaluation is a key tool commonly used by leaders to get information on the success of the strategies being executed. The three basic activities of strategy evaluation are the review of external and internal factors that become the basis of strategy, performance measurement and correction action.

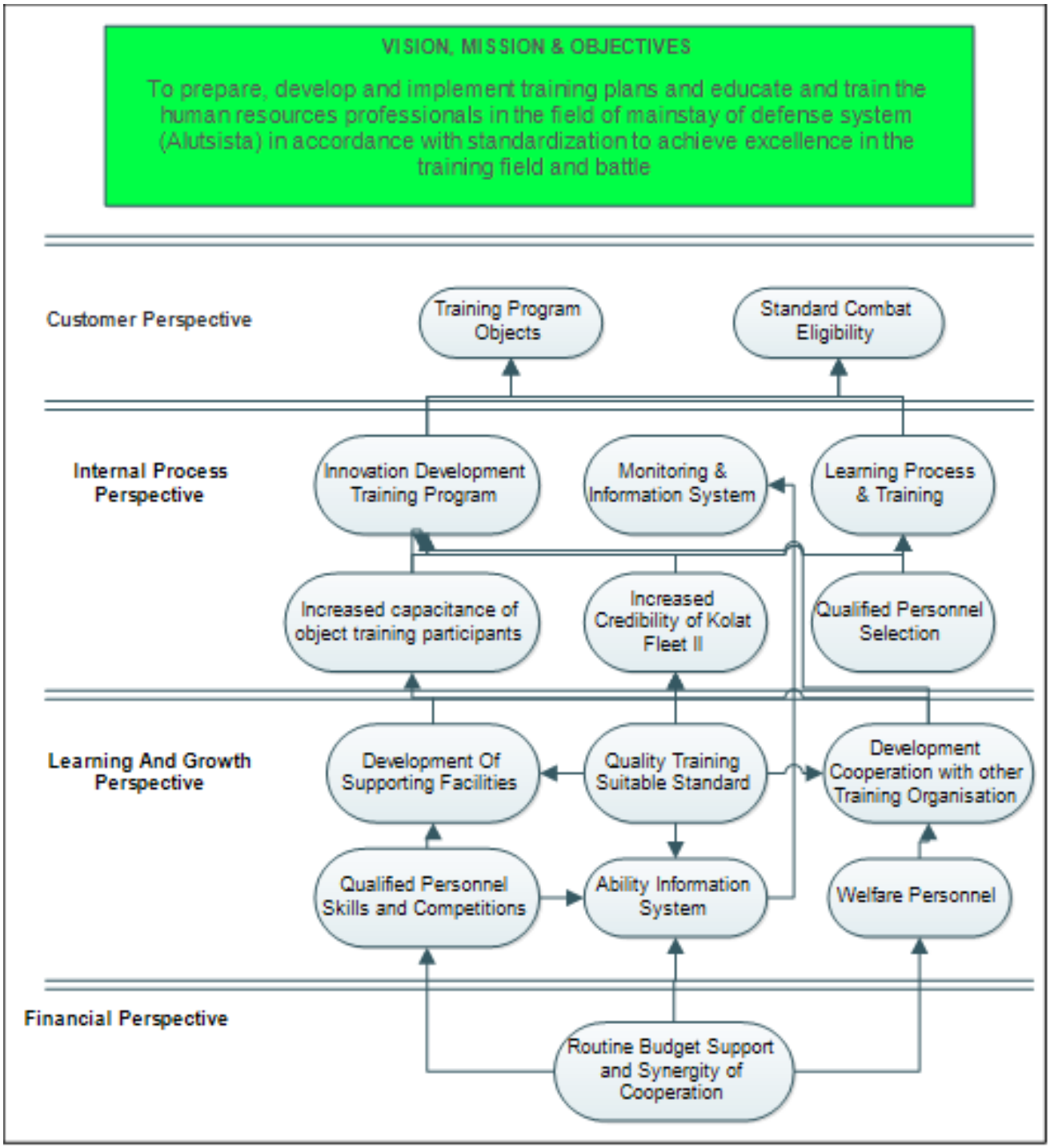


Figure 1. Strategic goal determination, variables and targets with a BSC perspective

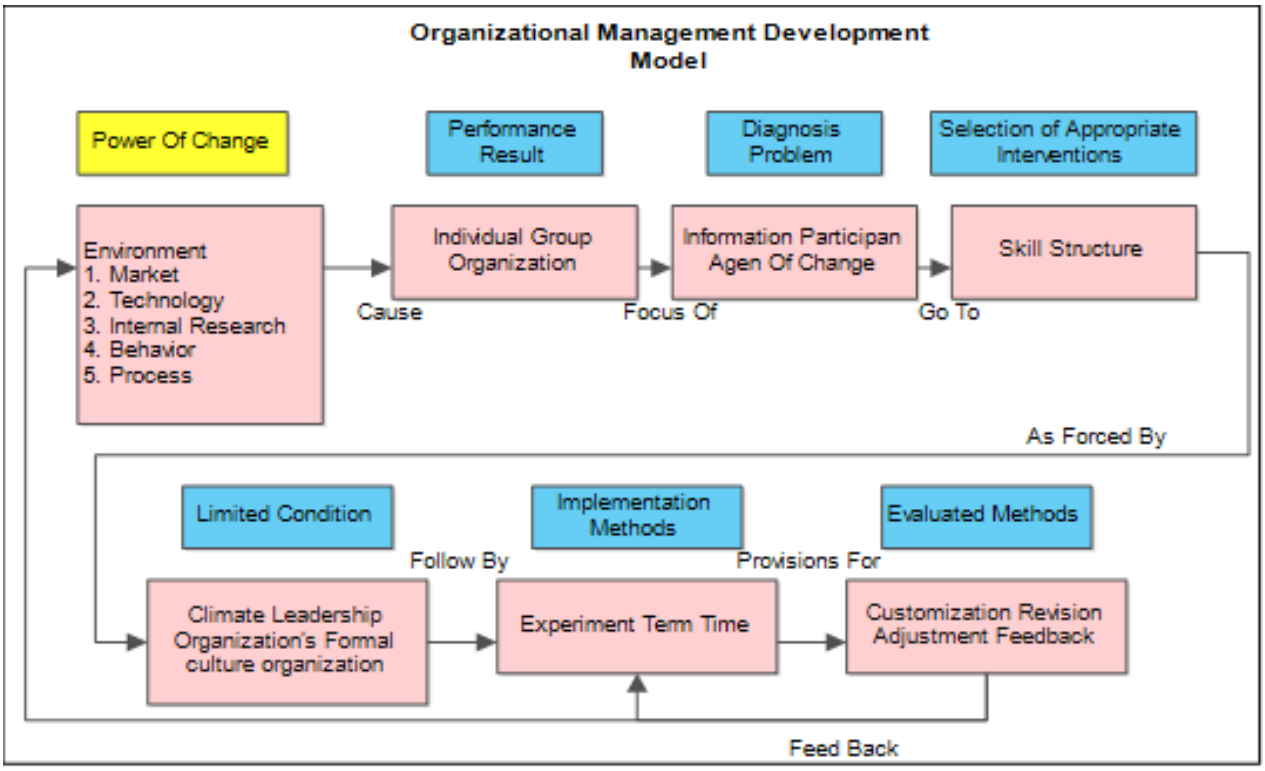


Figure 2. Strategy Development Model (Source: Modification)

3. RESEARCH METHODS

The research was conducted in the Fleet Command II training command in July until November 2019. The population is a total of 245 people Kolat fleet. The method used is qualitative quantitative combined research. A quantitative approach emphasizes the numerical assessment of the phenomenon being studied while a qualitative approach emphasizes narrative development or textual description of the phenomenon being researched. Quantitative data is obtained through questionnaires with a proportional sampling. To obtain a deeper picture of the research object, interviews with selected respondents. To interpret the results of an average analysis against the level of attribute importance used a scale range of five levels: very less (1.0-1.8), less (> 1.8-2.6), good enough (> 2.6-3.4), good (> 3.4-4.2), special (> 4.2-5).

4. RESULTS AND DISCUSSION

The Kopka-rank respondents dominated the survey of 10 percent of questionnaires. The position and level composition can be seen in figure 1. As for the sample composition based on representatives of the position elements can be seen in table 2. Based on the questionnaire responses given by the respondent, the average score was obtained for the Kolat fleet overall and the respective scores on the implementing elements. The level score implementation of the Kolat fleet II strategy is demonstrated by table 3 and table 4. According to table 3, the following results are obtained: (1) in aggregate, the quality of the implementation of the strategy in the Kolat fleet II is at a GOOD predicate indicated with a score of 3.4 (range > 3.4-4.2), (2) when the quality of the implementation stage strategy seen based on implementing elements,

then all have reached the predicate of GOOD except DPPS and DPK. The highest quality of the strategy implementation is the work program planning factor, which shows that the progress of the training activities implemented in the exercise object is good. It is a logical consequence of the implementation of BSC. While the least is a factor of monitoring program work which signifies the ability of the Kolat fleet II to run an organizational system to connect the activities of vision, mission and basic tasks of personnel with reward and punishment still not good. The scores of supporting factors in implementing the highest strategy are the factors of the HR competency program. While the lowest is the

.

financial support factor and the strategy management unit, which means that it has not sufficiently compacted its fleet of Kolat fleet II to provide a budget to support some work programs to implement its strategy. Reward and punishment still not good. The scores of supporting factors in implementing the highest strategy are the factors of the HR competency program. While the lowest is the financial support factor and the strategy management unit, which means that it has not sufficiently compacted its fleet of Kolat fleet II to provide a budget to support some work programs to implement its strategy

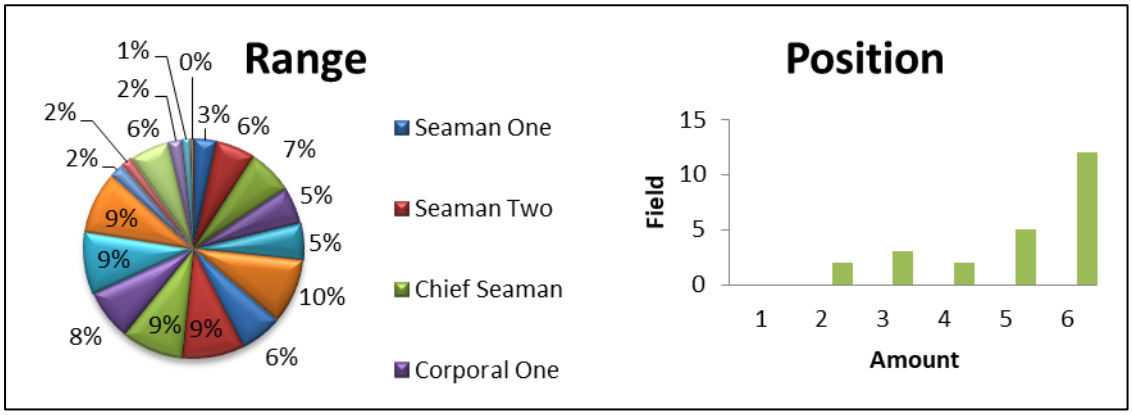


Figure 3. Respondents profile

4.1 Strategy implementation Stage Quality analysis

a. Vision, mission and objectives of the organization.

From the resulting score of 3.4 shows the personnel already clear and understand the vision and mission of Kolat fleet II. The level of understanding to the vision of a good mission is because the vision and mission is quite short and easy to remember, namely to produce a skilled human resource-picking, efficient and reliable alutsista. But in research still found the vision and mission of Kolat fleet II is less communicated to all levels of personnel so that the lack of optimal impact on the quality improvement of the organizational strategy implementation stage.

b. Success indicators vision, mission and organizational objectives.

From the score above, 3,5 shows Kolat fleet II is good at establishing clear indicators of vision, mission and organizational objectives, aligning them with the organizational unit's success indicators and ensuring every personnel understand roles and contributions to achieve them. In this study found personnel understanding of the success indicators of the vision, mission and objectives of the level of

service elements with lower predicate of an understanding of the level of performance indicators of auxiliary elements.

c. Success indicators vision, mission and objectives of department-based organizations.

There is an average score of 3,7 which means the ability of an organization to lower the success indicators of superiors level until the subordinate individuals are good. These results also indicate that Kolat fleet II has managed to make strategy a job for everyone.

Table 2. Sample composition based on representation on fleet work execution

Implementing Elm.	Abbrev.	Pop	% Pop	Sample	% Sample
CDR. TC Warship	CTW	52	26	10	20
CDR TC Fly Navy	CTFN	46	16	5	10
CDR TC Amphibious	CTA	43	15	3	8
CDR TC Ops. Support	CTOS	32	13	3	10
CDR TC Combat Tr.	CTCTr	63	30	2	1
		236	100		

Source: Processed 2019

Table 3. Analysis results of the stage quality factors implementation of strategy

NO	Variable	CTW	CTFN	CTA	CTOS	CTCTr
1	Vision, mission, organization Objective	3,2	3,5	3,2	3,1	4,3
2	Success Indicator Vis, mis, Objective organizations	2,3	3,1	2,5	2,3	3,1
3	Success Indicator Vis, mis, Objective organizations office-based	1,7	2,4	2,1	2,6	3,7
4	Annual Target Determination	1,9	2,1	2,2	2,4	2,1
5	Work Program Planning	2,3	2,1	2,4	2,6	3,5
6	Evaluation Work Program	2,1	2,3	2,4	2,6	3,8
7	Monitoring Work Program	1,4	1,7	1,6	1,8	3,2

Source: Processed 2019

Table 4. The results of the supporting factors of strategy implementation

NO	Variable	CTW	CTFN	CTA	CTOS	CTCTr
1	Financial Support	3,3	3,2	3,1	3,2	3,1
2	Lheaderships	3,3	3,2	3,1	3,5	3,2
3	Structure Organization	3,4	3,1	3,2	3,6	3,3
4	Human Resource Competency	3,7	3,3	3,1	3,2	3,1

Source: Processed 2019

4.2 Quality Analysis Supporting Factors Strategy Implementation

a. Financial Support

The average score of 3,1 shows that it has not been enough to match the Kolat fleet II to provide a budget to support the elements as well as working units underneath it in implementing its strategy. In other words the strategy that has been planned working element is not supported by adequate budget. Budgeting is not fully associated with the strategy, although there have been budget planning processes for the program but dynamization will always happen. Although the budget that is cut for stakeholders strives to be minimized, it still affects the success of planned programs. Frequent revisions indicate the implementation of a less qualified strategy.

b. Leadership

On the leadership factor, the score was 3,4. The condition is defined as the overall ability of the leaders in Kolat Fleet II to provide support and commitment very enthusiastic and serious. The leaders of the working elements are actively involved in supporting the program of activities that have been compiled, but the role in leading, executing and evaluating the implementation of organizational strategies has not been demonstrated quite well.

5. CONCLUSION

BSC as a strategy management tool can spur performance improvements when in its application pay attention to the factors that determine the implementation of the strategy, so as to help the Kolat fleet II in determining the priority of the program compiled. The successful implementation of the strategy on the Kolat fleet II is the quality factors of implementation of the strategy and the supporting factors of strategy implementation. This study found the factors that determine the quality of the stage implementation of the highest value strategy is the vision, mission and objectives of the organization, while the contributing factor to the implementation of the highest value strategy is leadership. This research also identifies the important factors of the success of the strategy implementation of BSC in Kolat fleet II is a strong commitment of the commander Kolat fleet II as a party with the leadership and supreme power in kolat fleet II.

To optimize the role of BSC in the implementation of strategy, top management in Kolat fleet II is expected to increase the intensity in communicating vision and mission, renstra as well as relation to BSC Throughout personnel, providing budget Support sufficient on each element in accordance with its strategic objectives. Each of the elements in Kolat fleet II Also should improve HR competence for management and functional skill needed to implement strategy.

BIBLIOGRAPHY

Agustini, E.P. (2012), in Business Process Analysis, Jakarta: Universitas Indonesia.

Ahmad, S. (2014) 'Technology Organization', *International Journal of Research in Business Management*, vol. 2 (7), pp. 2321–886.

Al-Ghamdi, S.M. (2015) 'Obstacles to successful Implementation of strategic decisions: The Saudi case', *International Journal of Management and Strategy*, vol. 6(9), pp. 1-11.

Andi Sultan Warafakih, E.C.R.A. (2015) 'Analysis Of Content Technology 3G For Telkom Flash Service Using Technometric Method In PT Telkomsel Jaksel ', *e-Proceeding of Engineering :* , vol. 2 (2), p. 4124.

Andriyanto, I.d.I. (2017) 'SWOT Analysis in Business Development (Study at the Jenang Center in Kaliputu Kudus Tourism Village)', *Bisnis*, vol. 5, p. 2.

Anwar, S. (2015) 'Mastery of Defense Technology by Indonesian Defense Human Resources in the Context of Facing Future Wars', Defense Journal,vol. 5, p. 15.

Beveridge, T. (2003) 'Guide to IT Enterprise Architecture', *ACM Journal Perks Aligment*, no. Springer.

Ching, Y.&.C.L. (2004) 'Performance measurement and adoption of balanced scorecard: A survey of municipal governments in the USA and Canada', *The International Journal of Public Sector Management*, vol. 17(2), pp. 204-221.

David, F.R. (2003) *Strategic Management Concepts and Cases*, Pearson Education International. Prentice Hall, Inc..

Dede Kurniadi, A.M. (2016) 'Implementasi Pengembangan Student Information Terminal (S-IT) Untuk Pelayanan Akademik Mahasiswa', *Jurnal Algoritma*.

Deshmukh, A.M.&.S.G. (1994) 'Vendor selection using interpretive structural modeling (ISM)', *International Journal of Operations and Production Management*, vol. 14(6), pp. 52-59.

Ebig, M.a.D.S. (2006) 'Adapting the Balanced Scorecard to Public Management aus betriebswirtschaftlicher Persfektive', *Journal For Public*.

Fitria Fresty Lungari, D.M.B.M. (2016) 'Measurement of Technology Component Readiness Level in Middle Class Shipyards Based on Techometric Methods (Case Study: PT. Dumas Tanjung Perak Shipyard)', *Jurnal Wave*, vol. 10 - 2, pp. 53-60.

Gasperzs, V. (2005) Integrated Performance Management System Balanced Scorecard with Six Sigma for Business and Government Organizations, Jakarta: Gramedia.

Hakim, L. (2014) 'Business and Information System of ESQ Business School', *Journal of Business and System Management*.

Hamel, G.&.P.C.K. (May-June 1990) ' The core competence of corperation', *Harvard Business Review*, pp. 1-15.

Harline, O.C.F.a.D. (2005) *Marketing Strategy*, South Western: Thomson Corporation.

Hunger, W.d.T. (2004) *Strategic Management and Business Policy*, 9th edition, Pearson Prentice Hall, Inc.

Hutabarat, J..H.M. (2006).Operationalization Strategy, Elex Media Komputindo.

K.C. Laudon and J.P. Laudon, P.C.P. (2000) 'Management information system', *organization and technology in the networked enterprise*.

Kaplan, R.S.&.N.D.P. (1996) *The Balanced Scorecard: Translating strategy into action*, USA: Harvard Business School Press.

Kaplan, R.S.&.N.D.P. (2008) *The executing premium: Linking strategy to operations for competitive advantage*, USA: Harvard Business School Press.

Kotter, J.P. (1996) *Leading change. (Joseph B.M.S., Terjemahan)*, Jakarta: Gramedi.

Malina, M.A.a.F.H.S. (2001) 'Communicating and Controling Strategy: An Empirical Study of the Effectiveness of the Balanced Scorecard', *Journal of Management Acounting Research*, vol. Volume 13.

Mulyadi (2001) *Balaced Scorecard:* Contemporary Management Tools to Double the Company's Financial Performance, Jakarta : Salemba Empat.

Mulyadi (2001) Balanced Score Card - Contemporary Management Tools To Double Corporate Financial Performance,Salemba, Jakarta.

Nazaruddin (2008) *Manajemen Teknologi*, 1st edition, Yogyakarta: Graha Ilmu.

Pramadhany, W. (2011) 'The Application of the Balanced Scorecard Method as a Benchmark in Nonprofits (Case Study at Bhayangkara Hospital Semarang)', Thesis at the Faculty of Economics,*Universitas Diponegoro*.

Prawitasari, S.Y. (2010) 'SWOT Analysis as the Basis for Formulation of Competitive Marketing Strategies (Study of Honda Tunggul Sakti Dealers in Semarang).', *Jurnal Teknik Industri*, vol. V, pp. 54-67.

Quinlivan, D. (2000) 'Rescaling the BSC for Local Government', *Australian Journal of Public Administration.*, vol. Vol. 59, no. Issue 4 , pp. pages 36–41.

Radomska, J. (2014) 'Model of successful strategy execution: Revising the concept. Problems of Management in the 21st century', vol. 9(3), pp. 213-222.

Rahayu, B. (Bandung, 2009) 'Information Systems Strategic Planning (Case Study:PT. AAS) '.

Rangkuti, F. (2004) SWOT Analysis of the Technique for Dissecting Business Cases, Jakarta.

Rifky, R.M. (2015) 'Performance Measurement of CV. Jiggy Sentosa Using the Balanced Scorecard Method', e-Proceeding of Engineering : Vol.2, No.3 Desember 2015 | Page 7540, 7540.

Robinson, P.I.J. (1997) *Strategic Management: Formulation, Implementation, and Control*, 6th edition, Illinois: Richard D. Irwin Inc.

Saaty, T.L. (1996) *Decision Making with Dependence And Feedback The Analytic NetworkProcess* , Pittsburgh: RWS Publications.

Sebastian, E. (2015) 'Enhancing the Role of National Defense HR to Face the Fourth Generation War',*Jurnal Pertahanan*, vol. 5.

Siswadi (2016) 'Influence of Competency-Based HR to Achieve the Performance of Indonesian Air Force Soldiers', September, p. 1.

Solihin, I. (2012)Strategic Management,Jakarta: Erlangga.

Sondang, S.P. (1998) Strategic Management,Jakarta: Bumi Aksara.

Subhan, A. (2017) 'Strategy Formulation of the Faculty of Engineering, University of Suryakancana using the Combined Model', *Jurnal Media Teknik dan Sistem Industri*, vol. 1, pp. 50-59.

Susiono, W. (2012) 'Technology Assessment to Determine Competitor Industry Position',*Jurnal Teknik Industri*, vol. VII (2).

Umar, H. (2008) *Strategic Management In Action*, Jakarta: PT. Gramedia Pustaka Utama.

Wahyudi, A. (1996) *Strategic Management* Jakarta: Grasindo.Ward, J..P.J.S.P.f.S. (2002) John Wiley.

Ward, J..a.P.J. (2003) *Strategic Planning for Information Systems*, 3rd edition, USA: John Wiley & Sons Ltd.

Wheelen, J.D.H.&.T.L. (2011) *Manajemen Strategis*, Yogyakarta.

William F. Jauch, L.R.d.G. (1991) *Strategic Management and Business Policy*, Jakarta: Erlangga.

PROPULSION ANALYSIS OF FAST ATTACK CRAFT MISSILE (KCR 60) USING NUMERICAL COMPARISON AND MODEL TEST METHODS

Akhmat Nuryadin, Wawan Kusdiana, Okol Sri Suharyo

Indonesian Naval Technology College, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia
Email: akhmatnur2019@gmail.com

ABSTRACT

Fast attack craft Missile 60 Meters (KCR 60 M) is the first warship type of 60 meters that was made in PT PAL shipyard Surabaya. The ability of this KCR 60 M is as fast patrol boats and as well as combatant ships (search and destroyer for the enemy surface ships), which has a high speed and maneuver agile and can be operated up to the battle in archipelagic warfare theatre. This ship has a length overall (loa) of 60 meters and displacement 460 tons in draft 2.6 meters (full load). This three KCR 60 M unit which has been completed is 628, 629 and 630. , according to the design of the shipyard (PT X) to reach the maximum speed (28 knots) of KCR 60 on the draft 2.4 meters (half load, displacement 319 tons), requires the shaft power (P_S) 5396 kW (P_B=5450,5 kW). However, based on the results of operations in the field with draft condition 2.4 meters (half load) and use the installed engine power at 100% MCR (P_B=5760 kW, P_S=5702,4 kW) just only reach the maximum speed at 23.3 knots. Based on the calculations of the DESPPC MARIN program on condition draft 2,4 meters using propeller B5-105 (diameter 1,550 m), the KCR 60 M requires a shaft power (P_S) of 6777 kW to be able to reach speed at 28 knots. While the Brake Horse Power (P_B) of The KCR 60 M is 5760 kW and Shaft Power (PS) 5702,4 kW at draft condition 2,4 meters can reach the maximum speed until 26.30 knots. The problems of low levels of maximum speed achievement from the KCR 60 with an existing engine (PB) 5760 kW is caused due to the lack of power absorption by propeller itself.

Keywords: *KCR, Powering, Propulsion.*

1. INTRODUCTION.

Fast attack craft Missile is one type of Indonesian Republic warship which has a length of 60 meters and made domestically by the sons and daughters of the Indonesian nation at the PT.X in Surabaya is engaged in the production of warships and commercial vessels, providing ship repair, and maintenance services as well as general engineering with order-based specifications (Martin.R, 2016). This fast missile ship is a fast reaction batter which in the execution of its tasks prioritizes the element of surprise, carries the mission of attacking quickly, destroying targets once at a time, having fast maneuvering speed and equipped with guided missiles (Susanto, 2017). Three of KCR 60 units that have been completed are 628, 629 and 630.

One of the problems faced in the KCR 60 stage I (628, 629, 630) is that there has not been a maximum speed of 28 knots (full load condition) following the provisions of the procurement contract. Achieving the maximum speed of the ship is an important factor as a benchmark for the success of the construction of a ship. So that in the ship design process it is necessary to take into account the total barriers of the ship and how much the driving engine power will be used as well as the choice of type and type of propeller as propulsor.

This fast missile ship (KCR 60) uses a PL 506 Powerline propeller made by Michigan Marine Propulsion (MMP). The characteristics of this propeller are having 5 blades, 1.550 M diameter, Pitch diameter ratio (PDRA) 1.460 M, Blade area ratio (BAR) 1.06 and efficiency 0.69. This propeller

was designed as a ship propulsor to reach speeds of 28 knots with engine 2x2880 KW. However, based on the report of the 629-speed test result on October 21, 2014, it cannot reach speeds of 28 knots. According to shipyard calculations (PT X) using shaft power (PS) of 5396 kW at draft 2.4 m, the maximum speed of KCR 60 can reach 28 knots. However, based on the results of operations on the sea with draft 2.4 m conditions and the use of 100% MCR engine power (PB = 5760 kW, PS = 5702.4 kW) this vessel is unable to reach a maximum speed of 28 knots. The maximum speed of KCR 60 in these conditions only reaches 23.3 knots. The failure to reach the maximum speed of KCR 60 (628) may be caused by several things, namely: the amount of engine power installed is not in accordance with the propulsion power of the ship, the installed propeller is not able to deliver all engine power, error in engine propeller matching and errors in designing the ship's hull itself which results in relatively larger vessel resistance.

The research aim is to find out the cause of failure to reach the maximum speed of KCR 60 in this case when carrying out a speed retest on October 21, 2015, and to find a solution to the problem.

2. MATERIALS AND METHODOLOGY

2.1 Planning of Ship Propulsion System

Leksono (2015) defines that in its operations at sea, a ship must have the ability to maintain official speed (Vs) as planned. This means that the ship must have a propulsion system design (drive) that can overcome the overall drag forces (total resistance) that occur to meet the service speed standards. The Ship Propulsion System consists of three main components, including: the main engine, transmission system, and propulsor.

Errors in design, will bring a very large 'consequence' to the conditions as follows; not achieving the speed of planned ship service, Inefficient fuel oil consumption, decrease in the economic value of the ship, effect on the level of vibration that occurs on the ship's body, etc

2.2 Ship Drive Motor Power

The ship's driving power component consists of:

a. Effective Power (P_E)

The equation of the effective power of the ship is:

$$P_E = R_T \text{ x } V_s \quad (1)$$

where:

P_E= Effective Power (kW)

R_T= Total Resistance (kN)

V_S= Ship service velocity(knot,m/s)

b. Thrust Power (P_T)

$$P_T = T \text{ x } V_a \quad (2)$$

$$V_a = V_S \text{ x } (1 - w) \quad (3)$$

where:

P_T = Thrust Power (kW)

T = Thrust Force (kN)

V_a = Advanced velocity (m/s)

w = wake fraction

c. Delivery Power (P_d)

$$P_D = 2 \times \pi \times Q_D \times n_P \quad (4)$$

where:

P_D = Delivery Power (kW)

Q_D = Propeller torque (kN)

n_P = Propeller rotation (rpm;rps)

d.. Shaft Power (P_S)

$$P_S = \frac{P_D}{\eta S} \quad (5)$$

where:

P_D= Delivery Power (kW)

ηS= shaft efficiency

e. Brake Horse Power (P_B)

$$P_B = \frac{P_S}{\eta G} \quad (6)$$

where :

ηG = Gear Reduction 0.98

$$P_{B-MCR} = \frac{P_{B-CSR}}{0,85} \quad (7)$$

where:

$P_{B\text{-}MCR}$ = Engine power-max cont rating (kW/HP)

$P_{B\text{-}CSR}$ = Engine power-continuous rating (kW/HP)

2.3 Efficiency in Ship Propulsion Systems

Efficiency in ship propulsion systems consist of:

a. Hull efficiency (ηH)

$$\eta H = \frac{P_E}{P_T} \quad (8)$$

where

P_E = Effective Power (kW)

P_T = Thrust Power (kW)

b. Propeller efficiency ($\eta Prop$)

Propeller efficiency (open water/ $\eta 0$)

$$\eta O = \frac{T \times V_a}{2 \times \pi \times Q_O \times n} \quad (9)$$

Propeller efficiency (Behind the ship/ ηB)

$$\eta B = \frac{P_T}{P_D} = \frac{T \times Va}{2 \times \pi \times Q_D \times n} \quad (10)$$

c. Relative-Rotative Efficiency (ηRR)

$$\eta RR = \frac{\eta B}{\eta 0} = \frac{Q_O}{Q_D} \quad (11)$$

d. Shaft Transmission Efficiency (ηS)

$$\eta S = \frac{P_D}{P_S} \quad (12)$$

e. Overall Efficiency/Propulsive Efficiency(ηP)

$$\eta P = \frac{P_E}{P_T} \times \frac{P_T}{P_D} \times \frac{P_D}{P_S} = \eta H \times \eta B \times \eta S$$
$$= \eta H \times \eta 0 \times \eta RR \times \eta S \quad (13)$$

2.4 Characteristics of Ship Propellers

Each type of ship propeller has different performance curve characteristics (Lewis, 1988), that is:

$$J = \frac{V_a}{nxD} \quad (14)$$

$$K_T = \frac{T_{Prop}}{\rho \times n^2 \times D^4} \quad (15)$$

$$K_Q = \frac{Q_{Prop}}{\rho \times n^2 \times D^5} \quad (16)$$

where:

J : Advanced coefficient

Va : The advanced speed (m/s)

KT : The thrust coefficient of a propeller

KQ : The propeller torque coefficient

T : PropellerThrust (kN)

Q : Propeller Torque (kN)

2.5 Admiralty Coefficient (A_C)

If two ships have similarities in type, displacement, and speed, then the admiralty (AC) coefficient for the two vessels is the same (Barras, 2004). The equation according to (Sv.Aa.Harvald, 1983) is:

$$A_C = \frac{\Delta_S^{2/3} \times V_S^3}{P_B} \quad (17)$$

where:

A_C : Admiralty Coefficient

Δ_S: : ton displacement (ton)

Vs : Ship Velocity (knot)

P_B : Engine Brake Power (kW)

2.6 Engine Propeller Matching (EPM)

The propeller matching engine is a synchronization between the hull, the engine, and the propeller. There are 2 (two) basic terms in determining the synchronization between the main engine and propeller.

a. Propeller load factor (PLF)

$$PLF = \frac{Qxn^3}{\rho x Va^5} \quad (18)$$

where:

Q = Propeller Torque (kN)

n = Propeller Rotation (rpm/rps)

ρ = Seawater Density (kg/m3)

b. Engine Load Factor (ELF).

The equation of ELF is:

$$ELF = \frac{P_D x n^2}{2x\pi \times Va^5} \quad (19)$$

Where:

P_D = Delivery Power (kW)

n = Propeller Rotations (rpm/rps)

V = The advanced speed of fluid flow in the stern (m/s)

The operating point of the engine speed with the character of the propeller load is obtained by placing the propeller load smaller than the engine load.

$$PLF < ELF \quad (20)$$

$$\frac{Qxn^3}{\rho x Va^5} < \frac{P_D x n^2}{2x\pi \times Va^5}$$

2.7 MARIN DESPPC and PREDFDS Program

Numerical calculations using the MARIN DESPPC and PREDFDS program require some data: main ship size data, hydrostatic data, propeller data, and installed shafts and position, steering leaf data along with installation location.

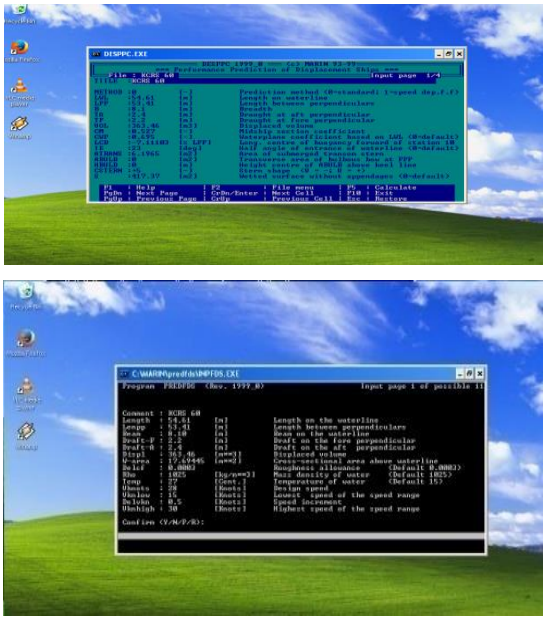


Fig. 1. MARIN DESPPC and PREDFDS Program Display

2.8. METHODOLOGY.

a. Flowchart of Research

Analysis of ship propulsion with the ship object (628) is focused on two main topics:

a. Maximum draft at 2.6 m (full load conditions)

b. Minimum draft 2.4 m (half load conditions). Especially in this condition, where the main problem arises, namely not achieving the speed of the ship according to the desired speed of 28 knots. The research process carried out can be seen in Figure 3.1.

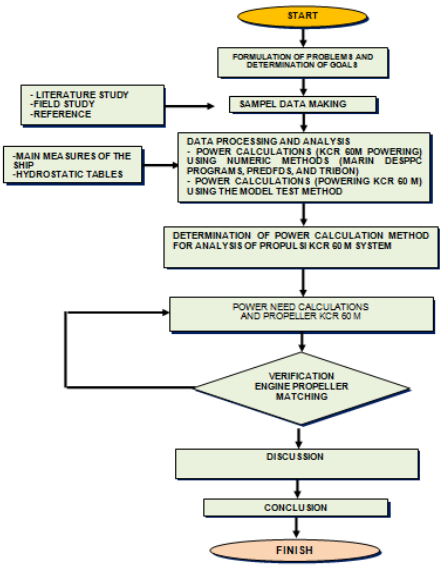


Fig. 2. Flowchart of research

b. **Data Processing and Discussion.**

Data analysis was carried out based on the results of retesting the shipping speed and technical reports calculation of powering the ship by PT X (TRIBON software). Further analysis using numerical methods (MARIN, DESPPC and PREDFDS programs) and model test results.

3. RESULT AND DISCUSS

3.1 Propulsion Analysis of KCR 60 M)

One of the causes of the failure to achieve the desired service speed is a result of mistakes in planning the ship's propulsion system (Setyo, 2015). Propulsion analysis on KCR 60 M is used to determine the size of the shaft power (PS) of the ship and propeller technical specifications to meet the desired service speed (VS). Calculation of powering using numerical methods (DESPPC and PREDFDS programs) and model test results.

3.2 Selection of Propulsion Calculation Methods KCR 60 M.

To obtain the appropriate calculation method for analyzing KCR 60 propulsion, the authors compared the results of the calculation of propulsion at draft 2.4 m. Propulsion analysis is carried out at

2.4 m due to the retesting of ship speed and a half load of KCR at draft 2,4 m.

Table 1. Results of power calculations from the DESPPC, PREDFDS, TRIBON, and model test at draft 2.4 m

Vs (Knots)	DESPPC	PREDFDS (P_S)		TRIBON (P_S)	MODEL TEST (P_S)
	P_S(kW)	BAILEY (kW)	HOLTROP (kW)	(kW)	(kW)
20	2739	2443,07	2869,52	2083	
20,5	2979	2656,06	3329,66	2281	
21	3226	2877,57	3818,28	2486	
21,5	3481	3102,76	4334,53	2697	
22	3742	3300,65	4861,86	2914	
22,5	4010	3505,17	5402,26	3137	
23	4284	3716,47	5935,75	3365	
23,5	4565	3915,11	6451,67	3599	
24	4850	4115,2	6944,23	3838	
24,5	5142	4320,4	7409,37	4083	
25	5424	4522,58	7845,76	4332	4662
25,5	5678	4721,74	8253,18	4529	4888
26	5916	4924,73	8633,05	4715	5119
26,5	6145	5136,96	8994,37	4893	5352
27	6364	5343,11	9326,48	5063	5585
27,5	6572	5556,21	9665,72	5226	5820
28	6777	5772,25	10039,54	5396	6067
28,5	6978	5988,76	10399,46	5605	6316
29	7197	6207,65	10744,5	5815	6550
29,5	7460	6428,78	11080,57	6027	6773
30	7757	6650,43	11410,13	6243	6982

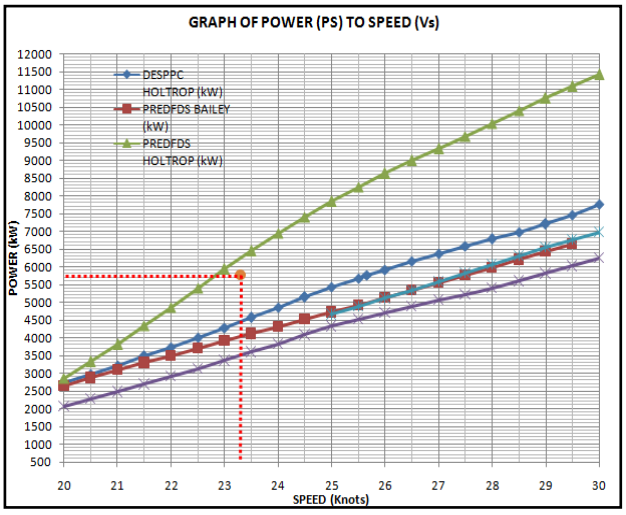


Fig.3. Graph of power calculation results from the DESPPC, PREDFDS, TRIBON program and model tests at draft 2.4 m.

From the KCR 60 M technical data it is known that the installed engine power (PB) is 5760 kW (PS = 5702.4 kW). By using Figure 4.2, at shaft power of 5702.4 kW, the maximum speed will be obtained as follows:

a. DESPPC : 25,59 knot
b. PREDFDS (Balley) : 27,84 knot
c. PREDFDS (Holtrop) : 22,78 knot
d. TRIBON : 28,73 knot
e. Uji model : 27,25 knot

3.3. Use of Admiralty Coefficient (AC) in KCR 60 M Propulsion Analysis

From table 1. is known that by using 5 calculation methods, 5 prediction results are different. To determine which method to use, an engineering adjustment action needs to be done. In the world of naval architect, the admiralty coefficient is often used to predict the amount of engine power using a comparison ship and the FPB 57 vessel as a comparison vessel was carried out to calculate the magnitude of the admiralty coefficient of the ship designed (KCR 60 M). FPB 57 is a ship made by PT X through its proven technology transfer process with the German State, so that it is worthy of being used as a reference in analyzing KCR 60 M propulsion. The ship data can be seen in the table below.

Table 2. Comparison of FPB 57 and KCR 60

DATA	FPB 57	KCR 60
PRINCIPAL		
Length	58.10 m	59.80 m
Length Water	54.40 m	54.91 m
Breadth	7.62 m	8.10 m
Depth	4.75 m	4.85 m
Draught Full	2.95 m	2.60 m
Displacement	445.00	460.00
Displacement	378.00	382.00
Speed/speed	29/32.4	28
Range at	3500 nm	2400
Endurance for	7 days	5 days
Main engine	2 x 3645	2 x 2880
Complement	42	55

A_c (FPB 57) = A_c (KCR 60 M)

$$A_{C(FPB-57)} = \frac{\Delta_S^{2/3} \times V_S^3}{P_B}$$

$$A_{C(FPB-57)} = \frac{(378\ ton)^{2/3}\ x\ (28\ knot)^{\ 3}}{7290\ kW}$$

$$A_{C(FPB-57)} = 174{,}90182$$

Tabel 3. Comparison of admiralty coefficients (DESPPC, PREDFDS,TRIBON and model test)

DATA	UNIT	FPB 57	KCR 60	DESPPC	PREDFDS-Bailey	PREDFDS-Holtrop	TRIBON	LHI
LWL	M	54,4	54,91	54,71	54,71	54,71	54,91	53,97
DISPLACEMENT TON	TON	378	404,94675	404,94675	404,94675	404,94675	416	404,875
DISPLACEMENT VOLUME	M³	368,7804878	395,07	395,07	395,07	395,07	405,8536585	395
DAYA (PB)	KW	7290	5760	6852,525253	5830,555556	10140,94949	5450,505051	6128,282828
DAYA (PS)	KW	7217,1	5702,4	6784	5772,25	10039,54	5396	6067
SPEED (Vs)	KNOTS	29	28	28	28	28	28	28
	M/S	14,91876	14,40432	14,40432	14,40432	14,40432	14,40432	14,40432
Ac COEFFICIENT		174,9019213	208,6012416	175,3431192	206,0769579	118,4842852	224,4396424	196,0420646

From Table 3. it is known that the value of the admiralty coefficient that approaches the FPB 57 coefficient value is 175.334311. The similarity of the admiralty coefficient between the results of the DESPPC program calculation and the FPB 57 shows that the calculation of the DESPPC program can be used as a basis for calculating the KCR 60 propulsion analysis.

3.4. Calculation of Powering KCR 60 M Using the MARIN DESPPC Program.

The output of this program is a propeller design and calculation of powering (shaft power) at draft 2.6 m. The design propeller is:

- Propeller: B-series
- Number of blades: 5 pieces (B5)
- Propeller diameter (D): 1,800 m
- Blade area ratio (AEAO): 1,411
- PDRA: 1,288
- Propeller rotation (n): 499,6rpm (8,3267rps)
- Vs: 28 knots (14.4032 m / s)

Table 4. The results of the DESPPC power calculation on draft 2.6 m (full load).

VS [knots]	THRUST [kN]	N [1/Min]	P_S [kW]
15.00	91.8	261.9	1128
15.50	97.0	270.0	1230
16.00	102.6	278.3	1343
16.50	109.2	287.0	1473
17.00	117.0	296.4	1627
17.50	126.5	306.5	1814
18.00	137.1	317.1	2028
18.50	148.6	327.9	2266
19.00	160.6	338.7	2521
19.50	172.3	349.2	2782
20.00	184.0	359.4	3052
20.50	195.6	369.5	3331
21.00	207.3	379.5	3620
21.50	218.9	389.2	3918
22.00	230.4	398.8	4224
22.50	241.9	408.3	4538
23.00	253.4	417.6	4860
23.50	264.9	426.8	5191
24.00	276.2	435.9	5528
24.50	287.5	444.9	5874
25.00	298.0	453.5	6211
25.50	306.9	461.5	6517
26.00	314.8	469.2	6806
26.50	322.0	477.1	7083
27.00	328.5	484.8	7351
27.50	334.4	492.3	7613
28.00	339.7	499.6	7869
28.50	344.6	506.7	8118
29.00	349.1	513.7	8360
29.50	353.3	520.5	8598
30.00	357.1	527.2	8830

The power is calculated using the B-series propeller according to the propeller output data from the DESPPC program. According to the B-series performance table for the number of blades (Z) equal to 5, then the maximum blade area ratio is 1.05. Thus to avoid / minimize errors, the propeller to be used on the KCR 60 M is:

- Number of blade: 5 pieces (B5)
- Propeller diameter (D): 1,800 m
- Blade area ratio (AEAO): 1.05 (B5-105)
- PDRA: 1,288
- Propeller rotation (n): 499,6rpm (8,3267rps)
- Vs: 28 knots (14.4032 m / s)
- Wake friction (W) : 0,062

Advanced coefficient (J) is:

$$J = \frac{Va}{nxD} = \frac{Vsx(1-w)}{nxD}$$

J = $\frac{14{,}4032x(1-0{,}062)}{8{,}3267\ x1{,}800}$ = 0,901

From the B-series B5-105 propeller performance diagram, we know that:

KT : 0,2334

KQ : 0,05138

η_0: 0,6574

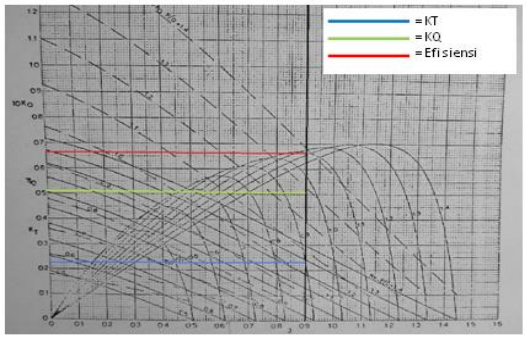


Fig. 4. Graph B5-105 propeller characteristic performance.

Then;

$T = K_T$ x ρ x n^2 x D^4

T = 0,2334 x 1025 x $8{,}3267^2$ x $1{,}800^4$

T = 174.124,777 N

The total of thrust for 2 propellers is 348,256 kN and shows that the B5-105 thrust propeller can push the ship to reach a speed at 28 knots. The value of torque (Q) propeller B5-105 m:

Q = K_q x ρ x n^2 x D^5

Q = 0,05138 x 1025 x $8{,}3267^2$ x $1{,}800^5$

Q = 68,996 kN

then;

$P_{Dc} = 2\pi\ x\ Q\ x\ n$

$P_{Dc} = 2\ x\ 3{,}14\ x\ 68.996{,}383\ x\ 8{,}3267$

$P_{Dc} = 3.607{,}937\ kW$

so that:

$P_s = \frac{PDc}{\eta S\ .\eta B}$

$P_s = \frac{7.215{,}874}{0{,}98}$

$P_s = 7.363{,}137\ kW$

By using a B5-105 propeller to reach a speed of 28 knots at draft 2.6 m the calculation of shaft power (Ps) is 7,363,137 kW. While the calculation of the DESPPC has a shaft power of 7869 kW. The value difference is caused by two factors, namely the blade area ratio used by the program is different from the manual count and the manual calculation above uses the open water test characteristics while the program uses the propeller characteristics behind the ship.

3.5. Calculation of powering at draft 2.4 m (half load).

When the KCR carried out a retest of speed at 2.4 m (half load) with the use of 100% MCR engine power (PB = 5760 kW, PS = 5702.4 kW), the maximum speed achieved 23.3 knots, this is not in accordance with the design of the shipyard (PT X) that the calculation of TRIBON on the draft 2.4 M can reach speeds of 28 knots. To analyze these problems, ship power (PS) is calculated on draft 2.4 m using the DESPPC program.

Table 5. The calculation results of the power from the DESPPC on the draft 2.4 m (half load).

VS [knots]	THRUST [kN]	N [1/Min]	PS [kW]
15.00	78.9	265.5	917
15.50	83.5	273.8	1002
16.00	88.7	282.4	1098
16.50	94.7	291.6	1210
17.00	101.8	301.2	1342
17.50	110.7	311.8	1505
18.00	120.4	322.6	1685
18.50	129.9	333.1	1871
19.00	139.4	343.5	2066
19.50	148.9	353.6	2268
20.00	158.4	363.6	2477
20.50	167.9	373.4	2693
21.00	177.3	383.1	2915
21.50	186.7	392.6	3144
22.00	196.0	402.1	3379
22.50	205.3	411.3	3621
23.00	214.6	420.5	3868
23.50	223.8	429.6	4122
24.00	232.9	438.5	4380
24.50	241.8	447.3	4642
25.00	250.0	455.8	4895
25.50	256.7	463.5	5120
26.00	262.4	470.9	5331
26.50	267.7	478.1	5535
27.00	272.4	485.1	5730
27.50	276.6	492.3	5917
28.00	280.5	499.5	6102
28.50	284.1	506.6	6285
29.00	288.3	514.0	6485
29.50	293.6	522.2	6725
30.00	299.9	530.9	6996

From table 5. is known that shaft power (PS) is required at 6,102 kW. Propeller design used in the above conditions as follows:

- Type: B-series (B5-105)

- Number of leaves: 5 pieces (B5)
- Diameter of a propeller (D): 1.80 m
- Blade area ratio (AEAO): 1,202
- PDRA: 1,218
- Propeller rotation (n): 499.5 rpm
- Speed (VS): 28 knots

3.6 Analysis of Propeller Matching at draft 2.4 Meter

Based on the results of the 628 speed retest, on average loaded conditions of 2.4 m with engine power (PB) 100% MCR (PB = 5760 kW, PS = 5702.4 kW) the maximum speed of the vessel only reaches 23.3 knots. Therefore it is necessary to calculate the propeller performance installed to be compared with the B5-105 propeller

Table 6. Comparison of propeller performance installed on KCR 60 M with B5-105 propeller

Existing Propeller KCR 60		**Comparison Propeller (B5-105)**	
Propeller type	PL 506	Propeller type	B5-105
Number of blades	5	Number of blades	5
PDRA	1,460	PDRA	1,321
AEAO	1,06	AEAO	1,05
Diameter (D)	1,550	Diameter (D)	1,550
Propeller rotation (n)	693 rpm	Propeller rotation (n)	589,9 rpm
Data from Tribon		Data from DESPPC:	
Wake friction (w)	0,046	Wake friction (w)	0,069
Vessel speed	28 knots	Vessel speed	28 knots
	(14,4 m /s)		(14,4 m/s)
Propeller rotation	693 rpm	Propeller rotation	589,9 rpm
	11,550 rps		9,832 rps
$J = \frac{Va}{nxD} = \frac{Vsx(1-w)}{nxD}$ $J = \frac{14,4032\ x\ (1-0,046)}{11,55\ x\ 1,550}$ J = 0,767 we get: KT: 0,160 KQ: 0,028 η_0: 0,695 $T = K_T \times \rho \times n^2 \times D^4$ $T = 0,160 \times 1025 \times 11,55^2 \times 1,550^4$ $T = 126,280$ kN then: $Q = K_q \times \rho \times n^2 \times D^5$ $Q = 0,028 \times 1025 \times 11,55^2 \times 1,55^5$ Q =34,253 kN so: $P_{Dc} = 2\pi \times Q \times n$ $P_{Dc} = 2 \times 3,14 \times 34.253,453 \times 11,55$ $P_{Dc} = 2.484,539$ kW P_{Dc} (2 prop)= 4.969,078 KW $\eta S . \eta B$ = 0,98 so the shaft power (Ps) is: $P_s = \frac{PDc}{\eta S . \eta B}$ $P_s = \frac{4.969,078}{0,98}$ $P_s = 5070,488$ kW		$J = \frac{Va}{nxD} = \frac{Vsx(1-w)}{nxD}$ $J = \frac{14,4032x(1-0,069)}{9,832x\ 1,550}$ J= 0,879 we get: KT: 0,2626 KQ: 0,05775 η_0: 0,6437 $T = K_T \times \rho \times n^2 \times D^4$ $T = 0,2626 \times 1025 \times 9,832^2 \times 1,550^4$ T = 150,186 kN then: $Q = K_q \times \rho \times n^2 \times D^5$ $Q = 0,05775 \times 1025 \times 9,832^2 \times 1,55^5$ Q =51,194 kN so: $P_{Dc} = 2\pi \times Q \times n$ $P_{Dc} = 2 \times 3,14 \times 51.193,885 \times 9,832$ $P_{Dc} = 3.160,964$ kW P_{Dc} (2 prop) = 6.321,928 KW $\eta S . \eta B$ = 0,98 so the shaft power (P_S) is: $P_s = \frac{PDc}{\eta S . \eta B}$ $P_s = \frac{6.321,928}{0.98}$ $P_s = 6.451$ kW	

3.7. Engine propeller Matching at draft 2,4 Meter

To optimize the engine installed in KCR 60 (MTU 4000M73L, PB = 2880 kW, PS = 2851.2 kW) to achieve maximum speed on the draft 2.4 m, engine propeller matching is necessary. The method used in conducting engine propeller matching is by taking into account the propeller load factor and engine load factor. The method is to place the propeller load (PLF) smaller than the engine load (ELF).

$$\mathrm{PLF} < \mathrm{ELF}$$

$$\frac{\mathrm{Qxn}^3}{\rho \mathrm{xVa}^5} < \frac{\mathrm{Pdxn}^2}{2\pi \mathrm{x}\rho \mathrm{xVa}^5}$$

Where:

Q = Torque propeller (kN)

Va = Advanced speed of fluid flow in the stern of the ship (m / s)

ρ = density of seawater (1025 kg / m3)

Pd = Power delivered (W)

n = propeller rotation (m / s)

Table 7. Comparison of the value of propeller load (PLF) and engine load value (ELF)

N (RPM)	V_S (knot)	T (kN)	Q (kN)	PLF	ELF	P_S (kW)
309	15	41,04118	137,7386	0,0042	0,0224	454,5655
318,6	15,5	42,7885	145,9113	0,0048	0,0238	496,4974
328,6	16	44,82462	154,7306	0,0056	0,0253	543,0327
339,3	16,5	48,28004	165,3132	0,0066	0,0270	599,0646
350,7	17	53,0282	177,5232	0,0079	0,0289	664,9257
363,3	17,5	56,92507	192,4391	0,0095	0,0310	746,6912
376,3	18	61,09313	208,7358	0,0115	0,0332	838,9063
388,9	18,5	65,27077	224,8645	0,0137	0,0355	933,9879
401,3	19	70,04167	241,1627	0,0161	0,0378	1033,622
413,4	19,5	74,65173	256,9542	0,0188	0,0401	1134,51
425,2	20	79,3365	272,9882	0,0217	0,0424	1239,708
436,8	20,5	84,02432	289,0434	0,0249	0,0448	1348,429
448,3	21	88,77495	305,3186	0,0284	0,0472	1461,855
459,5	21,5	93,43661	321,3088	0,0322	0,0496	1576,85
470,6	22	98,14257	337,4576	0,0364	0,0520	1696,108
481,5	22,5	102,8109	353,492	0,0408	0,0544	1817,851
492,2	23	107,431	369,3774	0,0456	0,0569	1941,754
502,7	23,5	111,8016	384,4695	0,0505	0,0593	2064,206
513,3	24	116,5316	400,744	0,0561	0,0619	2196,952
524,5	24,5	121,8595	419,0198	0,0626	0,0646	2347,266
535,6	25	127,2519	437,4191	0,0696	0,0674	2502,192
545,7	25,5	131,8296	453,3223	0,0763	0,0699	2642,064
546,7	25,55	132,3023	454,8993	0,0769	0,0702	2656,114
555,2	26	135,9905	467,7467	0,0829	0,0724	2773,592
564,4	26,5	139,9465	481,5002	0,0896	0,0748	2902,457
573,2	27	143,5947	494,2398	0,0964	0,0772	3025,702
581,6	27,5	146,9199	505,9147	0,1030	0,0795	3142,563
589,9	28	150,827	516,5548	0,1098	0,0817	3254,446
598	28,5	154,7281	527,5132	0,1168	0,0840	3369,122
606,5	29	158,2172	539,846	0,1247	0,0864	3496,898
616	29,5	163,3782	555,534	0,1345	0,0891	3654,884
626,3	30	168,7866	574,0641	0,1460	0,0921	3839,946

Shaft Power (P_S) Existings

:$P_B \times \eta_G$(asumption$\eta_G = 0{,}99$)

: 2.880 × 0,99

: 2.851,2 kW

Power Shaft (P_S) on matching point

: 2.347,266 kW

: $\frac{2.347{,}266\ \text{kW}}{2.851{,}266\ \text{kW}}$

: 82,325 % MCR

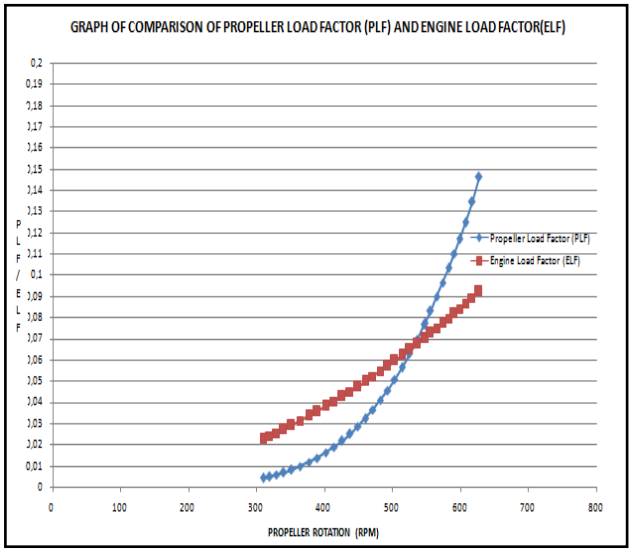


Fig.5. Graph of comparison of propeller load value (PLF) and engine load value (ELF)

From Table 4.8 and figure 4.6 It can be concluded that the propeller operation point and machine operation (matching point) is at propeller rotation 524.5 rpm with shaft power (PS) of 2347,266 kW. This point represents the position of the engine load in the condition of service rating (82.325% MCR) with a speed that can be achieved which is 24.5 knots. While the maximum speed with a shaft power of 100% MCR is 26.30 knots.

3.8 Analysis of the Propeller Diameter Effect on Ship Velocity

The ideal propeller diameter of the ship is 0.6-0.7 from the maximum draft of the vessel (Lewis, 1988). From the calculation of the DESPPC program at conditions loaded 2.6 m and 2.4 m and the use of 1.8 m and 1.550 m diameters are shown in the table below.

Table 8. Comparison of the use of B-series propellers (B5-105) with 1.8 m and 1.5 m propeller diameters

V_S	SARAT 2,6	SARAT 2,4M	
	Dia 1,800 m	Dia 1,550 m	Dia 1,800 m
	DAYA (P_S)	DAYA (P_S)	DAYA (P_S)
15	1128	1005	917
15,5	1230	1098	1002
16	1343	1203	1098
16,5	1473	1326	1210
17	1627	1472	1342
17,5	1814	1654	1505
18	2028	1855	1685
18,5	2266	2063	1871
19	2521	2281	2066
19,5	2782	2506	2268
20	3052	2739	2477
20,5	3331	2979	2693
21	3620	3226	2915
21,5	3918	3481	3144
22	4224	3742	3379
22,5	4538	4010	3621
23	4860	4284	3868
23,5	5191	4565	4122
24	5528	4850	4380
24,5	5874	5142	4642
25	6211	5424	4895
25,5	6517	5678	5120
26	6806	5916	5331
26,5	7083	6145	5535
27	7351	6364	5730
27,5	7613	6572	5917
28	7869	6777	6102
28,5	8118	6978	6285
29	8360	7197	6485
29,5	8598	7460	6725
30	8830	7757	6996

From table 8, it can be seen that by using a 1.8 m diameter propeller it takes a smaller shaft power (PS) compared to using a 1.550 m diameter propeller to operate in either draft 2.6 m or draft 2.4 m. In accordance with the results of the DESPPC program data obtained by the propeller calculation as follows:

-Type propeller : B-series
- Number of blades (Z) : 5 pcs
- Propeller diameter (D) : 1,800 m
- Blade area ratio (AEAO) : 1,411
-AEAO maksimum B-series : 1,05 (B5-105)
- PDRA : 1,288
- Propeller rotation(n) : 499,6 rpm(8,3 rps)
- Velocity (Vs) : 28 knots (14,4 m/s)

By using the propeller data above, it can be proven by calculating how the influence of the propeller when used in draft 2.4 meters) through the following calculations:

- Thrust at V_S 28 knot = 280,5 kN

- Propeller rotations (n) = 439,32 rpm (Propeller rotations at draft 2,6 m)
- Vs (thrust 280,5 at draft 2,6 m) = 24,190 knots
- Wake friction (W) = 0,063

The advanced coefficient at the speed of 28 knots is:

$$J = \frac{Va}{nxD} = \frac{Vsx(1-w)}{nxD}$$

$$J = \frac{12,443x(1-0,063)}{7,322x1,800} = 0,8846$$

From the B-series B5-105 propeller performance diagram obtained:

KT : 0,263281

KQ : 0,05791

η_0 : 0,66

then:

$$T = K_T \times \rho \times n^2 \times D^4$$

$$T = 0,263281 \times 1025 \times 7,322^2 \times 1,800^4$$

$$T = 151,877 \text{ kN}$$

The amount of thrust for 2 propellers is: 303.754 kN.. This shows that the B5-105 thrust propeller is able to push the ship to a speed of 28 knots. The amount of torque (Q) propeller B5-105 is:

$$Q = K_q \times \rho \times n^2 \times D^5$$

$$Q = 0,05791 \times 1025 \times 7,322^2 \times 1,800^5$$

$$Q = 60,131 \text{ kN}$$

so that:

$$P_{Dc} = 2\pi \times Q \times n$$

$$P_{Dc} = 2 \times 3,14 \times 60.131,135 \times 7,322$$

$$P_{Dc} = 2.764,959 \text{ kW}$$

The amount of propeller power (PDc) for 2 (two) propellers is 5,529.92 kW. Assuming shaft and bosing efficiency are 0.98, so:

$$P_s = \frac{PDc}{\eta S . \eta B}$$

$$P_s = \frac{5.529,92}{0,98}$$

$$P_s = 5.642,774 \text{ kW}$$

From the above calculation it is known that by using a B5-105 propeller with a diameter of 1,800 m to reach a speed of 28 knots at draft 2.4 m, shaft power (Ps) is needed at 5,642,774 kW. Taking into account the engine load factor must be greater than the propeller load factor, then according to the results of the calculation of the DESPPC program the amount of shaft power (PS) to reach a speed of 28 knots is 6102 KW. For KCR 60 M with engine power (PB) installed 5760 kW (PS = 5702.4 kW), using a B5-105 propeller the maximum speed can reach 26.9 knots.

4. CONCLUSION

From the results of the analysis and calculations that have been made, conclusions can be drawn as follows:

a. The calculation results of powering (shaft power (PS)) from numerical methods (DESPPC, PREDPDS, and TRIBON) and calculations through model tests can be taken one of the appropriate calculations to calculate the power requirements of KCR 60, namely the MARIN DESPPC program. FPB-57 (as a sister ship of KCR-60) with an admiralty KCR 60 coefficient value calculated from the MARIN DESPPC program

b. The calculation using the MARIN DESPPC program shows that KCR 60 M at 2.6 m (full load) condition requires a shaft power (PS) of 7869 kW to reach speeds of 28 knots using a B5-105 propeller with a diameter of 1.8 m.

c. The calculation using the MARIN DESPPC program shows that KCR 60 M at 2.4 m (half load) condition requires shaft power (PS) of 6102 kW to reach speeds of 28 knots by using a B5-105 propeller with a diameter of 1.8 m.

d. The calculation using the MARIN DESPPC program shows that KCR 60 M at 2.4 m (half load) condition requires shaft power (PS) of 6777 kW to reach speeds of 28 knots using a B5-105 propeller with a diameter of 1,550 m.

e. The speed that should be achieved by KCR 60 M is in accordance with the calculation of the MARIN DESPPC program at 2.4 m draft conditions with installed engine power (PB) of 5760 kW (PS = 5702.4 kW) and using a propeller with a diameter of 1,550 m ie 24, 5 knots with power usage of 82.325%

Maximum continuous rating (MCR) and maximum speed of 26.30 knots with the use of 100% MCR engine power. This is different from the results of operations in the field which only reached 23.3 knots in engine power usage (PB 100% MCR).

f. Factors that cause the failure to reach the maximum speed of KCR 60 M at operating conditions at 2.4 m with engine power (PB) 5760 kW can be caused by the propeller installed performance, it is necessary to do a propeller test.

g. The B-series propeller performance can be applied as a KCR 60 M booster to reach speeds of 28 solid knots 2.6 m (full load)

REFERENCES

Barras, C. (2004). Ship Design and Performance for Masters and mates. Oxford: Elsevier.

J. S. Carlton. (2012).Marine Propellers and Propulsion, Oxford: Butterworth-Heinemann

Leksono, S. (2015). Marine Military Feasibility Workshop. Surabaya: UPT BPPH.

Leksono, S. (2000). Propeller Synchronization with Master Machines on Fish Ships to Improve Efficiency and Performance. Surabaya: ITS Shipping Polytechnic.

Lewis, E. V. (1988). Principles of Naval Architecture Second Revision. New Jersey: The Society of Naval Architects and Marine Engineers

Martin.R. (2016). Optimization of Scheduling for Installation of Electrical and Navkom Installation in 60-missile Fast Ship Manufacturing with CPM Method. Proceedings of the STTAL Postgraduate National Seminar (pp. 1-18). Surabaya: STTAL.

Molland, Antony E.(2010), The Maritime Engineering Reference Book, Oxford University, Oxford UK

Samsu, H. (2016). Designing an Efficiency-Based Propeller Type Wageningen BSeries Selection Program. ITS Shipping Engineering Journal

Susanto, A. D. (2017). Analysis of the Propulsion System Toward The Speed Reduction of Vessels Type PC-43. International Journal of Engineering Research and Applications (IJERA) , 7 (4), 08-15.

Sv.Aa.Harvald. (1983). Resistant and Propulsion of Ships. New York: Wiley.

DOMINANT CRITERIA AND RELATIONSHIPS BETWEEN CRITERIA IN CARRYING OUT STRUCTURAL JOB EVALUATION IN THE INDONESIAN NAVY's WORK UNIT

Harun Bekti Ariyoko, April Kukuh Susilo, Sukmo Hadi Nugroho

Indonesian Naval Technology College, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia

ABSTRACT

Along with the demands of professionalism performance in the TNI work units faced in achieving the vision, mission and goals of the organization. Descriptions and specifications of the right positions are needed, so that analysis and identification by carrying out job evaluation is very necessary. The aim of this study is to determine the influential criteria and relationships and the weighting criteria in job evaluation, including knowledge, effort, working conditions and responsibilities through DEMATEL (Decision Making Trial and Evaluation) and ANP (Analytical Network Process). The results of the weight calculation of each criterion and subcriteria used in determining the alternative position level are analyzed using Microsoft Excel and Superdecision. Where the results obtained from the application of the DEMATEL-ANP method that the criteria that have the highest weight are the criteria for Responsibility (0.557309). The next rating is Knowledge (0.296572), Effort (0.135989) and Working Conditions (0.010131).

Keywords: *Job Evaluation, DEMATEL, ANP.*

1. INTRODUCTION

The development of a dynamic strategic environment has led to estimates of threats that have implications for policies of restructuring, reorganizing, revitalizing and increasing new organizations within the TNI (Ministry of defence of the republic of Indonesia, 2015). Faced with the limited support of the defense budget, then logically defense development is directed at priority and urgent targets, so the development of the current TNI strength is directed at the preparation of the Minimum Essential Force (MEF) based on three things: organizational policy, policies on equipment and defense equipment and personnel sector policies (Mabes TNI, 2009). Therefore, control of personnel is needed to maintain and maintain a balance between the separation with the addition (Zero Growth of Personnel) so that the structuring of TNI personnel in accordance with the accuracy of the post (Right Size) through the assessment and calculation of workload that is right on target. Where in the placement of personnel in accordance with Indonesian Navy (TNI AL) Organization and Procedure, is a process to get the best human resources (Mabesal, 2016). So that it requires an analysis of the specifications and efforts to identify various important factors which can be obtained from job evaluation based on the job description contained in the Work Guide Book (Pandey and Leelashree, 2012). Whereas in the process of job evaluation it means that it also has implications for determining the level of office in line with the increase in workload and responsibilities in the work environment or in other words must consider many criteria.

Based on the List of Personnel Arrangements, Organizations and procedures and work instructions in carrying out job evaluations highlight four major factors, including: knowledge, effort, working conditions and responsibilities (Adamus, 2009). How is the relationship between the dominant criteria and criteria in carrying out job evaluations in structural positions. The purpose of this study is to determine the dominant criteria and the relationship between

criteria in carrying out job evaluation of the four major factors (Pandey and Leelashree, 2012). It is expected that the results of this study are the application of quantitative methods to calculate all criteria / aspects in comparing criteria in calculating job evaluation and the selection of sub-criteria based on abilities and competencies that must be possessed in positions that are considered more objectively to apply the method in the expected personnel planning.

The approach used in this study is through the Decision Making Trial and Evaluation Laboratory (DEMATEL) method. The use of DEMATEL is to show the most dominant criteria, to find out the relationship between criteria, both inner dependence and outerdependence, and as a validity testing tool for the model made. The DEMATEL method is used to change the relationship between cause and effect of the criteria into a system of structured models that are easy to understand (Tzeng, Chiang and Li, 2007). This is done to get consideration of decision making by knowing the interrelationships between criteria or aspects. One method that is quite well known and compatible with such conflicts is the Analytic Network Process (ANP). Both Dematel and ANP methods are proposed as methods that can be used in solving problems with multiple criteria or Multiple Criteria Decision Making (Zolfani, 2012). The use of ANP is expected to anticipate if innerdependence occurs between the criteria that exist in the model that has been built. In order for the model criteria to be formed really the criteria that must be possessed by structural positions, then before being processed with the ANP method to find the respective weights, these criteria must be tested first with DEMATEL (Devadoss and Felix, 2013).

While the ANP method is used to determine the priority weight values of many criteria in determining the level of office identified based on the model obtained from the DEMATEL method. The ANP method is able to correct AHP weaknesses in the form of the ability to accommodate the interrelationships between criteria or alternatives (Saaty and Vargas, 2001). ANP also uses pairwise comparison methods such as AHP. Pairwise comparisons will help decision makers to compare each element of decision, because in each pairing comparison they only concentrate on two of them (Saaty, 2008). Namely by comparing structural position levels based on the List of Personnel Arrangements to find out the chosen alternatives from criteria that have close links. Some literature in the use of Dematel and ANP methods are: A Fuzzy Dematel Approach To Study Cause And Effect Relationship Of Youth Violence by A.Victor Devadoss and A. Felix in 2013, Application of MCDM Method - Analytic Network Process (ANP) and Balance Score Card for Performance Measurement by Ciptomulyono U and Herlina in 2008, Use of Analytic Network Processes (ANP) in the Selection Model of Technology Development Strategies in the Indonesian Telecommunications Industry by Herawan and Didit in 2009.

2. MATERIAL & METHODOLOGY

2.1. Concept of Human Resource Management

The greatest asset of any organization is its human resources that ensure that achievement of the company's goal and objective (Okoye and Ezejiofor, 2013). Some researchers took an approach in introducing the term human resource development (HR) in training and development, career development, and organizational development as an investment organization (Swanson and Holton, 2001) (Vinesh, 2014). HRD is based on the fact that an organization is a man-made entity that relies on human expertise to build and achieve goals and professional HRD is a supporter in groups, work processes and organizational integrity (Arif, 2007). HRD is the process of optimizing production and utilization of labor. HRD deals with: (a) Staffing problems; (b)

Education and training; (c) Performance management; (d) Working conditions (Dussault, 1999). Human resource development (HR) is a process of developing and enhancing human expertise through organizational development through training and personnel development with the aim of improving performance (Swanson and Holton, 2001).

2.2. Methods and criteria used in job evaluation

There are four most common methods to use in job evaluation. These methods are ranking methods, classification methods, comparison methods of factors and point methods (Pandey and Leelashree, 2012).

a. Ranking Method.

The ranking method is an easy evaluation method of office, uncomplicated and inexpensive. The evaluation process is to place various positions in the organization from the highest to the lowest order based on the overall value of the positions in the organization. This position value is usually assessed by a group of people from the human resources and manager, in terms of skills, effort (physical and mental), responsibility (supervisor and fiscal), and working conditions. Variations in weighting methods include paired comparisons, where the most valuable positions are chosen first, then the next position is chosen and compared and continues until the analysis is completed (Pandey and Leelashree, 2012).

b. Classification Method.

The classification or grading method is a simple, inexpensive, flexible and very popular position evaluation method used in public service positions. The aim is to create and maintain a compensation system using equitable and fair salary values throughout the organization. In the classification process, positions will be categorized in class descriptions such as managerial, professional, and staff. Positions are classified by comparing each position with the existing working class and choosing the salary level that best suits them. To ensure equality in classifying positions and wage levels, a general set of instruction and standard classification positions is used (Pandey and Leelashree, 2012).

c. Factor Comparison.

Factor comparison methods are used less frequently than other methods because of their complexity. The factor comparison method is a quantitative method in which evaluators identify and determine the value of several compensable factors for all positions. Examples of compensable factors used are skills (responsibility), responsibility, effort and working conditions (Pandey and Leelashree, 2012). This method has similarities with the ranking method in several ways.

d. Point Method.

Which is also referred to as point-factor, point evaluation and point value method is the most commonly used position evaluation method in which the position value is expressed in numbers. Analysts identify the characteristics of key positions (compensable factors), which include skills (responsibility), responsibility, effort and working conditions. compensable factor can appear at different levels in the field of office, then weighting for each compensable factor and sub-factor, then determined the value for each description in the sub-factor. After that each position will be evaluated by matching the job description with the description in each sub-factor, so that the value will appear for each sub-factor. These values are summed to produce the total value of each position. This amount of value represents the "value" of a position relative to all other positions in the organization (Pandey and Leelashree, 2012).

Implementation of job evaluation in the TNI there are four criteria that are used and classified based on Permenpan No. 34 of 2011 concerning

guidelines for carrying out job evaluation. The four main criteria that are most often used to evaluate positions are knowledge, effort, working conditions and responsibilities (Menteri PAN RB, 2011). An explanation of each criterion and subcriteria will be described below:

a. Knowledge Criteria. In this case related to the knowledge that must be possessed by someone in a position.

b. Effort Criteria. is a human effort to do something to achieve certain goals. Effort is an activity by observing energy, mind or body to achieve a purpose, work, action, initiative, effort, effort to achieve something in all fields.

c. Criteria for Working Conditions. It can be defined as a series of conditions in the workplace of employees who work there. Includes everything in the employee's environment that can improve performance, work safety and security, temperature, humidity, installation, lighting, cleanliness and others.

d. Responsibility Criteria. According to the large Indonesian dictionary, responsibility is a necessity that must be solved by everything (if anything happens that can be prosecuted, blamed, brought to justice, taking responsibility, agreeing on everything or giving responsibility and controlling the consequences as a realization of awareness will maintain it).

2.3 DEMATEL

The DEMATEL method has been applied in many fields, it extracts various uneasy factors in life (Tamura and Akazawa, 2005). The DEMATEL method can describe the interrelations between criteria and find the main criteria that present the effectiveness of a factor, so that a causal relationship can be analyzed between complex factors in a causal diagram. DEMATEL is used to test whether the model we make with several criteria, indeed has a relationship between the criteria with each other before the criteria model is processed by the ANP method to find the weight of each criterion. The relationship between criteria or subcriteria in the DEMATEL method is illustrated on a scale of values from 0 to 4.

In the preparation of the DEMATEL method, there are several steps that must be taken (Chiu et al., 2006), include:

a. Stage 1: Create a linkage matrix directly by showing the scale of pairwise comparisons made into four levels. The results of paired comparisons will produce a direct linkage matrix.

b. Stage 2: Normalize the direct linkages matrix, where the main diagonal element is zero.

c. Stage 3: Obtain a total linkage matrix. After obtaining a normalized linkage matrix that is normalized, namely the M matrix, the total linkage matrix, where matrix I is an identity matrix.

d. Stage 4: Calculate the dispatcher group and receiver group. Some criteria with positive D-R values have a greater influence than the other criteria and are assumed to be the top priority (dispatchers). While the criteria with a negative D-R value receive an effect greater than the other criteria and are assumed to be the last priority (receiver). The greater the D + R value of a criterion means to have more relationships with other criteria while the criteria with a smaller D + R value means having a relationship with other smaller criteria. (Seyed hosseini, Safaei and Asgharpour, 2006). While the value of D + R or Prominence shows the importance of these subcriteria (Lin and Wu, 2004).

e. Stage 5: Set the threshold value and get an impact-diagraph map. To get the right impact-diagraph map, in setting the threshold value for the level of influence can be determined by the decision maker or from an expert person by conducting a discussion (Tzeng, Chiang and Li, 2007). The impact-digraph map can be obtained by mapping the values (D + R, D-R), where the horizontal axis is the

value of D + R and the vertical axis is the value of D-R (Wu and Lee, 2007).

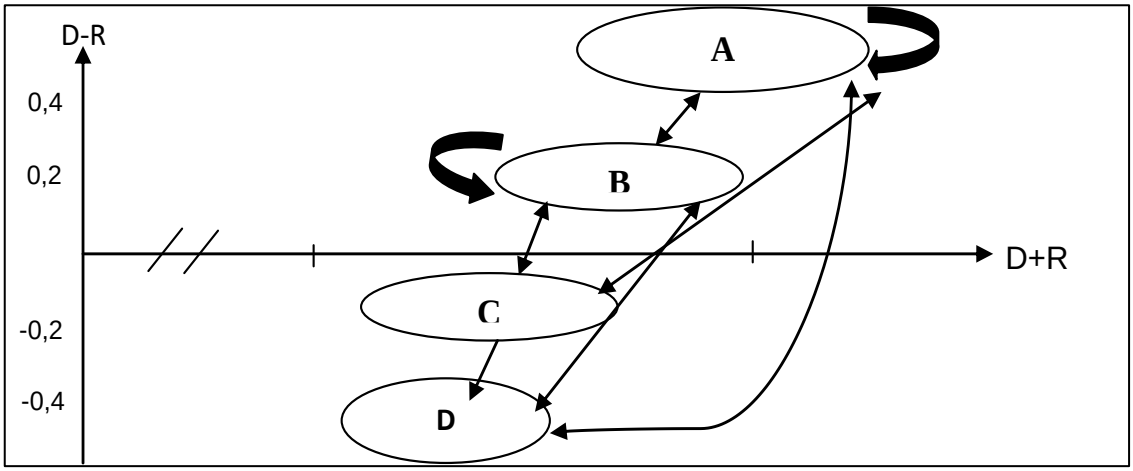


Figure 1. Impact-Diagraph Map

2.4 Analytic Network Process (ANP)

Analytic Network Process or ANP is a method of decision making on technical-social (socio-technical) issues based on a number of criteria (multi-criteria). ANP is a new approach to qualitative methods, which is intended to 'replace' the Analytic Hierarchy Process (AHP) method. ANP's strengths from other methodologies are its ability to help us measure and synthesize a number of factors in a hierarchy or network. There are no other methodologies that have synthesis facilities such as the ANP methodology. Meanwhile, the simplicity of its methodology makes ANP a more general methodology and easier to apply for various qualitative studies, such as decision making, forecasting, evaluation, mapping, strategizing, resource allocation, and so on.

The important thing in building the ANP model is the existence of alternative choices and selection criteria through pairwise comparisons on the scale of importance 1-9, into the model, then the results will be in the form of choice priorities (Saaty, 2005). ANP is a development of the AHP (Analytical Hierarchy Process) methodology that is used to solve the Multi Criteria Decision Making (MCDM) problem that cannot be structured, because it involves the interaction and dependence of the top elements on the bottom element. ANP can model the system with feedback where one level may dominate and be dominated either directly or indirectly by other levels.

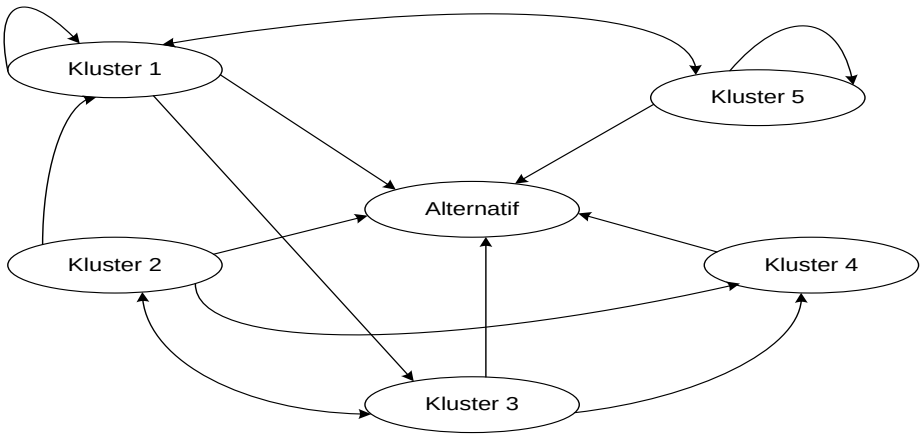


Figure 2. Network Model

In creating a network on ANP there are several types of feedback that are used according to needs, each network has its own advantages and disadvantages. Some types of networks can be seen in Figure 2. ANP itself is intended to determine the relative importance of a set of activities in MCDM using Pairwise Comparison. In general, ANP is applied to the dominance of influence among stake holders or alternatives in relation to attributes or criteria. The scale of pair comparison is used in ANP as in Table 1

Table 1. Pairwise Comparison Scale

Intensity of importance	Definition
1	**Equal importance**
2	Weak
3	**Moderate importance**
4	Moderate plus
5	**Strong importance**
6	Strong plus
7	**Very strong or demonstrated importance**
8	Very, very strong
9	**Extreme importance**

Source: according to saaty (1977; 1980)

The steps that are generally carried out in this ANP are: 1) Defining the problem; 2) Define evaluation criteria; 3) Defining the weight of interest, where the scale of rating is of importance; 4) Defining the weight of dependency; 5) Define priority weights by multiplying the weight of importance and the weight of dependency.

2.4.1 Feedback Network.

Many decision problems cannot be arranged hierarchically because they involve interactions and dependencies of elements at a higher level with elements at a lower level. The level of alternative interest is not only determined based on the level of importance of the cluster but also determined based on the level of alternative interest itself. Feedback is also possible to factor in the future at this time to determine what we must do to get the desired goal

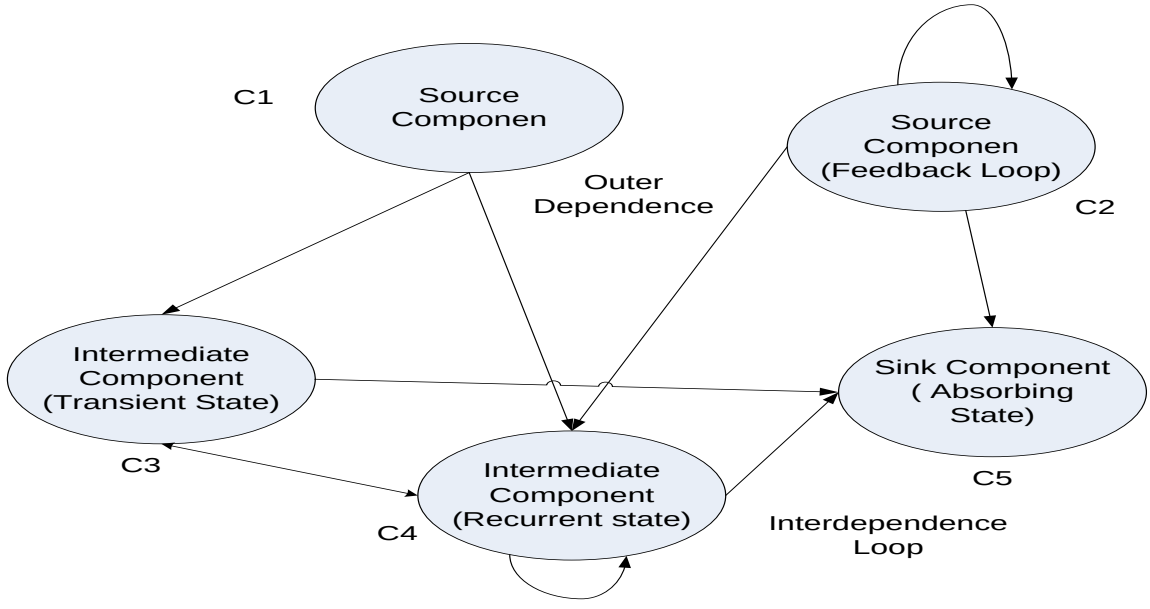


Figure 3. Feedback Network Structure

The influence of a collection of elements given in a component on each element in the system is symbolized by the priority vector. It can be formed a matrix that reflects the flow of influence of a component element both with the element itself and with other elements in the network can be seen in equation 1 according at Saaty (1997).

$$W = \begin{array}{c|c|cccc} & & \mathbf{C_1} & \mathbf{C_1} & \cdots & \mathbf{C_n} \\ & & e_{11}e_{12}\ldots e_{1m_1} & e_{11}e_{22}\ldots e_{2m_2} & & e_{n1}e_{n2}\ldots e_{nm_n} \\ \hline \mathbf{C_1} & e_{11} & & & & \\ & e_{12} & W_{11} & W_{12} & \cdots & W_{1n} \\ & \vdots & & & & \\ & e_{1m_1} & & & & \\ \mathbf{C_2} & e_{21} & & & & \\ & e_{22} & W_{21} & W_{22} & \cdots & W_{2n} \\ & \vdots & & & & \\ & e_{2m_2} & \vdots & \vdots & \vdots & \vdots \\ \vdots & & & & & \\ & e_{n1} & & & & \\ \mathbf{C_n} & e_{n2} & W_{n1} & W_{n2} & \cdots & W_{nn} \\ & \vdots & & & & \\ & e_{nm_n} & & & & \end{array} \quad \ldots.(1)$$

Source: according to saaty (1977; 1980)

Wij input data in a supermatrix is called a block. The block is a matrix with arrangement as in equation 2 (Saaty, 1997).

$$W = \begin{bmatrix} W_{i1}^{(j_1)} & W_{i1}^{(j_2)} & \cdots & W_{i1}^{(j_{n_j})} \\ W_{i2}^{(j_1)} & W_{i2}^{(j_2)} & \cdots & W_{i2}^{(j_{n_j})} \\ \cdots & \cdots & \cdots & \cdots \\ W_{in_i}^{(j_1)} & W_{in_i}^{(j_2)} & \cdots & W_{in_i}^{(j_{n_j})} \end{bmatrix} \ldots (2)$$

Source: according to saaty (1977; 1980)

Equation 2 above shows how much influence one element has with other elements. to produce the priority limit of the supermatrix, then the supermatrix must be converted into a matrix where each column has a uniformity of number, so it is necessary to compare between these components according to the of this process are known as weighted supermatrix which is stochastic.

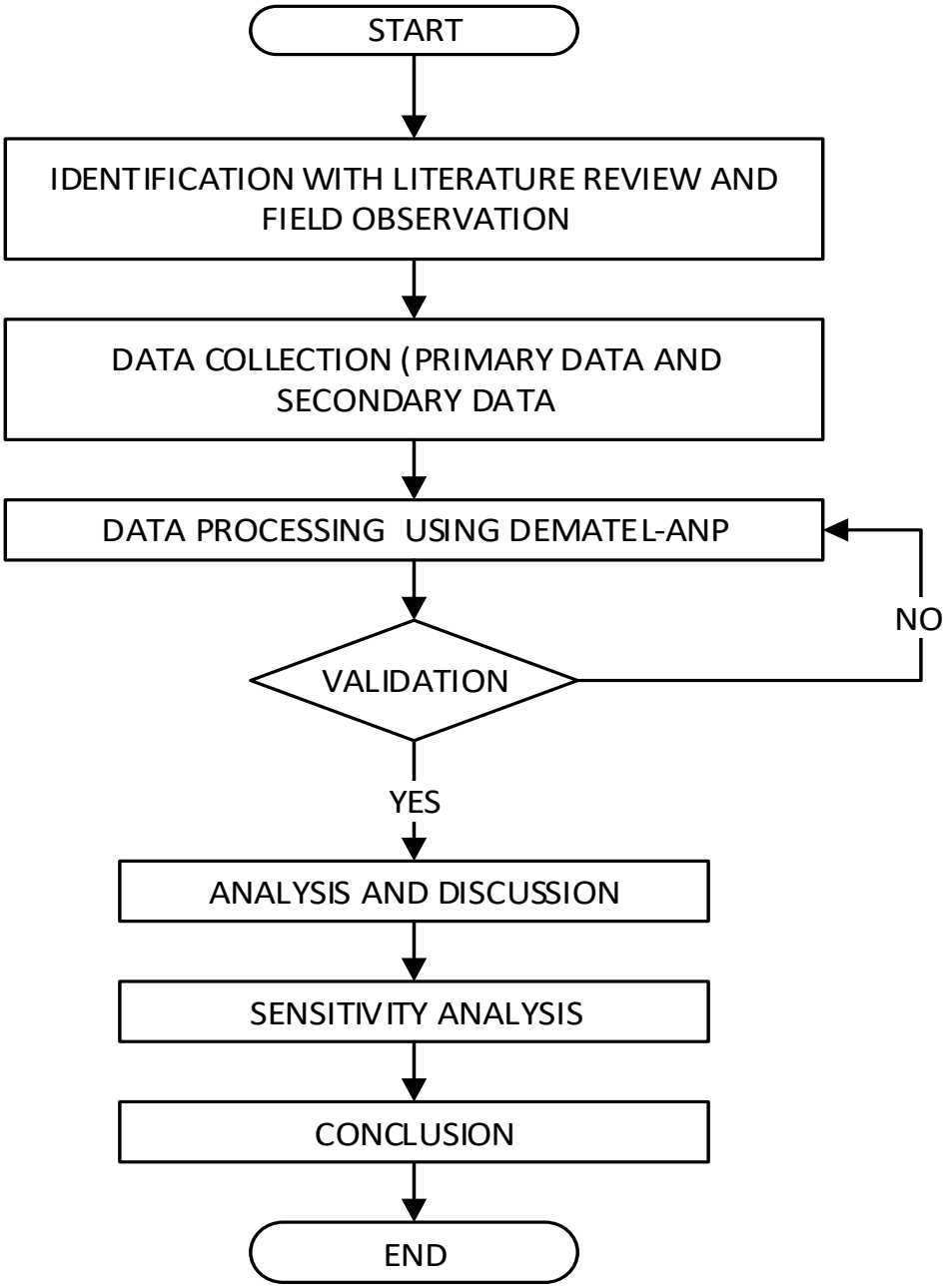
2.4.2 Sensitivity analysis

To anticipate a change in decision caused by a change in weight, sensitivity analysis is carried out. This change occurs if you change the weight of a criterion due to an input that makes the criteria not so important or vice versa. This is useful for knowing how far these changes can affect the results obtained. Sensitivity analysis conducted is changing the weight of criteria and sub criteria by using super decision software.

In this study, the sampling technique was done by Non-Probability Sampling, which is a sampling technique that does not provide an opportunity (opportunity) for each member of the population to be sampled (Doherty, 1994) (Showkat & Parveen, 2017). The Non-Probability Sampling technique used is using Purposive Sampling or

sampling considerations. Definition of purposive sampling is a sampling technique used by researchers if researchers have certain considerations in sampling or determining samples for specific purposes (Doherty, 1994) (Showkat & Parveen, 2017). the research stages as illustrated in the flow diagram.

Figure 4. Flowchart Diagram



3. RESULTS AND DISCUSSION

3.1. DEMATEL Data Processing.

3.1.1. Combining the values of the direct linkages matrix that the experts have filled in using the average value

Table 2. Average data expert

		Knowledge		Effort		Working Condition		Responbilities				
		education	experience	mental effort	physical effort	inconveniences	danger	relation	tool	method	supervision	
Knowledge	education	0,0	2,3	3,7	2,0	1,0	1,0	2,7	2,3	2,7	4,0	21,7
	experience	2,7	0,0	4,0	2,0	1,0	1,3	3,7	2,3	2,0	3,3	22,3
Effort	mental effort	2,3	2,3	0,0	1,7	1,0	1,0	2,0	1,0	2,3	3,0	16,6
	physical effort	1,0	2,0	1,0	0,0	1,0	1,0	1,0	1,0	1,0	1,0	10,0
Working Condition	inconveniences	1,0	1,0	1,0	1,0	0,0	1,3	1,0	1,0	1,0	1,0	9,3
	danger	1,3	1,0	1,7	1,7	2,0	0,0	2,0	2,0	1,0	2,3	15,0
Responbilities	relation	3,0	2,7	2,7	2,0	1,0	1,3	0,0	1,3	2,0	2,0	18,0
	tool	1,0	2,0	1,0	1,0	1,0	2,0	1,0	0,0	2,0	2,0	13,0
	method	2,3	2,0	1,0	1,0	1,0	1,0	1,7	1,7	0,0	2,3	14,0
	supervision	2,7	3,7	2,7	3,0	1,0	2,7	2,7	3,0	3,0	0,0	24,5
		17,3	19,0	18,8	15,4	10,0	12,6	17,8	15,6	17,0	20,9	0,0400
											0,0476	

(Source: data processed with Microsoft Excel).

3.1.2. Normalize the linkage matrix directly by multiplying the values in each column with the total value of the number of values for each row. This result is obtained after doing an average in the data expert which then normalizes the matrix, after going through the stages of multiplying the values in each column with the total value of the number of values for each row, as follows.

Table 3. Normalization on the relationship matrix

		Knowledge		Effort		Working Condition		Responbilities			
		education	experience	mental effort	physical effort	inconveniences	danger	relation	tool	method	supervision
Knowledge	education	0,0000	0,0933	0,1467	0,0800	0,0400	0,0400	0,1067	0,0933	0,1067	0,1600
	experience	0,1067	0,0000	0,1600	0,0800	0,0400	0,0533	0,1467	0,0933	0,0800	0,1333
Effort	mental effort	0,0933	0,0933	0,0000	0,0667	0,0400	0,0400	0,0800	0,0400	0,0933	0,1200
	physical effort	0,0400	0,0800	0,0400	0,0000	0,0400	0,0400	0,0400	0,0400	0,0400	0,0400
Working Condition	inconveniences	0,0400	0,0400	0,0400	0,0400	0,0000	0,0533	0,0400	0,0400	0,0400	0,0400
	danger	0,0533	0,0400	0,0667	0,0667	0,0800	0,0000	0,0800	0,0800	0,0400	0,0933
Responbilities	relation	0,1200	0,1067	0,1067	0,0800	0,0400	0,0533	0,0000	0,0533	0,0800	0,0800
	tool	0,0400	0,0800	0,0400	0,0400	0,0400	0,0800	0,0400	0,0000	0,0800	0,0800
	method	0,0933	0,0800	0,0400	0,0400	0,0400	0,0400	0,0667	0,0667	0,0000	0,0933
	supervision	0,1067	0,1467	0,1067	0,1200	0,0667	0,1067	0,1067	0,1200	0,1200	0,0000

(Source: data processed with Microsoft Excel)

3.1.3. Obtain a total linkage matrix by subtracting each column of identity matrix values from the normalized matrix, which is continued by processing it with minverse and mmult.

Table 4. Minverse results matrix

		Knowledge		Effort		Working Condition		Responbilities			
		education	experience	mental effort	physical effort	inconveniences	danger	relation	tool	method	supervision
Knowledge	education	1,2121	0,3175	0,3558	0,2598	0,1625	0,1907	0,3092	0,2727	0,3056	0,3887
	experience	0,3147	1,2374	0,3746	0,2647	0,1654	0,2050	0,3487	0,2760	0,2877	0,3734
Effort	mental effort	0,2538	0,2683	1,1807	0,2101	0,1368	0,1580	0,2441	0,1887	0,2501	0,3047
	physical effort	0,1365	0,1797	0,1450	1,0861	0,0969	0,1088	0,1390	0,1262	0,1339	0,1544
Working Condition	inconveniences	0,1268	0,1345	0,1333	0,1168	1,0541	0,1150	0,1283	0,1181	0,1251	0,1432
	danger	0,1888	0,1914	0,2096	0,1859	0,1592	1,1027	0,2130	0,1986	0,1755	0,2469
Responbilities	relation	0,2851	0,2884	0,2888	0,2291	0,1419	0,1748	1,1797	0,2074	0,2473	0,2839
	tool	0,1650	0,2104	0,1737	0,1499	0,1153	0,1667	0,1678	1,1147	0,1972	0,2225
	method	0,2269	0,2281	0,1927	0,1635	0,1220	0,1407	0,2062	0,1901	1,1395	0,2525
	supervision	0,3249	0,3783	0,3422	0,3089	0,1987	0,2611	0,3288	0,3126	0,3314	1,2704

(Source: data processed with Microsoft Excel)

The Mmult result matrix value shows the relationship between subcriteria. To find out the relationship between subcriteria, the threshold value must be determined first. The threshold value can be determined in two ways, namely:

a. Take the average value from the Mmult result table value.

b. Can be determined through expert opinion.

In this study, the value of the Threshold Value is determined by the average value of the results of the mmult table, which is 0.2112. The column matrix value which is equal to or greater than the threshold value in the mmult matrix is given a yellow color, while the smaller column value is still white. The yellow value indicates that the subcriteria in the row affects the subcriteria in the column. While for white means the subcriteria in the row does not affect the subcriteria in the column.

Table 5. Mmult results matrix with Threshold Value

		Knowledge		Effort		Working Condition		Responbilities				D
		education	experience	mental effort	physical effort	inconveniences	danger	relation	tool	method	supervision	
Knowledge	education	0,2121	0,3175	0,3558	0,2598	0,1625	0,1907	0,3092	0,2727	0,3056	0,3887	2,7747
	experience	0,3147	0,2374	0,3746	0,2547	0,1654	0,2050	0,3487	0,2760	0,2877	0,3734	2,8476
Effort	mental effort	0,2538	0,2583	0,1807	0,2101	0,1368	0,1580	0,2441	0,1887	0,2501	0,3047	2,1953
	physical effort	0,1365	0,1797	0,1450	0,0861	0,0969	0,1088	0,1390	0,1262	0,1339	0,1544	1,3064
Working Condition	inconveniences	0,1268	0,1345	0,1333	0,1168	0,0541	0,1150	0,1283	0,1181	0,1251	0,1432	1,1953
	danger	0,1888	0,1914	0,2096	0,1859	0,1592	0,1027	0,2130	0,1986	0,1755	0,2469	1,8716
Responbilities	relation	0,2851	0,2884	0,2888	0,2291	0,1419	0,1748	0,1797	0,2074	0,2473	0,2839	2,3263
	tool	0,1650	0,2104	0,1737	0,1499	0,1153	0,1667	0,1678	0,1147	0,1972	0,2225	1,6830
	method	0,2259	0,2281	0,1927	0,1635	0,1220	0,1407	0,2062	0,1901	0,1395	0,2525	1,8622
	supervision	0,3249	0,3783	0,3422	0,3089	0,1987	0,2611	0,3288	0,3126	0,3314	0,2704	3,0574
R		2,2346	2,4340	2,3964	1,9749	1,3527	1,6234	2,2648	2,0051	2,1932	2,6406	

(Source: data processed with Microsoft Excel)

3.1.4. Calculates dispatcher groups and receiver groups.

The value of D is obtained from the number of values per row while the R value is obtained from the number of values for each column of the mmult matrix. From the values of D and R, the D + R (Prominence) and D-R (Relation) values can be determined, the D + R or Prominence values indicate the importance of these sub-criteria (Lin and Wu, 2004). The greater the D + R value, the more important the criteria are. While for the D-R or Relation value it means two kinds. If the D-R value is positive, then the sub-criteria that influence (influence) other sub-criteria (dispatchers) or as a cause of the sub-criteria has a negative D-R value. And if the D-R value is negative, then the subcriteria is the effect (effect) of the subcriteria that is positive or in the term given the name of the receiver.

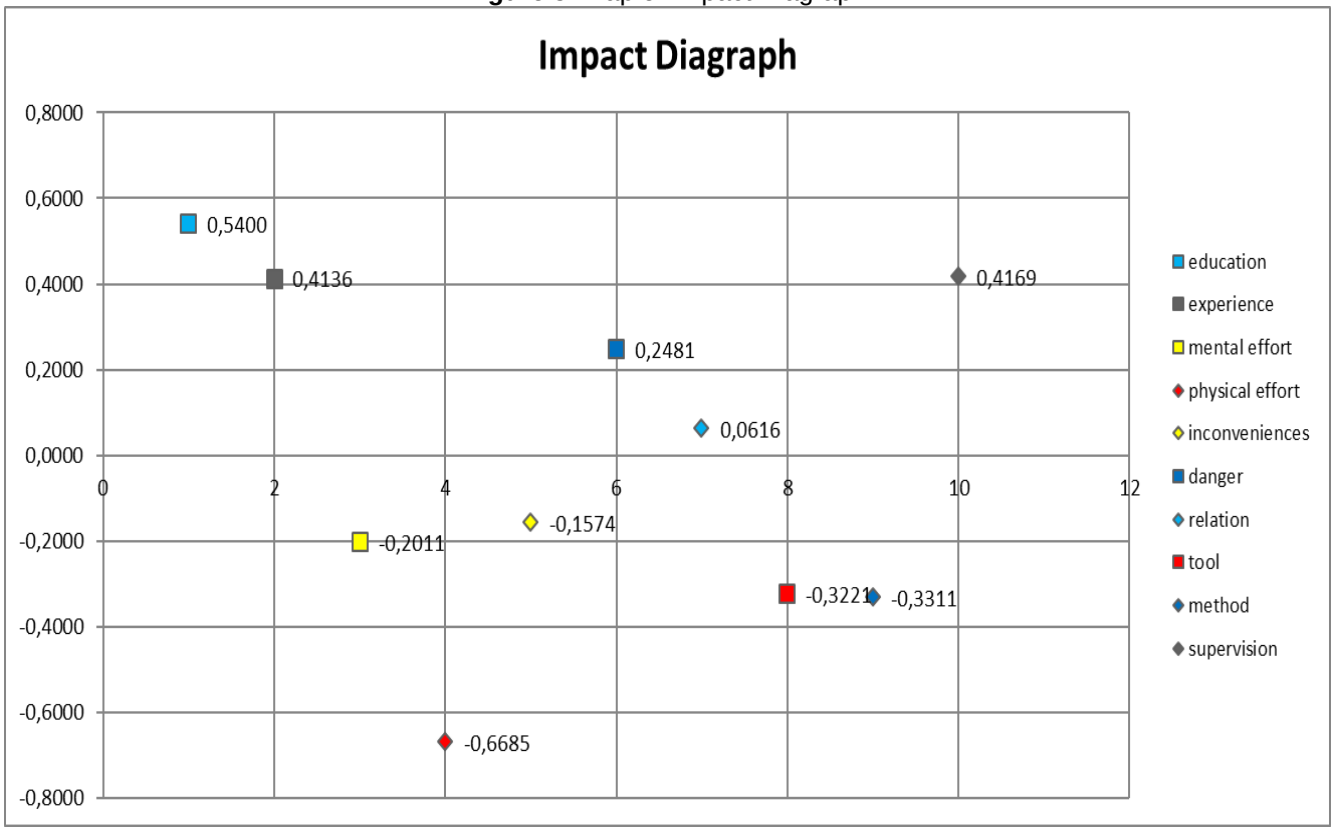
Table 6. Dispatcher and Receiver sub-criteria

		D	R	D+R	D-R	
Knowledge	education	2,7747	2,2346	5,0093	0,5400	dispatcher
	experience	2,8476	2,4340	5,2816	0,4136	dispatcher
Effort	mental effort	2,1953	2,3964	4,5917	-0,2011	receiver
	physical effort	1,3064	1,9749	3,2813	-0,6685	receiver
Working Condition	inconveniences	1,1953	1,3527	2,5480	-0,1574	receiver
	danger	1,8716	1,6234	3,4950	0,2481	dispatcher
Responbilities	relation	2,3263	2,2648	4,5911	0,0616	dispatcher
	tool	1,6830	2,0051	3,6881	-0,3221	receiver
	method	1,8622	2,1932	4,0554	-0,3311	receiver
	supervision	3,0574	2,6406	5,6980	0,4169	dispatcher

(Source: data processed with Microsoft Excel)

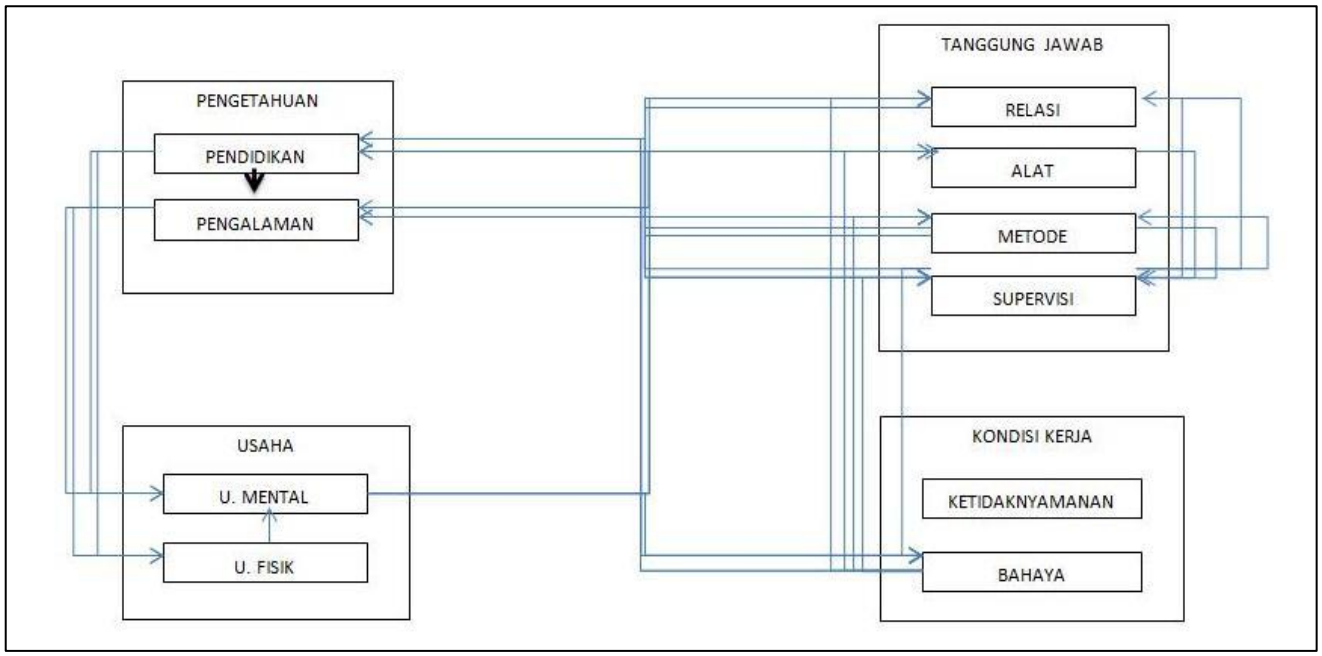
From the relationship between sub-criteria which is indicated by the yellow column, then the method selection model will be built in evaluating and determining the level of position with a case study in the position of Commander. Establish threshold values and get impact-diagraph maps.

Figure 5. Map of Impact Diagraph



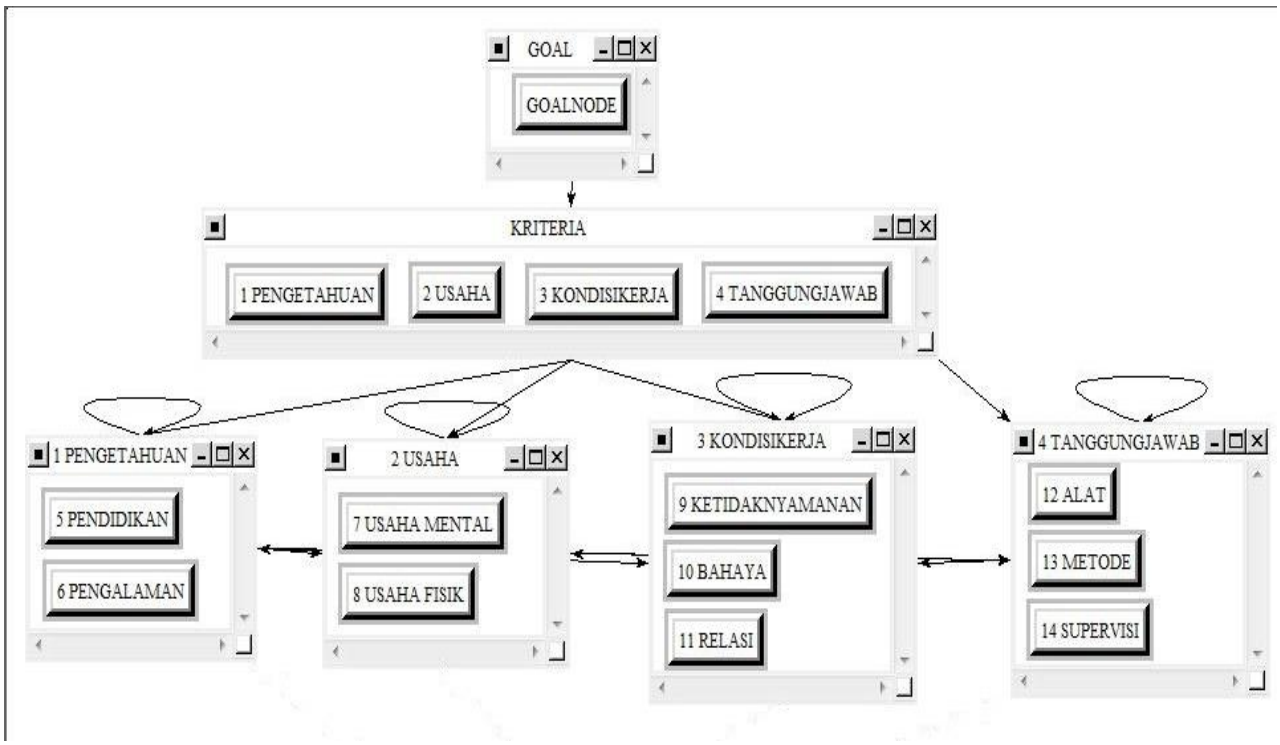
(Source: data processed with Microsoft Excel)

Figure 6. Network ANP with the relationship between Innendependence and Outerdependence



After knowing the Innerdependence and Outerdependence relationship between criteria and subcriteria, then a valid model can be prepared from the method chosen in carrying out job evaluation and determining the level of position.

Figure 7. Criteria and Subcriteria Model in the selection of methods in evaluating and determining the level of position



(Source: data processed with Microsoft Excel)

3.2 ANP Data Processing

The data obtained from the expert questionnaire is comparative data between sub-criteria, which will then be combined with the geometric mean process into a single comparison data, which is then processed using Superdecision software to be the weight value of each subcriteria. Next will be described ANP comparison scale data obtained from three experts based on the criteria and subcriteria used in this study.

3.2.1. Geometric Mean Calculation.

After the results of the questionnaire testing from each expert tested its consistency, the results of the filling are feasible to be put together through the geometric averages of each of these questions.

Table 7. Geometric mean pairwise comparison matrix on Criteria

	KNOWLEDGE	EFFORT	WORKING CONDITIONS	RESPONSIBILITY
KNOWLEDGE	1,00	2,62	2,00	0,44
EFFORT	0,38	1,00	2,29	3,63
WORKING CONDITIONS	0,50	0,44	1,00	2,62
RESPONSIBILITY	2,29	0,28	0,38	1,00

(Source: data processed with Microsoft Excel)

Each value of comparison between criteria and subcriteria in this study must be tested whether the inconsistency index is worth below 0.1 or not. If the inconsistency index value is below 0.1 or 10%, according to Saaty, the criteria and subcriteria are consistent.

After all comparison data between clusters and nodes of the models in the superdecision program have been filled in, then we can find out unweighted supermatrix, supermatrix weighted, matrix limit, and priorities. Single comparison data which is the result of the Geometric Mean process for the three data from the experts which is then carried out rounding so that the value can be used in the Superdecision software.

Table 8. Rounding Geometric mean comparison matrices on criteria.

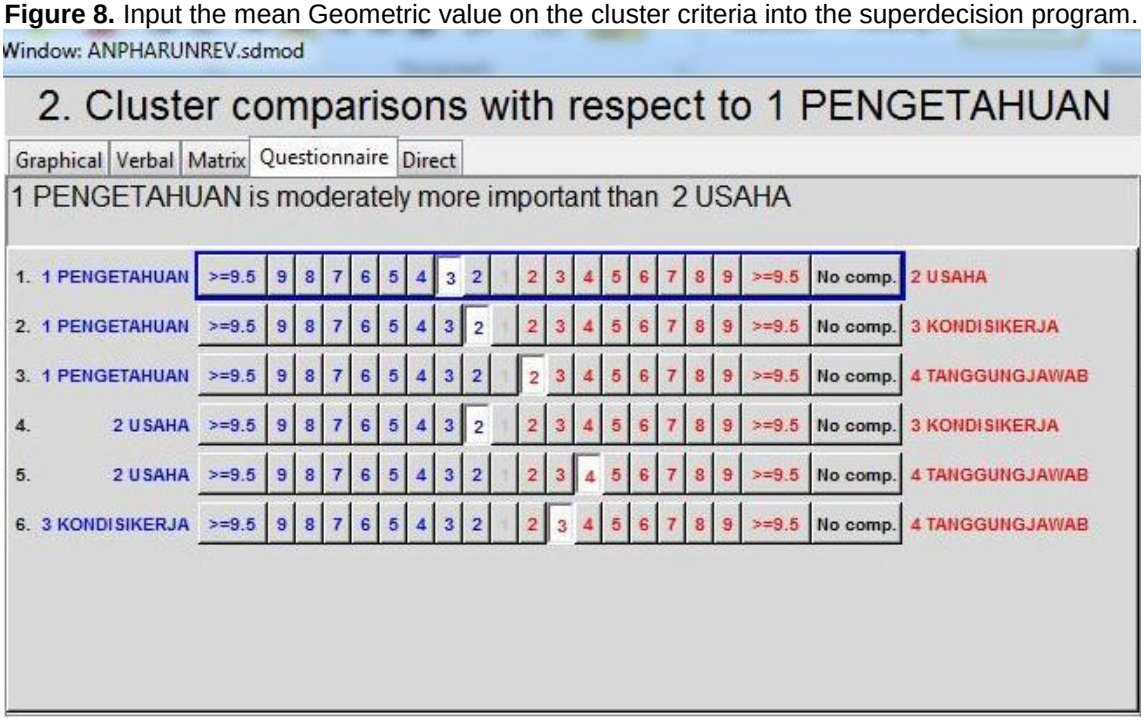
	Knowledge	**Effort**	**Working Conditions**	**Responsibility**
Knowledge	1	3	2	0
Effort	0	1	2	4
Working Conditions	1	0	1	3
Responsibility	2	0	0	1

(Source: data processed with Microsoft Excel)

In table 8 above, number 3 belongs to the criteria of knowledge (lines) with the effort criteria (columns) which become input data in superdecision software.

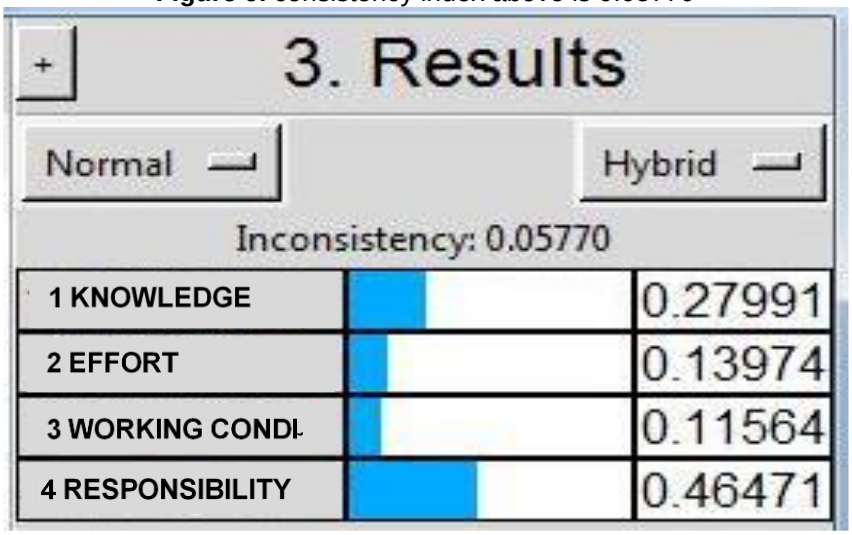
After the Mean Geometric process is carried out, then the next step is processing data values of comparison between criteria and subcriteria using Superdecision software. This process begins by entering the comparison value of the results of the Geometric Mean process.

Figure 8. Input the mean Geometric value on the cluster criteria into the superdecision program.



(Source: data processed with Superdecision)

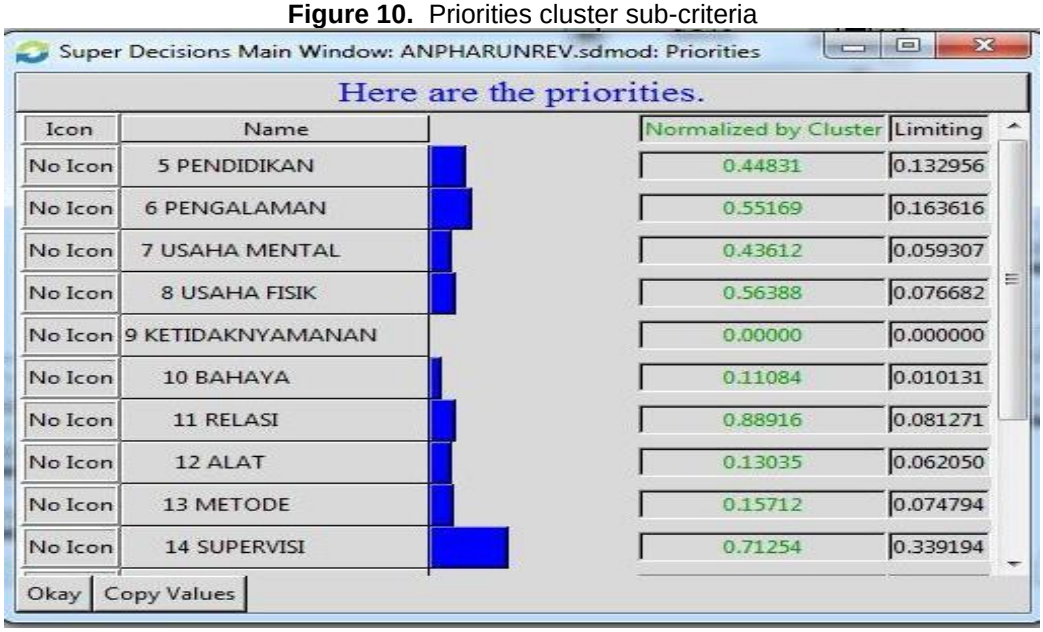
Figure 9. consistency index above is 0.05770



(Source: data processed with Superdecision)

Each value of comparison between criteria and subcriteria in this study must be tested whether the inconsistency index is worth below 0.1 or not. If the inconsistency index value is below 0.1 or 10%, according to Saaty, the criteria and subcriteria are consistent. After all comparison data between clusters and nodes of the models in the superdecision program have been filled in, then we can find out unweighted supermatrix, supermatrix weighted, matrix limit, and priorities.

Figure 10. Priorities cluster sub-criteria



(Source: data processed with Superdecision)

From the results of fig.10. Priorities it is known that the five sub-criteria that have the greatest weight are Supervision (0.339194), Experience (0.163616), Education (0.132956), Relations (0.081271) and Physical Effort (0.076682). After knowing the weight of each subcriteria, the weights of each criterion can also be known. The way to find out the weight of the criteria is to add the weight of the subcriteria to each criterion respectively.

Based on the results of figure 4.5 about the weight of the criteria, the results obtained that the criteria that have the highest weight are the criteria for Responsibility (0.557309). The next rating is Knowledge (0.296572), Effort (0.135989) and Working Conditions (0.010131).

3.2.2. Analysis of Consistency Ratio on Criteria and sub-criteria

From the results of processing the data in the form of questionnaires, it can be obtained Inconsistency Index (inconsistent numbers), where all inconsistency index values are at 0.01354, which is below 10% (0.1) so that according to Saaty (1990) then the system this assessment can be called "consistent".

Table 9. List of Criteria and Subcriteria Inconsistency Index

No	Comparative Matrix	Index Consistency
1	Between criteria	0,01354
2	Ybd node GOAL in the cluster criteria	0,00000
3	Ybd node Education in the Knowledge cluster	0,00000
4	Ybd Mental Business node in the Knowledge cluster	0,00000
5	Ybd node Relations in the knowledge cluster	0,00000
6	Ybd Supervision node in the knowledge cluster	0,00000

(source: data obtained from superdecision)

3.2.3. Subcriteria Priority Analysis

In addition to alternative priorities, the results of data processing using Superdecisions software also contain priority subcategories that can be identified by looking at the weight values of each subcriteria. Subcriteria with the highest weight is Supervision (0.281658), according to the table below:

Table 10. Sub-criteria Priority Sequence

No	Sub-criteria	Weight value
1	Supervision	0.339194
2	Experience	0.163616
3	Education	0.132956
4	Relation	0.081271
5	Physical effort	0.076682

(source: data obtained from superdecision)

3.2.4. Criteria Priority Analysis

Priority criteria can be obtained when the priority of all subcriteria is known. The sum of the weights of each sub-criteria in one criterion will be the weight value of the criteria. The order of priority criteria is based on the amount of weight value of each alternative as follows:

Table 11. Priority Sequence Criteria

No	Criteria	Weight value
1	Responsibility	0,557309
2	Knowledge	0,296572
3	Effort	0,135989
4	Kondisi Kerja	0,010131

(source: data obtained from superdecision)

4. CONCLUSION

In conclusion, this study provides a new systematic approach to job evaluation analysis in organizations through the concept of strategic planning. The combination of DEMATEL and ANP in the effectiveness of the evaluation matrix and in qualitative and quantitative approaches one way integrated through criteria analysis is the most important part of this paper. Along with the development of organizational dynamics in the field of service, new positions will emerge in the organizational structure so that it needs organizational restructuring by adjusting the position level. So it is necessary to compile a model for determining the level of position and description and standardized specifications in helping carry out job evaluation.

Where it relates to a complete position class from the lowest position level to the highest position level so that between performance appraisal, workload and performance allowance can run in harmony and increasingly spur personnel performance. Furthermore, it can be standardized and applied in the Personnel Composition List by including the description, specifications, level, rank, class and number of performance allowances in the office clearly and in detail.

REFERRENCES

Adamus, W., 2009. *A NEW METHOD OF JOB EVALUATION.* Polandia: Analele Stiintifice ale Universitatii "Alexandru Ioan Cuza" din Iasi - Stiinte Economice.

Arif, H., 2007. Human resource development and organizational values. *Journal of European Industrial Training,* 31(6), pp. 435-448.

Chiu, Y., Chen, H. C., Tzeng, G. & Shyu, J. Z., 2006. Marketing Strategy Based on Customer Behavior for the LCD-TV.. *International Journal of Management and Decision Making,* 2(3), pp. 143-165.

Devadoss, A. & Felix, A., 2013. A FUZZY DEMATEL APPROACH TO STUDY CAUSE AND EFFECT. *International Journal of Computing Algorithm,* Volume 02, pp. 363-372.

Doherty, M., 1994. *Probability versus Non-Probability Sampling in Sample Surveys,* The New Zealand: The New Zealand Statistics Review March issue, pp 21-28.

Dussault, G., 1999. *Human Resources Development: The Challenge of Health Sector.* Washington, DC: Latin America and the Caribbean Department, Human Development Division, World Bank.

Lin, C.-J. & Wu, W.-W., 2004. A Fuzzy Extension of the DEMATEL Method for Group Decisionmaking.

Mabes TNI, 2009. *Petunjuk Administrasi Penilaian dan Perhitungan Beban Kerja di Lingkungan TNI.* Jakarta: Markas Besar TNI.

Mabesal, 2016. *REGULATION OF THE HEAD OF THE SEA FORCE STAFF NUMBER 5 OF 2016 : BASIC POLICY OF DEVELOPMENT*

OF THE INDONESIAN NAVY TOWARDS A MINIMUM ESSENTIAL FORCE. 3rd penyunt. Jakarta: Mabesal.

Menteri PAN RB, 2011. *POSITION EVALUATION GUIDELINES.* 1st penyunt. Jakarta: Regulation Of The Minister Of State Regulation Of Use Of State Apparatus And Bureaucratic Reform.

Ministry of defence of the republic of Indonesia, 2015. *Indonesian Defence White Paper.* 3rd penyunt. Jakarta: Ministry of defence of the republic ofIndonesia.

Okoye, P. & Ezejiofor, R. A., 2013. The Effect of Human Resources Development on Organizational Productivity. *International Journal of Academic Research in Business and Social Sciences,* Volume Vol. 3, No. 10.

Pandey, J. & Leelashree, M., 2012. A Strudy on job evaluation-point Factor analysis in SME's. *Asian Journal of Research in Business economics and management,* 2(5), pp. 179-239.

PANDEY, J. & LEELASHREE, M., 2012. A STUDY ON JOB EVALUATION – POINT FACTOR ANALYSIS IN SME'S. *ASIAN JOURNAL OF RESEARCH IN BUSINESS ECONOMICS AND MANAGEMENT,* 2(5), pp. 179-239.

Saaty, T., 1997. That is not the analytic hierarchy process: what the ahp is and what it is not. *Journal of Multi Criteria Decision Analysis,* 6(6), pp. 320-339.

Saaty, T., 2008. Decision making with the analytic hierarchy process. *Internastional J. Services,* 1(1), pp. 83-98.

Saaty, T. L., 2005. *Theory and Applications of the Analytic Network Process: Decision Making with Benefits, Opportunities, Costs, and Risks,.* Pittsburgh: RWS Publications.

Saaty, T. & Vargas, L., 2001. *Models, Methods, Concepts and Applications of the Analytic Hierarchy Process..* Norwell: Kluwer Academic Publishers.

Seyed hosseini, M., Safaei, N. & Asgharpour, M., 2006. *Reprioritization of failures in a system failure mode and effects analysis by decision making trial and evaluation laboratory technique.* s.l.:Reliability Engineering & System Safety.

Showkat, N. & Parveen, H., 2017. Non-Probability and Probability Sampling. Dalam: *Communications Research.* New Delhi: Publisher: e-PG Pathshala, pp. 1-9.

Swanson, R. A. & Holton, E. F., 2001. *FOUNDATIONS of HUMAN RESOURCE DEVELOPMENT.* first penyunt. s.l.:Berrett-Koehler Publishers, Inc..

Tamura, H. & Akazawa, K., 2005. Structural modeling and systems analysis of uneasy factors for realizing safe, secure and reliable society. *Journal of Telecommunications and information technology,* Volume 3, pp. 64-72.

Tzeng, G., Chiang, C. & Li, C., 2007. Evaluating intertwined effects in e-learning programs: a novel hybrid MCDM model based on factor analysis and DEMATEL. *Expert Systems with Applications,* 32(4), pp. 1028-1044.

Vinesh, 2014. Role of Training & Development in an Organizational Development. *International Journal of Management and International Business Studies,* 4(2), pp. 213-220.

Wu, W.-W. & Lee, Y.-T., 2007. Developing global managers' competencies using the fuzzy. *Expert Systems with Applications,* Volume 32, pp. 499-507.

Zolfani, S. H., 2012. Application of MCDM methods in short-term planning for private universities based on balanced scorecard: a case study from Iran. *Int. J. Productivity and Quality Management,* 10(2), pp. 250-266.

FIELD II

LOGISTICS MANAGEMENT

MINSK (MARITIME INFORMATION SEEKER) NAUTICAL DRONE BASED ON F- GO JAVASCHE ALBION ANDROID APPLICATION AND WEBSITE BASED ON FFD/M TO ESTABLISH SUSTAINABLE MARINE RESOURCES IN INDONESIA

Fitria Dwi Ratnasari, M.P. Sejati, A.R. Mahardika, I Kade Mulia Radinata, A.A. Yanarso.

Indonesian Naval Academy. Surabaya, Indonesia.

ABSTRACT

The Trinity in this study is maritime culture and technology wrapped in military honor. Inspired by the local wisdom of coastal communities, the Researchers proposed a simple and effective program called Fishing Free Day and Fishing Free Month (FFD / M) as an effort to promote activity and national culture. In the success of the FFD / M program, the researcher has an implementation strategy by creating a web-based information system specifically for the FFD / M program as well as the F-Go Javasche Albion android application. Affordability, web-based information systems can be accessed anywhere and anytime as long as the devices used by users are connected to the internet. Researchers also made natical drones named MINSK (Maritime Information Seeker) as data sources and within the military it could be used for amphibious landing operations. The hope is that with an information and nautical drone system, it can help fishermen, activists, experts in the field of marine and fisheries to create sustainable marine resources, can improve the condition of marine and fisheries resources that have been damaged by IUU fishing and overfishing through efforts to increase preservation activity. In addition, the existence of this information system can facilitate and succeed the FFD / M program as well as the introduction of AOFIC INDESO satellite-based technology and support the main tasks and functions of the Navy. In order to validate the data in this study, the researchers worked with several institutions including Pushidros, BMKG Maritim, LIPI, Marine Research and Observation (BPOL), INDESO Center, Ministry of Maritime Affairs and Fisheries (KKP) and other institutions.

Keyword: *MINSK, F-GO Javasche Albion Android Application Sustainable Marine Resources Indonesia*

1. INTRODUCTION

Indonesia is a maritime country with an area of 5.8 million km2 with abundant marine and fisheries resources potential. The Ministry of Maritime Affairs and Fisheries (KKP) noted the wealth of marine resources covering fish resources in Indonesia, being the largest mega biodiversity in the world with more than 8,500 species of fish (Rompas, 2011: xv). In addition, Indonesia also has 17,480 islands, consisting of large islands and small islands. Between islands in Indonesia are connected by straits and seas, one of which is the geographical conditions that affect the cultural diversity of Indonesia. The diversity of Indonesian culture is created from the culture of each region (Arifin and Noviani, 2014: 172). Can be interpreted, the culture of each region is local wisdom.

The coastal area is one of the regions that has local wisdom that is sustainable and inherent as the identity of coastal communities. Maluku has local wisdom in the form of Sasi culture and Maren culture, East Nusa Tenggara has Ola Nua culture, West Nusa Tenggara and Bali with its Awig-awig, Bapongka culture from Central Sulawesi, Tiyatiki culture in Papua, Eha culture originates from Miangas and, still lots of other local wisdom. Traditionally guided, coastal communities m/ aintain the sustainability of marine and fishery resources by

having special days not going to sea.Fishing Free Day and Fishing Free Month are taken from the term Fishing day. Fishing is an attempt to catch or collect fish and other types of aquatic resources, on the basis that fish and aquatic resources have economic value. Fishing day is the number of days used in fishing activities (Sudirman and Mallawa, 2004: 15).

2. METHODOLOGY

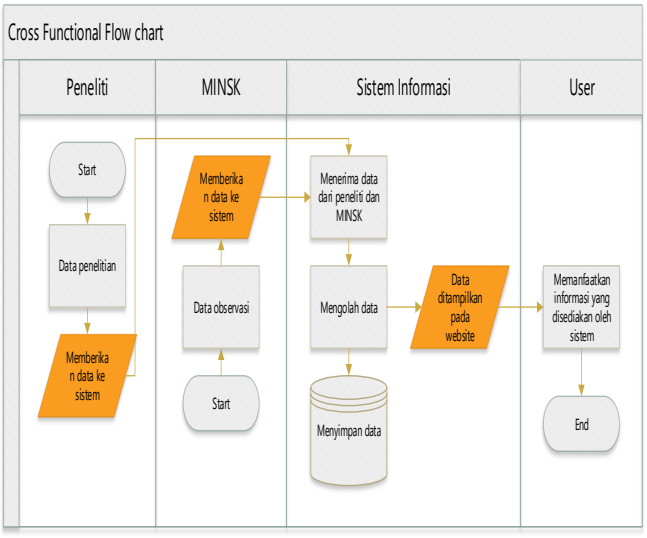
The data in the study were obtained through the ADDIE Research and Development (R & D) method (Analysis, Design, Development, Implementation, and Evaluation). The method aims to produce media through developing and testing the effectiveness of the media (Sugiyono, 2012: 297).

Based the method, this is the scema of our research process. In the picture bellow, it can be seen that the concept of this information system

Is that the system receives input from two data sources, namely from the and from the MINSK device. Researchers provide input in the form of research data, while MINSK provides data obtain from observations.

Figure 1. Proposed procedures

3. RESULT AND DISCUSSION



3.1. Result Of The Fishing Free Day and Fishing

Free Month program means setting the number of days free from fishing activities. Fishing Free Day and Fishing Free Month is shortened to FFD / M. The main objective of FFD / M is to provide special time for fish resources to reproduce, grow and develop optimally, without fishing activities.The results of analysis of fish resources include population dynamics, also reproductive biology and aspects of growth and development each, spawning time, to the peak of spawning samples in each sample. The spawning time is known from the Gonad Maturity Level (TKG) and Gonad Maturity Index (IKG). TKG is the stages of gonadal development before and after spawning. Recording the composition of gonad maturity at one time produces a cycle of gonadal development, however, depending on the pattern and type of spawning of each fish sample.

The percentage of TKG can be used to estimate spawning time. Fish with a short spawning season in one year or when spawning is long, marked by a high percentage of TKG every approaching spawning season. For fish that have a peak of spawning throughout the year, in each sample the composition of TKG will be composed of various levels with an unequal percentage. A high percentage of large TKG is the peak of spawning even though spawning occurs throughout the year. So, from the composition of TKG can be obtained information on the start and end of spawning, also the peak of spawning (Effendi in Prihartini, 2006: 24-25).

FFD / M as preservation activity as well as a manifestation of fish resource conservation activities. Quoting Law Number 45 of 2009, the conservation of fish resources is an effort to protect, preserve and utilize fish resources, including ecosystems, species, and genetics to ensure the existence, availability and sustainability by

maintaining and improving the quality of sources and diversity of resources fish power.

IKG is a comparison between the weight of gonads and body weight (Nikolsky in Asrianti, 2014: 8). The gonad maturity index increases and will reach the maximum limit when spawning will occur. After knowing the fish spawning period along with population dynamics and peak spawning, followed by Temperature analysis of fish resource RPP per WPPNRI.

How to retrieve data through observation, interviews, questionnaires, and roaming libraries. The following are the results of the F-Go Javasche Albion questionnaire using the Mi Likert scale = (13 + 100) / 2 = 56.5 and SDI = (100 - 13) / 6 = 14.5, using Mi + 1.5 SDI <X ≤ Mi + 3 SDv I obtained an interval score of 56.5 + 1.5x14.5 <X ≤ 56.5 + 3x14.5 so that 78.25 <X ≤ 100 was obtained then this result was rounded to 78 <X ≤ 100, and so on.

Tabel 1. Criteria for score benefits and use of the *F-Go Javasche Albion* for fishermen

Interval	Skor (X)	Criteria
Mi + 1,5 SDI < X ≤Mi + 3 SDI	78 <X ≤ 100	Veri high
Mi +0,5 SDI < X ≤Mi + 1,5 SDI	64 <X ≤ 78	high
Mi -0,5 SDI < X ≤Mi + 0,5 SDI	49 <X ≤ 64	Is being
Mi -1,5 SDI < X ≤Mi -0,5 SDI	35 <X ≤ 49	low
Mi-3 SDI ≤X ≤Mi -1,5 SDI	13 ≤ X ≤ 35	Very low

(Azwar, 2013: 163)

F-Go Javasche Albion reviewed benefits and usability can be said to be accepted by fishermen if the measurement results reach an average score of more than 64 or a minimum of high criteria.

How to obtain the F-Go Javasche Albion score interval for activists, experts in the fisheries field are as follows:

Mi = (9 + 100) / 2 = 54.5 and SDI = (100 - 9) / 6 = 15.17, using Mi + 1.5 SDI <X ≤ Mi + 3 SDI obtained an interval score of 54.5 + 1.5x15.17 <X ≤ 54.5 + 3x15.17 so that it is obtained 77.26 <X ≤ 100 then this result is rounded up to 77 <X ≤ 100, and so on.

Tabel 2. Criteria for score benefits and usability of *F-Go Javasche Albion* for activists, experts in the of Marine and Fisheries

Interval	Skor (X)	Criteria
Mi + 1,5 SDI < X ≤Mi + 3 SDI	77 <X ≤ 100	Very high
Mi +0,5 SDI < X ≤Mi + 1,5 SDI	62 <X ≤ 77	High
Mi -0,5 SDI < X ≤Mi + 0,5 SDI	47 <X ≤ 62	Is being
Mi -1,5 SDI < X ≤Mi -0,5 SDI	32 <X ≤ 47	Low
Mi-3 SDI ≤ X ≤Mi -1,5 SDI	9 ≤ X ≤ 32	Very low

(Azwar, 2013: 163)

F-Go Javasche Albion reviewed benefits and uses can be said to be accepted by activists, marine and fisheries experts if the measurement results reach an average score of more than 62 or a minimum of high criteria.

Data type consists of stock unit data and statistical data. Stock unit data is real condition data from marine and fisheries resources from habitat, population dynamics, to reproductive biology of fish resources including aspects of development and growth, spawning time, peak spawning of each WPPNRI, and other data describing fisheries stocks in a WPPNRI. The researcher analyzed the results of these studies later, processing data with statistical data. Statistical data is data from statistical analysis or calculation of numbers, this data can describe about 30% of the actual condition of marine and fisheries resources. The following is for sample stock unit data and statistics for Kurisi fish. The researcher also illustrates how the Sampling Analysis of Fish Resources of each WPPNRI.

3.2. Discussion

One very important factor for measuring the success of an information system project is that the information system must be of high quality. For the purposes of measuring the quality of the system after the system has been built / developed, several key success factors (KSF) or criteria need to be defined. The criteria defined must cover aspects of system security, user convenience, speed of access / reports (including aspects of scalability) and correctness of data / reports. Display design is a rough description of the appearance of information systems that will be built. App view design will help developers to provide an overview of the layout of the information system built. The display design that is made includes the design of the home, dashboard, etc. In order for the developer and user to understand and have the same perception of the provisions and constraints of the system, these matters need to be clearly defined and agreed upon by both parties. The following are the provisions related to software (including tools) that are used in the construction of systems and infrastructure that must be provided by the user so that the information system can be operated (after completion and installation).

4. CONCLUSIONS

Based on the needs analysis and system design that has been carried out, this software requirement specification (SRS) document is produced which provides an overview for developers to build information systems. The information system that will be built provides information on the strategy for implementing the FFD / M program and supports the realization of Sustainable Marine Resources in Indonesia. This information system can be accessed anywhere and anytime by the user as long as it is connected to an internet connection. Users can use this information system only by accessing the site in a web browser.Analysis consists of analysis of FFD / M program and identification of F-Go Javasche Albion products. The results of the 1 FFD / M criteria analysis strongly support the reproduction, growth, and development of fish resources for each WPPNRI, so that sustainable marine resources can be created. Criteria 2 supports the safety of fishermen, especially traditional fishermen. While criterion 3, supports FFD / M to be used as Indonesian national culture as well, as an initial capital for fishermen who already have the habit of not going to sea on certain days. Based on the analysis of the FFD / M Database and the FFD / M Criteria, FFD in Indonesia is precisely carried out every 15th of the Hijri calendar and FFM is carried out according to the schedule of each WPPNRI. The entire FFD / M analysis and various information can be accessed practically through the F-Go Javasche Albion both offline and online.

The Implementation is divided into three stages, namely preparation, implementation, and evaluation. The implementation of FFD / M can create sustainable marine resources as well, can improve the condition of marine and fisheries resources that have been damaged due to IUU fishing and overfishing through efforts to increase preservation activity.

Evaluation, F-Go Javasche Albion is acceptable to fishermen, activists, experts in the field of maritime affairs and fisheries. The existence of the F-Go Javasche Albion can facilitate and succeed the FFD / M program as well as the introduction of technologies such as AOFIC INDESO.

The hope is that the existence of an information system based on FFD / M can create Sustainable Marine Resources in Indonesia. In addition, this information system also presents data obtained from the MINSK (Maritime Information Seeker) hardware that provides additional information to optimize the FFD / M program to save our sea.

REFERENCE

Adilaviana, Tillana. (2012). Study of Priacanthus tayenus swanggi fish stocks (Richardson, 1846) in the Sunda Strait waters landed at PPP Labuan, Banten. Thesis Faculty of fisheries and marine science Bogor agricultural Institute. Bogor: central library of bogor agricultural university. Diakses 1 Juli 2016 dari http://repository.ipb.ac.id/andle/123456789/55636.

Adinawan, M Cholik & Sugijono. 2010. *Bilingual mathematics for junior high school volume 1B*. Jakarta: Penerbit Erlangga.

Adv. 2015. "Monitor the Indonesian oceans with INDESO technology*"*. Akuamina, 16-31 Agustus 2015.

Amir, Faisal *& Mallawa, Achmar. (2015).* Assessment of skipjack fish stocks (katsuwonus pelamis) in the waters of the Makassar Strait.*Jurnal IPTEK PSP, Vol.2 (3) April 2015: 208-217. Diakses 12 Juli 2016 dari* http://journal.unhas.ac.id/index.php/iptekspsp/article/view/74.

Andaman, Retno, et al. (2012). Reproductive aspects of yellowfin tuna (thunnus albacares). Journal of Tropical Marine Science and Technology, Vol. 4, No. 1, p. 89-96, June 2012. Accessed 17 July 2016 from http://www.itk.fpik.ipb.ac.id/ej_itkt41/.../Kuning.pdf.

Anggraeni, Rosa, et al. (2015). Some aspects of skipjack fish biology (katsuwonus pelamis) in relation to fisheries management in sadeng ppp gunungkidulyogyakarta regency. Diponegoro Journal of Maquares Management Of Aquatic Resources Volume 4, Number 3, Year 2015: 230-239. Accessed June 19 from http://ejournal-s1.undip.ac.id/index.php/maquares.

Arifin, Zainal. (2012). Learning Evaluation. Bandung: PT Remaja Rosdakarya.

Asrianti, Rika. (2014). Biological reproduction of curried fish (nemipterus hexodon) caught in Makassar Strait waters. Essay/*Undergraduate Theses from publisher*. 2015-01-16. Diakses 28 Juni 2016 from http://repository.unhas.ac.id:4002/.../aa649fc.

Azwar, S. (2013). Achievement Test: function and development of learning achievement measurement.Yogyakarta: Pustaka Pelajar.

Badan Informasi Geospasial. (2016). Tidal Prediction Book. Accessed June 16, 2016 from http://tides.big.go.id/pasut/pdf/2016.

Badan Meteorologi Klimatologi dan Geofisika. (2016). Moon phases and earth-moon distance in 2016.http://bmkg.go.id/BMG_Pusat/Geofisika/Tanda_Waktu/fasefase_bulan_dan_jarak_bumi-bulan_pada_tahun_2016.bmkg.

Froese, R., D. Pauly & Fish Base Team. (2015). Fishbase world wide web electronic publication. Diakses 6 Juni 2016 dari http://fishbase.org.

Gromico, Andrey. (2015). The Susi Style Moratorium is Assessed to Have a Positive Impact. Accessed May 10, 2016 from http://geotimes.co.id/moratorium-gaya-susi-dinilai-berdampak-positif/.

Hanum, Dinda Zakiyah. (2010). Reproductive biology aspects and estimation of the recruitment of layur fish (trichiurus lepturus) in Palabuhanratu bay, sukabumi, west Java. Thesis of the faculty of fisheries and marine science,*IPB*. Diakses 13 Juli 2016 dari *repository.ipb.ac.id/handle/123456789/62508.*

Harmanto, Gatot. (2013). Geography for SMA / MA Class X (Specialization).Bandung: Penerbit Yrama Widya.

Hariatati, Tuti *&* Fauzi, Moh. (2011). Reproductive aspects of Banyan fish, Rastrelliger Kanagurta (cuv. 1817) in the northern waters of Aceh. Indonesian ikitologi journal,*11(1):47-53*. Diakses 12 Juli 2016 dari http://iktiologi-indonesia.org/?option=com_content&view=article&id=119&Itemid=119.

Huda, Hakim Miftahul. (2015). *Sasi,* Local Wisdom of Management and Utilization of Marine Resources. Accessed June 9, 2016 from http://wwf.or.id/berita_fakta/blog/?43964/Sasi-Kearifan-Lokal-Pengelolaan-dan-Pemanfaatan-Sumber-Daya-Laut.

Husna, Fadilatul. (2012). Reproductive aspects of upeneus moluccensis (Bleeker, 1855) fish from Sunda Strait waters landed in PPP Labuan, Banten. Thesis of the Faculty of Fisheries and Marine Sciences of IPB.Bogor: Central Library of Bogor Agricultural University. Diakses 25 Juni 2016 dari http://repository.ipb.ac.id/handle/123456789/57795.

Jihad, Sam*Syahra. (2014). Reproductive biology of the tenualosa ilisha in labuhanratu regency, sumatra utara province. Vol.1 No.2 (2014). Diakses 28 Juni 2016 dari* http://jom.unri.ac.id/index.php/JOMFAPERIKA/article/view/2101.

Jamal, Muhammad, et al. (2011). Utilization of skipjack biology data (Katsuwonus pelamis) in the context of responsible fisheries management in bone bay waters. Jurnal Natur Indonesia 14 (1), October 2011: 107-11. Accessed July 7, 2016 from https://eafm-indonesia.net%2Fpublic%2Ffiles%2Fpenelitian/.../Teluk-Bone.pdf.

Jatmiko, Irwan, et al. (2015). Reproductive biology of skipjack fish (Katsuwonus pelamis) in the eastern Indian ocean. BAWAL Vol.7 (2) August 2015: *87-94.* Diakses 11 Juli 2016 dari http://ejournal-balitbang.kkp.go.id/index.php/bawal/article/view/285.

Kaschner, K., K. Kesner-Reyes, C. Garilao, J. Rius-Barile, T. Rees & R. Froese. (2015). *AquaMaps: Predicted range maps for aquatic species*. Diakses 17 Juli 2016 dari www.aquamaps.org.

Manohas, Feronica. (2015). Managing Natural Resources Using Local Wisdom of TNTC Coastal Communities. Accessed May 28 2016 from http://www.wwf.or.id/?43982/Managing-Sumber-Daya-Alam-Using-Kearifan-Lokal-Masyarakat-PNsir-TNTC.

Mulyatiningsih, Endang. (2011). Applied Research Methods in Education. Bandung: Alfabeta. Ocean Biogeographic Information System. (2016). Journal publications. Accessed June 5, 2016 from http://iobis.org. Ministry of Communication and Information

Technology Republic of Indonesia. (2015). Indonesia Asia Digital Technology Giant. Accessed 29 July 2016 from https://kominfo.go.id/content/detail/6095/indonesia-r giant-teknologi-digital-asia/0/sorotan_media.

Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia. (2011). Decree of the Minister of Maritime Affairs and Fisheries Number 45 / MEN / 2011 concerning Estimation of Potential Fish Resources in the Fisheries Management Territory of the Republic of Indonesia.

_____. (2012). Regulation of the Minister of Maritime Affairs and Fisheries of the Republic of Indonesia Number 16 / MEN / 2012 concerning the National Commission on Assessment of Fish Resources.

_____. (2012). Regulation of the Minister of Maritime Affairs and Fisheries of the Republic of Indonesia Number Per.29 / MEN / 2012 concerning Guidelines for the Preparation of Fisheries Management Plans in the Field of Fishing.

People's Coalition for Fisheries Justice. (2013). Preserve the sea with local wisdom, not foreign debt / assistance. Accessed May 28, 2016 from http://www.kiara.or.id/petisi.

Landu, Anti. (2013). Growth rate of exploitation and reproduction of tiger grouper (plectropomus leopardus) fish in the waters of the district of Southeast Sulawesi. Thesis of the faculty of marine science and fisheries of IPB. Bogor: central library of Bogor Agricultural University. Accessed July 11, 2016 from http://repository.ipb.ac.id/handle/123456789/63738.

Moleong, Lexy J. (2007). Qualitative research methodology. Bandung: PT Youth Rosdakarya Offset.

National Working Group on Ecosystem Approach to Fisheries Management. (2014). Indicators for fisheries management using an ecosystem approach. Jakarta: Directorate of Fish Resources.Accessed June 1, 2016 from http://www.eafm-indonesia.net/data/sumberdayaikan/572.

Nolalia. (2013). Reproduction of the nemipterus japonicus (bloch 1791) fish from the banten bay landed in Karangantu village, Banten. Thesis of fisheries and marine science, Bogor agricultural institute. Bogor: central library of Bogor Agricultural University. Accessed 2 July 2016 from http://repository.ipb.ac.id/handle/123456789/645941.

Nurhasanah & Tumiyanto, Didik. 2007. Large Indonesian picture dictionary. Jakarta: CV Bina Sarana Reader.

Nurulludin & Prihatiningsih. (2014). Population parameters and the rate of exploitation of turmeric fish (upeneus sulphureus) in the Java Sea. Bawal Vol.6 (3) December 2014: 163-168. Accessed July 11, 2016 from

http://ejournal-balitbang.kkp.go.id/index.php/bawal/article/view/40.

Panggabean, U.S., et al. (2015). Population dynamics of layur fish resources (trichiurus lepturus, Linnaeus, 1758) in Cilacap waters and beyond. Indonesian fisheries research journal. Vol 21, No 3 (2015). Accessed 18 July 2016 from http://ejournal-balitbang.kkp.go.id/index.php/jppi/article/view/239.

Rompas, Rizald M. (2011). Building the ocean builds its former, present and future glory. Jakarta: Directorate General of Information and Public Communication of the Ministry of Communication and Information.

Sari, Hikma. (2013). Estimation of some parameters of the dynamics of the flying fish population (decapterus macrosoma) in the waters of Bone Bay, South Sulawesi. Thesis of the faculty of marine science and fisheries Universutas Hasanudin, Makassar. Accessed July 13, 2016 from journal.unhas.ac.id/index.php/torani/article/download/262/153.

Satrio, Nurhadi. (2016). Study of aspects of growth, reproduction, and eating habits of curried fish (nemipterus japonicus), Bloch 1791) in the waters of the Sunda Strait. Diakes on July 19, 2016 from http://documents.tips/documents/l reports-biologi-perikanan-ikan-kurisi.html.

Sonia, Ursula Florene. (2015). Prohibition of Minister Sususi was violated, fish production fell by half. Accessed May 20, 2016 from https://m.tempo.co/read/news/2015/02/23/090644476/larangan-menteri-susi-dilanggar-production-ikan-turun-separuh.

Sudirman., & Mallawa, Achmar. (2004). Fishing techniques. Jakarta: PT Rineka Cipta.

Sugiyono (2012). Qualitative Quantitative Research Methods and R&D. Bandung: Alfabeta.

Suryana (2010). Research Methodology Practical Quantitative and Qualitative models. Bandung: Indonesian Education University.

Susanto, Ichwan. (2013). Strengthen local wisdom for marine sustainability. http://sains.kompas.com/read/2013/07/11/1532005/Percuat.Kearifan.Lokal.untuk.Kelestari.autaut. Accessed June 9, 2016.

Suwarso, et al. (2015). Biological reproduction and suspected spawning of mackerel (rastrelligerbrachysoma) on the north coast of Java. Bawal vol.7 (1) April 2015: 9-16. Accessed July 13, 2016 from http://ejournal-balitbang.kkp.go.id/index.php/bawal/article/view/199.

The Diagram Group. (2006). Marine Science An Illustrated Guide to Science. New York: Chelsea House. Republika Research Team. (2014). Fishing in Indonesia is Overrated. Accessed June 9, 2016 from http://m.republika.co.id/berita/nasional/umum/14/07/04n875uq-the -ikan-di-indonesia-has-been too much.

Torry Research Station. (2015). The handling of wet fish during distribution. Accessed September 9, 2015 from http://www.fao.org/wairdocs/tan/x5884e/x5884e01.htm.

Triana, Nani. (2011). Growth patterns and reproduction of turmeric fish (upeneus moluccensis Bleeker, 1855) in the waters of Jakarta Bay, North Jakarta. Thesis of the Faculty of Fisheries and Marine Sciences of IPB. Bogor: Central Library of Bogor Agricultural University. Accessed June 16, 2016 from http://repository.ipb.ac.id/handle/123456789/47088.

Tridjoko. (2010). Reproduction performance of grouper duck (cromileptes altivelis) from nature (F-0), first generation (F-1) parent, and second generation (F-2) parent. Journal of IPB tropical marine science and technology, Vol. 2, No. 2, pp. 17-25, December 2010. Bogor: central library of Bogor Agricultural University. Accessed July 11, 2016 from http://repository.ipb.ac.id/handle/123456789/53383.

Triharyuni, Setya, et al. (2013). Productivity and vulnerability of curried fish (nemipterus spp.) Cantrang catches in the Java sea. Indonesian Fisheries Research Journal. Vol 19, No. 4 (2013). Accessed July 1 from http://ejournal-balitbang.kkp.go.id/index.php/jppi/article/view/758.

Utina, Ramli. (2012). Ecological intelligence in the local wisdom of Bajo village, Torosiaje village, Gorontalo province. ISBN; 978-602-18848-0-5 (Pages: 14-20). Accessed May 19, 2016 from http://repository.ung.ac.id/get/karyailmiah/334/kec intelligence-ekologis-dalam-katarifan-lokal-masyarakat-bajo-desa-torosiaje-provinsi-gorontalo.pdf.

Widyastini, Tyas & Dharmawan, Arya Hadi. (2013). The effectiveness of awig-awig in managing the lives of fishing communities on the beach of Kedonganan Bali. ISSN: 2302 - 7517, Vol. 01, No. 01. Accessed May 20, 2016 from http://journal.ipb.ac.id/index.php/sodality/article/view/9389.

Wijayanti, Ristyaningrum. (2016). Growth and reproduction biology aspects of beloso fish (saurida tumbil Bloch, 1975) in Lampung bay waters. Thesis of the Faculty of Agriculture, Lampung University. Accessed 4 July 2016 from http://digilib.unila.ac.id/23063/3/SKRIPSI%20TANPA%20BAB%20PEMBAHASAN.pdf.

Yusri, Safran. (2007). Coral Bleaching and Coral Diseases. Accessed June 9, 2016 from http://www.terangi.or.id/index.php?option=com_content&view=article&id=32.

Wahyudi, Reza. (2015). Google Maps offline is already in Indonesia, this is how to access it. Accessed June 30, 2016 from http://nationalgeographic.co.id/berita/2015/11/google-maps-offline-sudah-ada-di-indonesia-ini-cara-accessnya.

WWF. (2011). Seafood Guide. Accessed June 6, 2016 from www.wwf.or.id/seafoodguide.

Zairion, et al. (2015). Reproductive biology of the blue swimming crab portunus pelagicus (brachyura: portunidae) in east lampung waters, Indonesia: fecundity and reproductive potential. Tropical life research, 26 (1), 67-85, 2015. Accessed July 13, 2016 from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4437326.

THE URGENCY OF MARITIME CONNECTIVITY POLICY IN INDONESIA

[1]Arleiny, [2]Iie Suwondo, [3]Rudi Sugiharto, [4]Sutoyo, [5]Monika Retno Gunarti

[1,2,3,4]Department of Nautics, [5] Department of Engineering
Surabaya Shipping Polytechnic
Gunung Anyar Boulevard St, No.1 Surabaya, East Java, Indonesia, 60294
E-mail: arleiny@poltekpel-sby.ac.id, iiesuwondo@gmail.com, rudysugiharto32@gmail.com
sutoyopoltekpel@gmail.com, monikaretnogunarti33@gmail.com

ABSTRACT

The development of maritime connectivity is carried out in order to increase competitiveness and increase the availability of products needed by the community. The geographical condition of Indonesia, which consists mostly of the sea, causes the need to strengthen maritime facilities and infrastructure to carry out the distribution of goods and means of sea transportation. Until now, it is indicated that there are still many inefficiencies in domestic sea transportation. This paper is a study that seeks to understand the sea highway plan that will be carried out on the government of this period, the obstacles faced, and the policies needed to realize the plan. The problems faced in developing maritime connectivity can be divided into two, namely: internal aspects of the port, and external aspects. In order to achieve the goal of developing maritime connectivity, a number of improvements are needed, including improvements in infrastructure facilities, energy availability, technological and information innovation, quality of human resources, funding, and existing capacity.

Keywords: *Domestic Sea Transportation, Maritime Connectivity, Port, Indonesian Port Infrastructure, Loading And Unloading.*

1. INTRODUCTION

Indonesia has an advantage based on the potential of the region originating from the sea, thanks to the coastline of 80,791 km2 and the area of water reaching 3.25 million km2 or about 63 percent of Indonesia's territory. From the area of the waters that, around 0.30 million km2 is a territorial sea and the area of archipelagic waters reaches 2.95 million km2. Whereas the sea area included in the exclusive economic zone reaches 2.55 million km2.1 The sea is a link between 17,499 islands which are home to 237,641 million3 inhabitants of Indonesia.

The third pillar of infrastructure development and maritime connectivity is a real effort as a liaison to minimize barriers to trade, services, and information, which can be directly felt by the community. The Ministry of Research, Technology and Higher Education shows that until 2014, the number of ports and terminals in Indonesia reached 2,154, consisting of 111 commercial ports, 1,129 non-commercial ports, and more than 914 special terminals. While the number of shipyard industries reaches around 250 companies.

In addition, another thing that is also important is the development of the maritime sector, among others, can contribute: island economic integration, with the movement of traded commodities and barrier-free labor between islands; and the social and political integration of the nation with barrier-free citizen movements between islands for various purposes

The Problem Statements

The role of sea ports as a driver of marine economy is undoubtedly, with the acquisition of economic benefits that can be derived from the existence of sea ports. However, in reality there are still a number of obstacles that arise, including: the

efficiency and productivity of goods through seaports are still very low due to the lack of ready supporting infrastructure, such as shelters, both permanent and temporary; unloading time that has not been effective; and a convoluted bureaucracy. In addition, maritime connectivity has a number of problems in its development.

2. MATERIAL AND METHODS

2.1 The maritime connectivity policy

The maritime connectivity policy is carried out to increase the competitiveness of domestic products and reduce the cost of distributing goods from the producing regions to the user area. Therefore, the theory used for maritime connectivity is reviewed from the aspect of competitiveness.

The sea transportation sector is an economic activity that is very important for the archipelagic state, such as Indonesia. Sea transportation services develop to serve the transfer of cargo of goods and passengers from one island to another as a distribution function as well as driving the economy of the community.

The application of the blue economy concept on sea transportation can be directed at establishing hubs / strategic points as the main port and feeder port, so as to be able to build an integrated sea transportation system by using efficient and effective resources. Transportation sector that is smooth and in accordance with needs the community will influence investment.

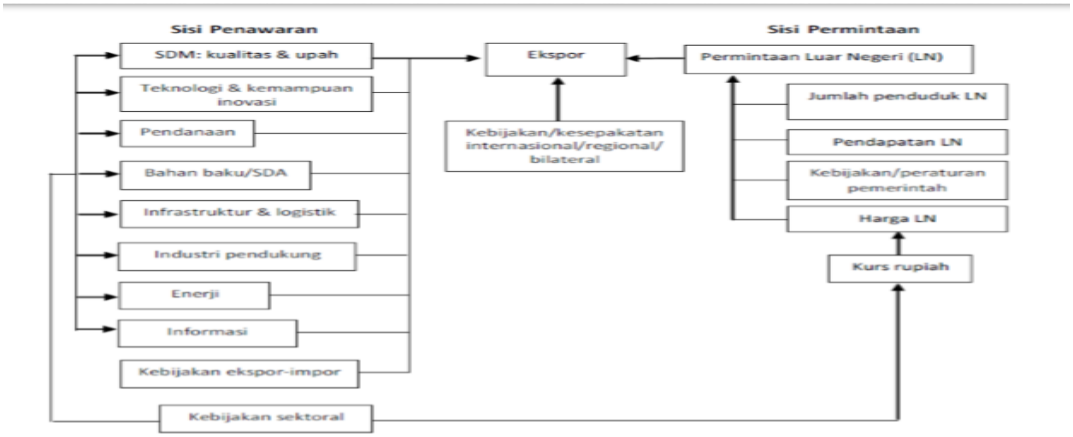
2.2 The Methods of Research

Based on the focus and purpose of the study, the type of research used in this study is a descriptive quantitative analysis approach. The quantitative approach is used with the aim of understanding what happens to research objects in a descriptive and quantitative way in terms of dimensions, clearly measured numbers that need to be recapitulated to be described and concluded. The quantitative approach always begins with the identification of problems that then change and develop into clear, which is then carried out data processing, data analysis to produce conclusions according to the research objectives. The measurable meaning is continuously explored from variable interactions that continue throughout the research period. This study continuously observes, measures and processes data until it finds answers to emerging problems (Hair JF, 2010)

Based on the literature review on The urgency of maritime connectivity policy in Indonesia Resilience system in the maritime field, a conceptual framework has been developed that underlies this research.

From the explanation of the problem, a conceptual model can be formulated in research modeling in Figure 1, as follows:

Figure 1. Conceptual Model of Research



3. RESULT AND DISCUSSION

3.1 Description of Maritime Connectivity Development Plan

Indonesia's geographical conditions, most of which are marine, cause the need to strengthen maritime facilities and infrastructure to carry out shipping activities. Until now, it is indicated that there are still many inefficiencies in domestic sea transportation. With a relatively different distance, shipping goods from Tanjung Priok to Singapore is much cheaper than shipping to Padang and Banjarmasin. Shipping costs to Jayapura are 2.5 times the shipping costs to Guangzhou, China. Comparison of costs per kilometer for shipping distance also shows that shipments to Singapore and China are cheaper than domestic shipping via the sea.

The high cost of logistics in Indonesia is a burden for companies providing logistics services, which certainly have an impact on manufacturing companies. The burden of transportation costs arises since the process of supplying raw materials to the most downstream processes from the supply chain, namely the delivery of finished goods to consumers. Inefficiencies and limited facilities in port activities cause many additional costs to be incurred.

For 2015-2019 is community movements in the form of people's shipping vessels totaling 500 ships. The large amount and budget for public shipping vessels is intended so that the flow of people to the area that has not been connected so far / the frequency of arrival is still limited can be served by people's shipping vessels. As a result, the frequency of the departure of people's shipping vessels has become more frequent, so that the region can develop.

However, this must be anticipated properly, because a number of problems will arise, such as damage environment, modernization of development that can erode the cultural values of society, and the emergence of immigrant communities that can make the local community marginalized. To minimize the impact that will arise, a number of anticipatory steps are needed. Some things that can be done is to make a comprehensive study, which is based on three aspects, namely economic, socio-cultural, and environmental. In addition, development is carried out by observing the zoning plan of coastal areas based on Law Number 1 Year 2014 concerning Amendments to Law Number 27 of 2007 concerning Management of Coastal Areas and Small Islands, by involving and paying attention to the needs of local communities. This is related to the habits of local people who live and have livelihoods in coastal areas. Determination of zoning plans by local governments by taking into account the characteristics of local communities will make the existence of local communities not easily eroded by the modernization of development.

The maritime connectivity policy in the form of sea highway construction has a focus and target. The focus in 2014 was to meet the needs of pioneering shipping, while the target for the fifth year was to realize a sea transportation system capable of reducing logistics costs to 20 percent of gross domestic income, growing a national shipping fleet from 10 to 30 percent, rejuvenating national vessels by pressing ships over 25 years from 70 percent to 50 percent, and reduce port service time at major ports from 6 to 7 days to 3 to 4 days. This target is very likely to be achieved, if a number of important steps are taken, especially in cross-sectoral planning, and involving the local government and the community. Planning depends on the planning process and the extent to which it explains the involvement between stakeholders. So far, planning related to maritime connectivity has not produced results as expected.

The failure of the planning process is caused by a number of specific problems in the form of 26: 1) limitations in planning and implementation. Plans are often competing or even conflicting. The details of the policy to achieve the stated objectives must be clear; 2) inadequate and unreliable data. Economic policy in a development plan depends heavily on the quality and reliability of the underlying statistical data; 3) external and internal economic turmoil that cannot be anticipated beforehand. The open economic system adopted by many countries makes it difficult to arrange fixed and precise predictions in the short term. The energy crisis and financial crisis in other countries will have an impact on the national economy; 4) institutional weaknesses. The problem that often arises is the inability and incompetence of government employees, convoluted bureaucratic procedures, excessive caution and reluctance to innovate and change, interdepartmental competition, or the personal goals of some political leaders and government bureaucrats, as well as a lack of awareness to prioritize national interests in for personal interests; 5) lack of political will. The important action of this statement is that cooperation between the elite must be carried out which may have to be sacrificed for the sake of serving the interests of national development.

The facts above show that the implementation of planned maritime connectivity from the planning was inadequate. Maritime connectivity planning carried out through the development of sea and sea freight tolls in Indonesia is very good and must be supported, as a liaison between islands, including small islands. Therefore, ports that need to be developed in the long term are national ports, regional ports, and local ports which primarily function as a place to transfer passengers and goods. Whereas in the short term, the role of international hub ports and international ports must be completed considering the development has long been carried out. The international port's main hub functions as transshipment of goods between countries, while the international port serves as a place for transshipment of passengers and a national container distribution center and international container transportation services.

3.2. Constraints on the Development of Maritime Connectivity

The development of maritime connectivity through the development of sea tolls, deep seaport, logistics, shipping industry, and maritime tourism is a policy that directly touches the problems of transportation and trade in island nations, such as Indonesia.

Seaports as one component in the construction of sea tolls are undoubted, where the economic benefits that can be taken from seaports, especially international ports, are largely influenced by several factors, such as: 1. Efficiency and productivity. This is not only related to technical efficiency, but also energy, finance, space, labor, administration, and other factors. 2. Environment. Seaports are built in

areas that are very vulnerable to ecological change. The increasing demand for port services, the higher the risk of the pollution caused. 3. Social and Institutional. The social and institutional changes that support the direction of good change undoubtedly affect the economic performance of the port and have a multiplier effect on the overall marine economy. However, if the opposite happens, then the social costs borne are very large.

Factors in growth or demand for port services. The increase in demand for port functions can only be done through a healthy micro and macro economic climate. Economic instruments and the investment climate must be accompanied by political and security stability. The aim of the maritime connectivity policy is to increase the competitiveness that has been questioned by business operators, shorten the time the products shipped from Indonesia to the ordering countries, increase the availability of products needed by the community, but are not produced in the region at affordable prices, and open remote areas through development cruise. To achieve these objectives, it is necessary to first map the problems faced in maritime connectivity.

The problems faced in developing maritime connectivity consist of loading and unloading time, licensing bureaucracy, existing capacity, and human resources. In addition, there are also problems with the availability of infrastructure, energy, technology and information, and funding. In order for the objectives of developing maritime connectivity to be achieved, a number of improvements will be needed consisting of improvements to infrastructure facilities, energy availability, technological and information innovation, quality of human resources, funding, and existing capacity; decrease in loading and unloading time and licensing bureaucracy.

The Coordinating Minister for Maritime Affairs stated that the loading and unloading system in Indonesia reached 6-7 days and will be pursued to be 3-4 days. 30 Long dwelling time makes foreign investors prefer to open their businesses in neighboring countries, such as Vietnam and Malaysia. Therefore, several indicators that affect both aspects must be trimmed. The licensing bureaucracy aspect is influenced by the existence of illegal fees / high fees that cause the high cost of licensing if through official procedures. The loading and unloading time is also affected by the availability of adequate infrastructure, such as roads, bridges, and telecommunications. The lack of quality roads and good bridges to the port has made the development of maritime connectivity disrupted. Based on BPS data in 2011, the ratio of road length per national area reached 25.99 km, with the lowest ratio being Maluku and Papua which reached 7.42 km, Kalimantan reaching 10.04 km, Sumatra reaching 35.31 km, Sulawesi reaching 43.53 km, Bali and Nusa Tenggara reaching 48.01 km, and Java reaching 91.43 km.

Based on data from the Directorate of Export and Import Facilitation, the Directorate General of Foreign Trade, Ministry of Trade, dwelling time in Indonesia is affected by pre -stage clearance (56 percent), clearance stage (8 percent), and post-clearance stage (36 percent). Therefore, the procedure in the pre-clearance and post-clearance stage must be trimmed. The step that can be taken is to ask the Indonesian trade attaché in the importing country to participate in validating the validity of the licensing procedure and cutting the time for processing the Goods Expenditure Approval (SPPB) which is at the post-clearance stage. This SPPB should also be managed in the country of origin to avoid the accumulation of the SPPB issuance process in Indonesian ports.

The development of maritime connectivity includes the development of pioneer ships. So far, pioneer ships have only stopped at city / district ports in eastern Indonesia, such as Ambon, Jayapura, Manokwari, Sorong, and Nabire. Other

islands visited are also islands with fairly large populations, but not with islands with only 100 families. The main root of the constraints to developing maritime connectivity is the government's willingness to connect between regions through maritime affairs. The area in the form of islands with the densest population spread only on a few islands makes the island others become neglected. When the development of connectivity through maritime is done, many important factors are apparently not ready, such as the availability of electricity and roads. This important factor is the government's duty to resolve it and be related to inter-ministerial coordination. The development of sea tolls through 24 designated ports has been running for several years, so that the current policies only continue. However, the development of a pioneer port / feeder port / pioneer port must be well planned, including preparing supporting facilities.

3.3. Policy Support

Non-economic factors determine the success of economic policies. A policy more on the issue of whether there is adequate support at the level of choice and implementation of policy. The development problem starts with a big strategy for choosing policies, including financing strategies and political issues that are very closely related to power and money. Therefore, choosing a development strategy in Indonesia must always be assessed from the flow of power and economic interests. Many other practical issues faced by the private sector have driven the high total logistics costs in Indonesia.

To make Indonesia more competitive, it is necessary to strengthen the enabling environment which can reduce trade logistics costs and increase investment competitiveness. Supporting factors needed to strengthen investment attractiveness through maritime connectivity are influenced by the existence of seaports, shipping services, and intermodal services from sea to land.

The maritime connectivity policy initiated by Indonesia can now be synergized with the idea of 21st century Chinese silk lines. One of these ideas is maritime connectivity from Africa to the Indies, to India, Bangladesh, Myanmar continues to enter the Straits of Malacca or through the south that enters the Lombok Strait, Sunda Strait, continues north into the South China Sea.36 Viewed from the Chinese idea , it looks like China will strengthen its shipping fleet because it also leads to Indonesian territory. If not prepared properly, the maritime connectivity proposed by the government will not obtain optimal benefits.

Therefore, the success of maritime connectivity should be supported by a number of policy support. Policy support must be made to support maritime connectivity in the form of: 1. Policy Planning The Government has explained maritime development in the National Medium-Term Long-Term Development Plan, with one of the goals being done is to build a network of facilities and infrastructure as an adhesive for all islands in Indonesia.

Problems that emerging from the current conditions are: 1) inadequate development of transportation facilities and infrastructure to and from small islands; 2) distribution of goods from large islands to small islands / vice versa is often not balanced, where from small islands to large islands are often empty; and 3) inadequate port facilities and infrastructure, especially in the eastern region. To overcome these problems, a number of improvements are needed in policy planning so that the gap between large islands and small islands can be minimized. In a practical setting, it is very important for Indonesia to overcome gaps in the maritime belt, which are largely a consequence of economies of scale (eg load factors). Most of the maritime belts in the western part of Indonesia have

been commercialized because of the high economic activity in the area, and thus can be easily integrated into regional or even global maritime connectivity. Most maritime belts in eastern Indonesia are still pioneered due to a lack of economic activities in the area, and thus cannot be easily integrated with regional maritime connectivity.

The main problem of the development of the Eastern Region of ASEAN and the eastern region of Indonesia, is the economies of scale. The market is too small to sustain long-term economic activities. The development of power plants is always hampered by very limited domestic demand, because most household users are scattered. Compared to other commodities, electricity has certain characteristics which are produced and consumed at the same time.38 In order for the development of maritime connectivity policies to achieve the expected goals, it is necessary to make periodic / policy stages, which are divided into short-term, mid-term and term policies long. This is needed so that the planning is arranged to be directed and in accordance with the needs and budgeting that is owned.

The periodization / stages of developing maritime connectivity in Indonesia are compiled based on APBN / APBD owned by the government / regional government. So that the development of new maritime infrastructure can be felt in the medium term. In the short term, what can be done is simplifying bureaucracy, such as licensing administration and loading and unloading time, so that it is more directed at structuring the bureaucracy. In the short term, planning has also begun to accelerate the implementation of maritime connectivity policies, such as reviewing the time of port development, improving the quality of human resources, and planning to increase energy availability. Improving the quality of human resources is carried out through a number of trainings, policy socialization, and education.

The territory of Indonesia in the form of islands will make many potential places to become locations for developing maritime connectivity, as a door to exports in the territory of Indonesia. For the western part of Indonesia, development can be focused on Batam and Belawan as export ports, while eastern Indonesia, development can be carried out in Bitung.

The Indonesian Employers' Association in its report published in 2014 stated that the provision of adequate infrastructure capacity including in the form of seaports, air, and roads as well as efficient electricity and telecommunications networks is absolutely necessary to keep pace with economic development, without which economic growth will slow down. With limited government funds, the Public-Private Partnership (PPP) scheme must be addressed with legal and regulatory certainty and appropriate economic incentives to attract private investment in funding priority projects. Accountability of the government and local government is very much needed in ensuring the ongoing infrastructure projects, for example in terms of ease of land access and certainty of business licensing for electricity, railroad, port, and other projects.

The maritime connectivity policy should also be supported by the existence of reliable pioneer services in order to meet the needs of the community. The central government and regional governments must have a high commitment to the certainty of pioneer service routes for a certain period of time and if associated with the concept of sea tolls, the pioneering sea transport homebase must be connected regularly with the port that is visited by the main corridor. So the concept of connectivity and accessibility can be fulfilled by pioneer ships as their expected role in the concept of sea toll.40 Infrastructure development policies are contained in the Master Plan for the Acceleration and Expansion of Indonesian Economic Development (MP3EI), which divides Indonesia's

territory into nine main economic activities. Substantively, the MP3EI concept with maritime connectivity is in line and can complement each other. On that basis, the policies in MP3EI can still be used and can be continued. The MP3EI concept is indeed not thick with the maritime axis concept, but in it there are priority activities based on the potential of the region. In order to support the effectiveness of this potential, it is necessary to develop transportation that is in accordance with the characteristics of the region in Indonesia, namely the archipelago, and as a liaison it takes transportation in the form of ships.

Based on Law Number 23 Year 2014 regarding Regional Government, local governments can also finance infrastructure in the region through the issuance of regional bonds. So that in order to fix infrastructure in the region, the funds used are no longer limited to balancing funds, but also third party funds whose allocations are regulated in the APBD as a component of regional income. Increased Maritime HR Capacity Maritime human resources are an important aspect in realizing Indonesia as an independent, developed and strong island nation.

Some strategies that need to be carried out to improve the ability of qualified and competitive human resources in the maritime field are to form long-term national policies in the field of technology, and to encourage and support sustainable technology education and training programs including budgetary support, adding higher education institutions and schools vocational middle school in the maritime field, and add researchers who focus on the maritime sector. The number of state vocational schools (SMK) associated with maritime affairs is currently 145 and private as many as 170, with the number of students reaching around 40 to 60 thousand students. The vastness of the sea owned by Indonesia, the potential that has not been well explored, and the many communities living around coastal areas makes the number of SMKs related to maritime need to be increased. A maritime school graduate is an educated workforce that can immediately enter the workforce because the subjects are accompanied by practice skills. This differentiates graduates from marine college graduates. The number of districts / cities in the coastal area reaches 324 districts / city or reach 65.2 percent48. The total number of SMKs, both public and private, is sufficient enough, so that the quality of graduates of these vocational schools needs to be improved. The challenges faced to prepare qualified marine vocational graduates are lack of qualified instructors and industry integration. Many instructors are lazy to teach in Vocational Schools because of low salaries and there is no incentive for the industry to accept internships. Indonesia can follow the example of Germany where between marine and industrial Vocational Schools are integrated, instead the industry contributes equipment and is willing to accept paid internships. Form incentives to the industry can be from land, taxes, equipment, and others.

Presidential Instruction No. 5 of 2005 concerning the Empowerment of the National Shipping Industry does not work properly as a result of parties who have received the mandate not yet able to coordinate properly. Maritime sector activities involve many agencies, such as the Ministry of Transportation, Ministry of Trade, Ministry of Finance, and Ministry of Maritime Affairs and Fisheries.50 Each ministry focuses on its tasks, main points and functions, even though these instructions involve the ministry. The success of maritime connectivity requires the support of many agencies / institutions, not only the Ministry of Transportation, the Ministry of Public Works, and the Ministry of Energy and Mineral Resources, but also the regional government, the Ministry of Finance as the state treasurer and the Ministry of BUMN. shipping sector. Therefore, improving regional governance is also important to be the direction of

future development policies. The number of budgets managed by local governments continues to increase, but it does not parallel the improvement in outcome performance. Efficient and effective use of regional budgets must be a policy agenda in the future for all levels of regional government. To realize this, local governments need to be encouraged to be more transparent, accountable, and participatory in managing their regional finances.

Accompanying these efforts, structuring regional government institutions, increasing coordination between levels of government, developing the capacity and professionalism of the apparatus, and improving licensing processes and mechanisms, are a number of important agendas in the future.51 The non-parallel causes of budgetary outcomes with improved performance results are due to parameter measurements which is more focused on the successful absorption of the budget amount, namely budget-based measurement. The existence of the Maritime Coordinating Ministry in this period can facilitate coordination between sectors in realizing maritime connectivity, but can also add to the intricacies between sectors. Therefore, clear division of authority between agencies, quality and quantity. adequate meetings, strong leadership, and recognizing problems are key to overcoming the ego-sector constraints and coordination that has been occurring so far. Infrastructure development also requires coordination between agencies, so many things need to be considered. The considerations are related to efforts to achieve a balance of development between regions and support the centers of economic growth through national connectivity. Another thing that is not less important is that in building infrastructure it is necessary to coordinate Central, Regional, BUMN and Private investment and increase the effectiveness and efficiency of infrastructure funding and the development of creative financing schemes. Therefore, there must be firmness in the criteria and scope of assignments of State-Owned Enterprises (SOEs) in infrastructure development and clarifying the authority between the center and the regions in the construction and maintenance of infrastructure. In addition, there is a need to improve the quality of bankable Public and Private Partnerships (KPS) to ensure certainty for investors through the integration of the PPP process in the planning and budgeting mechanism for each infrastructure sector.

Thus infrastructure investments can be targeted to support the achievement of development targets, increase the efficiency of the use of infrastructure budget to maximize value for money, and form alternative funding mechanisms to close the funding gap (Funding Gap). experts are not needed. The most important thing to overcome the funding problem is socialization to banks regarding the promising maritime economic potential. The government and regional governments must also remove all rules and activities that are counter-productive for investment in maritime affairs, not only for infrastructure investment. If these two things are done, then the public banking will undoubtedly flock to fund investments in the maritime sector. Infrastructure development faces cross-sector constraints. First, the issue of land acquisition. Often infrastructure development is constrained by difficulties in land acquisition for the sake of timely and costly infrastructure development. Second, institutional capacity which includes governance, relations between institutions, and human resource capacities that are often not optimal so that each views the interests of his own sector or institution so that he ignores a far greater public interest. Therefore, priority issues are important to note so that the priority of cross-sector, cross-regional and inter-sectoral infrastructure development (national, provincial, district / city) becomes synchronous.

The aim of infrastructure development is to realize Indonesia's infrastructure conditions which reflect its status as a Middle Income country. This can be done using international comparison (international benchmarking) for identification: 1) key performance indicators (KPI) that are appropriate for each infrastructure sector; 2) Indonesia's competitive position towards competing countries; and 3) the gap between Indonesia and other countries.53 These benchmarks are needed in order to spur infrastructure development in accordance with community needs. Unequal infrastructure conditions between western and eastern Indonesia have caused key performance indicators to be unbalanced, so that adjustments need to be made to the indicator. The benchmark is also related to efforts to catch up with Indonesia compared to other countries in terms of attention to maritime development, so that the development of the shipping industry must be carried out immediately. The Ministry of BUMN through shipping SOEs, such as PT PAL, is a motor for the national shipping industry. The competitiveness of the shipyard industry has been worse when it has to compete. Domestic ship production prices are more expensive than imported vessels. Most of the addition of Indonesian flagged vessels from 6,041 units to 11,600 units occurred in the period 2005 - 2013. Based on data from the Indonesian Ship and Offshore Industry Company Association, about 90 percent of the additional vessels are imported vessels, not ships produced in domestic shipyards. The burden of import duty and component value added tax is thought to weaken the competitiveness of the shipyard industry.

National maritime connectivity realized and plan the next action that needs to be done. One of them is to make 24 main ports as port cities. The port city concept is a form of port area development, with a typical revenue structure of 60 percent port services and 40 percent property services. This concept needs to be adopted for three reasons, namely: 1) port business risk mitigation, 2) increasing local government interest in participating and contributing to public expenditure, and 3) focusing on growth strategies.55 Governments and local governments can share authority in developing ports city and port city must have integration with industries that continue to grow so that the development of maritime connectivity can achieve the expected goals, namely to make maritime as a motor of the national economy.

On this basis, the development of the national shipbuilding industry through a number of incentives, starting from the release of certain taxes to incentives for ship users produced by national industries must continue to do. Policy support, in the form of policy planning, improvement of infrastructure conditions, development of human resource capacity, and coordination between sectors should be able to make.

4. CONCLUSION

The maritime connectivity policy is carried out by the Government in order to increase the efficiency and effectiveness of the distribution of goods, the flow of society between regions, and improve national competitiveness. Constraints faced in developing maritime connectivity policies can be divided into two, namely: port internal aspects and external aspects. Internal aspects consist of loading and unloading time, licensing bureaucracy, existing capacity, and human resources. The external aspect consists of problems in the availability of infrastructure, energy, technology and information, funding, and government will. Policy support must be made so that the maritime connectivity policy runs in accordance with the goals and objectives set are:

a. Policy Planning. Planning for maritime connectivity policies should be prepared based on the objectives to be achieved and divided based on

the set target time for the conditions owned, in terms of the budget and characteristics of existing resources. The time period was prepared by involving all stakeholders, such as the regional government and business actors. Particularly for the eastern part of Indonesia which has lagged behind the western part of Indonesia, the Government should give wider attention. The plan was also compiled with prioritizing the active participation of stakeholders in the region, such as the regional government, business actors, and the community;

b. Improvement of Infrastructure Conditions. Provision of adequate infrastructure capacity, including in the form of sea, air and road ports and efficient electricity and telecommunications networks, is absolutely necessary to keep pace with the rapid economic development, without which maritime connectivity policies will not work. Infrastructure financing can also be done by the local government through the issuance of regional bonds;

c. Increased maritime HR capacity. Skilled human resources who understand the increase in maritime performance, including ports, shipyards, and fishing procedures are very necessary. Reliable human resources will be able to improve technological innovation and control of the maritime sector by national stakeholders;

d. Coordination between agencies. The development of maritime connectivity requires cooperation from all stakeholders, both the Government, BUMN, and business actors. Government agencies must sit together to solve the most difficult problems, namely from the aspect of coordination. Each party must understand their respective duties and authorities.

REFERENCES

Dachlan, Junaidi dan Sultan Suhab (Editor), Makassar: Research Center for Policy and Management, Institute for Research and Community Service, Hasanuddin University, 2014.

Fauzi, Akhmad, Fisheries and Marine Policy: Issues, Synthesis, and Ideas, Jakarta: PT Gramedia Pustaka Utama, 2005.

Gultom, Elfrida, Functionalization of Port Arrangements to Improve National Economy, Jakarta: PT. Raja Grafindo Persada, 2007.

Oktaviani, Rina, Economic Model of General Balance: Theory and its Application in Indonesia, Bogor: IPB Press Publishers, 2011.

Prasetyantoko, A., Economic Ponzi, Jakarta: Kompas Book Publisher, 2010.

Prasetyantoko, A, S. Bahagijo, dan S. Budiyanto, "Prospects and Challenges of Inclusive Development in Indonesia" in Inclusive Development: Prospects and Challenges of Indonesia, Jakarta: Publishers LP3ES, 2012.

Priatna, Dedy S., "National Development Policy Framework for Infrastructure Development in 2015 - 2019", Eastern Indonesia Development in the Context of Indonesian Present, Editor Junaidi Dachlan and Sultan Suhab, Makassar: Research Center for Policy and Management, Institute for Research and Community Service, Hasanuddin University, 2014.

Safitri, Dini dan Budinono. Observing Indonesia's Economic Development, Surabaya: Publishers of the Ubaya Faculty of Business and Economics and Surabaya Economic Lecturer Forum, 2014.

DESIGN OF ELECTRONIC GOODS SALES WEBSITE APPLICATION ON CV. JAYA GEMBIRA

Michael Soegito, Catur Wulandari

Universitas Internasional Semen Indonesia Jalan Veteran Kebomas Gresik

ABSTRACT

CV. Jaya Gembira engaged in the sale of electronic goods have more than 120 regular customers who are outside the area, it requires a sales information system to help customers buy and receive products from the CV. Jaya Gembira. In this study, the Design of Electronic Goods Sales Website at CV. Jaya Gembira addressed in Surabaya, currently CV. Jaya Gembira still uses the sales system manually. Among the related factors of the manual system are a lack of extensive information, a less efficient sales analysis system and several other factors. Along with the development of the business carried out CV. Jaya Gembira, data and information carried out manually as it is now considered no longer efficient. In carrying out its activities, CV. Jaya Gembira still uses simple information delivery media so that the marketing of products and services is still not maximal, because it still uses handwritten notes in ordering records, books for purchasing goods, each customer's transaction data and for media to deliver information to customers through telephone media and through Facebook. The framework used in the design of this website is the Laravel framework, the programming language used as server-side scripting is PHP 5.2.2, HTML. Cascading Style Sheet (CSS) as a representation of content, Macromedia Dreamweaver VIII, MySQL database as data storage.

Keywords : *Laravel, Website, Website Design*

1. INTRODUCTION

CV. Jaya Gembira is a business in the field of electronics that serves the sale of electronic goods and various other forms of goods. In carrying out its activities, CV. Jaya Gembira still uses simple information delivery media so that its marketing products and services are still not maximal, because it still uses handwritten notes in booking records, books for purchasing goods, each customer's transaction data and for media to deliver information to customers through telephone media and Facebook delivery.

Request for customer goods CV. Jaya Gembira this year has been less stable, it can affect the service of goods transactions for quite a long time. Factors that affect the delay in goods transactions are because they still use the old transaction method and the items ordered do not exist. Though the monthly transaction recap of CV. Jaya Gembira enough for more than 500 transactions with a total value of more than 1 billion.

This research will be made an information system for selling web-based electronic goods applications on CV. Jaya Gembira located in Surabaya using the Laravel Framework. Laravel has a prominent advantage in terms of security. This is because Laravel has an open source developer community so that gaps in security will be more easily detected and corrected. Security Laravel is easily available for free. Laravel is also more cost effective because all of the features are complete from maintenance bugs.

Supporting software in making this website are Hypertext Preprocessor (PHP) programming languages, Hypertext Markup Language (HTML), Model View Controller (MVC) architectures and databases using MySQL and local servers using XAMPP.

Table 3. Laravel As A Website Implication Model

No	Research	Result	Research Gap
1	(Fernando *et al.*, 2016)	This study aims to examine the functions of applications that have been made to look for errors / bugs with the Black-Box method.	In this analysis researchers do not design websites.

2. RESEARCH METHODS

2.1 Website.

A website is a page that contains websites that are on the internet that serve as a medium for delivering information, communication, entertainment or transactions (Pacitan, 2014).

2.2 Database

Database is a collection of data (elementary) that is logically related in presenting phenomena or facts structured in a particular domain to support applications on certain systems(Komalasari, 2008).

2.2.1 MySQL

MySQL is a SQL / DBMS database management system that is multithreaded, multi-user, with around 6 million installations worldwide (Nasir *et al.*, 2015). Following Excellence from MySQL include: portability, open source, multi user, performance tuning, column types.

2.3 Information System

Information systems are any regular combination of people (people), hardware (software), software (software), computer networks and data communications, and databases that collect, change and disseminate information in a form of organization (Hilmawan, Nurhayati and Windasari, 2015).

2.4 E-Commerce

E-Commerce is a commercial transaction carried out between the seller and the buyer or with another party in the same agreement relationship for sending a number of goods, services, where this commercial is contained in electronic media (digital media) which does not physically require meeting between parties and the existence of this media in a public network (closed system) (Miranda *et al.*, 2017).

2.5 Data Flow Diagram (DFD)

Data flow diagram is a logic model of data or process that is made to describe: where data comes from, and where the data that comes out of the system, where data is stored, what process produces the data, and the interaction between the data stored, and the process imposed on that data (Afyenni *et al.*, 2014).

2.6 Entity Relationship Diagram (ERD)

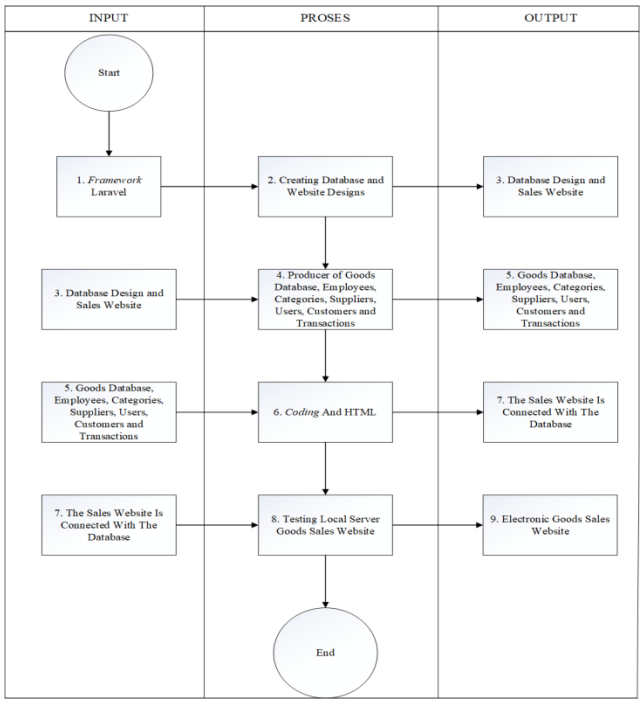
Entity relationship diagram is a design or form of relationship of an activity in the system that is directly related and has a function in the process. Entity relationship diagram is a modeling of a relational database based on perceptions in the real world, and consists of a set of objects which are interconnected with one another (Nasir *et al.*, 2015).

2.7 Laravel

Laravel Framework is an Open Source (OS) web application framework. This framework runs on PHP 5 and is based on Model View Controller (MVC). Laravel was first released on February 22, 2012, and the latest version is version 4.211 which was released on October 4, 2014 (Irfandi, 2015)

3. Results And Discussion

Search for the various theories and models for making websites for the sale of electronic goods is done by literature studies. In making a website sales of electronic goods are carried out with grooves that are in accordance with those required by CV. Jaya Gembira



Picture 1. Diagram Swimlane Website Implementation

3.1 Expected System

The system will be designed later in order to be able to answer all the problems above, including:

a. The sale of electronic goods does not have to be done directly.

b. This system can increase sales and expand marketing of electronic goods products.

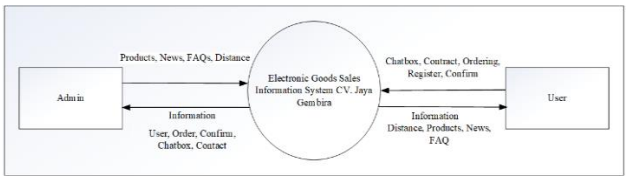
c. To create a system it is necessary to make DFD and ERD. What needs to be analyzed in this case includes sales, purchases whether it is efficient in use for the needs of the store.

3.2 System Architecture

The design of the system architecture consists of users who use internet facilities as mediabrowser, web servers as a media provider of PHP services and interconnected databases.

3.2.1 Data Flow Diagram Level 0

Data Flow Diagrams (DFD) level 0 can be seen from figure 4.1 below. At level 0 DFD describes the processes and data flow on the system as a whole.



Picture 2. Data Flow Diagram Level 0

Data Flow Diagram (DFD) level 0 shows all existing data flows towards one process, namely Electronic Goods Sales Information System CV. Jaya Gembira.

3.3 Database Design

This stage is transformed from manual data into a database that is divided into several tables, in which there are sections called fields or columns. Database table on information systems for selling electronic goods.

3.3.1 Entity Relationship Diagram

Entity relationship diagram in the form of set of entities and set of relations. Components will be transformed into tables. Attributes in Entity Relationship diagrams are expressed as fields from tables.

Picture 3. Entity Relationship Diagram Of Electronic Goods Sales

3.4 Design Of Table Structure

The following is the table structure that is generated

a. Item Table

Item table is used to store product data which has fields namely id_barang as primary key, id_category as foreign key, item, price, stock, weight, description

and image.

b. Payment Table

Payment table is used to store payment data consisting of fields namely id_payment as primary key, id_please as foreign key, tgl_bayar, no_bukti, jum_bayar, verification and id_user.

c. Users Table

Users tables are used to store users data that has Id fields as primary key, name, email, email_verified, password, remember_token, updated_at, created_at.

d. Order Details Table

Order detail table is used to store detailed order data which consists of several fields, including id_det as primary key, id_ message, id_user, item, price_ unit, total_barang and total_juml_bayar.

e. Category Table

Category table is used to store item category data which consists of the id_category field as the primary key and the category for storing item categories.

f. Delivery Table

Delivery table is used to store data - data items to be sent consist of id_kirim fields as primary keys, id_paid, id_user, send date, status_ send, nama_kurir and invoice.

g. Order Table

Order table is used to store data - user data order consists of id_post as primary key, tgl_bayar, jmlh_bayar, id_user, number_hp, name, province, city, sub-district, address, proof, item.

3.5 List Of Files Used

In system implementation files are used which are divided into member user files and admin files. The files used in the implementation of the system from the description of each file, namely :

Table 2. Register Member User Files

No	File Name	Description
1	Index.PHP	User main page and homepage file
2	Login. PHP	Login for user script file
3	Register. PHP	Registration file for user
4	Product.PHP	File to see items being sold
5	Cart.PHP	File to add items to the basket
6	Checkout.PHP	File to see what items will be purchased
7	Pay .PHP	File for payment
8	Send. PHP	File to view shipping items
9	About Us.PHP	File to display CV. Jaya Gembira

Table 3. List of Admin Files

No	File Name	Decription
1	Index.PHP	Intro page file for admin
2	Login. PHP	File for admin page login
3	Logout.PHP	File to logout the admin page
4	Add Item. PHP	File to see the purchase or delivery of goods
5	Edit Item. PHP	File for editing items
6	Payment Process. PHP	File to see the payment process entered
7	Delivery Process. PHP	File to see the sending process when the user has made a payment
8	Edit Delivery. PHP	File to edit the send status if the ordered item has been sent and has been received by the user
9	Check Shipping Items. PHP	File to display what items are ordered by the user

3.6 Implementation Of User Interface

Implementation of a normal user interface is intended for users in this section where users cannot place an order, but can see a collection of electronic items.

3.6.1 Index Page

Index page containing the login form and visitor page is intended for users who are not logged in, a normal user can browse electronic items but cannot order before registering as a user.

3.6.2 Login Page

Login page contains a login and register page for visitors. Visitors who have not yet become users can fill in the list on the form page.

3.6.3 Product Page

Product page contains electronic items sold on CV. Jaya Gembira on the product page has 27 categories of goods, and there are 3 criteria namely kitchen equipment, household electronics and audio & video.

3.6.4 Add To Cart Page

Add to cart page contains items that will be purchased before the items purchased enter the checkout process.

3.6.5 Checkout Page

Checkout page contains items to be purchased by the user, the checkout process is to contain the name of the item to be purchased, the number of purchases and total purchases then proceed to the payment process.

3.6.6 Pay Page

Pay page contains the form that is filled in to determine the address of the item to be sent along with the calculated price of the item automatically and upload a photo of proof of payment.

3.6.7 Send Page

Send page contains the form filled in by the admin on this form containing payment no, Delivery date, send status, courier name and receipt of goods if the item has been received by the customer.

3.6.8 About Us Page

About us page is a page that shows about biodata about us CV. Jaya Gembira.

3.6.9 Admin Index Page

Admin index page when logging in as admin. Admin assignments add new products, edit products, delete products, verify payments and send shipping receipts.

3.6.10 Admin Add Item Page

Added item page contains the form filled in by the admin on this form to add existing items.

3.6.11 Admin Goods Page

Admin item page contains items displayed by the admin, on this page the admin can edit or delete items.

3.6.12 Admin Item Edit Page

Item edit page is used by admin to edit items. The item edit page can only be accessed by the admin, the user cannot access the item edit page.

3.6.13 Admin Payment Process Page

Page that functions as a payment process when a user orders an item. The payment page can only be accessed by the admin, the user cannot access the payment page.

3.6.14 Admin Delivery Process Page

Page that functions as the sending process to the user. . The shipping process page can only be accessed by the admin, the user cannot access the shipping process page.

3.6.15 Admin Edit Shipping Page

Edit shipping page display is used to add proof of delivery photos if the items sent have been received by the user. The shipping edit page can only be accessed by the admin, the user cannot access the edit shipping page. Users can only find out whether the item has been sent and the item has been received.

3.6.16 Admin Invoice Page

Invoice page display is used to display what items are purchased by the user. The invoice page can only be accessed by the admin, the user cannot access the invoice page.

4. CONCLUSIONS

From the process of analysis, design and implementation carried out in the previous chapters, then conclusions can be drawn, along with

suggestions that can be useful for improvement in subsequent research, as follows: An information system for selling web-based electronic goods has been produced on CV. Jaya Gembira. The system built can display online about services and products CV. Jaya Gembira. Using the Laravel website framework is easier to design because Laravel's framework has clear expressive syntax and saves time because Laravel framework doesn't need to input all PHP files.

For further system development, the following suggestions can be given:

The object of the research carried out can be broader, namely not only referring to product sales information, but also to the entire network of social organizations that exist. The complexity and features of the website can be further expanded. In terms of website appearance, it is expected to be able to be refined to make it more attractive. It is expected that further development of information systems designed, so that it becomes an integrated information system to cope with and process larger data in the future.

REFERENCES

Afyenni, R. et al. (2014) *'Flow Diagram Data Design For School Information System (Case Study In Unp Laboratory Development High School)* ', 2 (1).

Fernando, S. et al. (2016) *'Design And Development Of Company Quality Management Information System Using Laravel And Materialize Framework* (Case Study: Document Control Section of PT. Pura Barutama Division Boxindo, Kudus), pp. 46–61.

Hilmawan, H., Nurhayati, O. D. and Windasari, I. P. (2015) '*Information Technology Governance Analysis Using The Cobit 5 Framework At Amik Jtc Semarang* ', Journal of Technology and Computer Systems, 3 (2), p. 247. doi: 10.14710 / jtsiskom.3.2.2015.247-252.

Irfandi, M. (2015) *Met Measurement Of Software Metric On Implementation Of Framework Laravel Framework Application (Application) Web-Based Application: Journal Logic Software Metric Measurement On Laravel Framework Impelementation Application, Application* 3. 7731–7738.

Komalasari, R. (2008) '*Civil Service In Sanggar Office Learning (Skb) Sungailiat Using Visual Basic Programming Language 2008*'. Miranda, O. S. et al. (2017) 'JOM FISIP Vol. 4 No.1 - February 2017 Page 1 ', 4 (1), pp. 1–15.

Komalasari, R. (2008) 'CIVIL SERVICE IN SANGGAR OFFICE LEARNING (SKB) SUNGAILIAT USING VISUAL BASIC PROGRAMMING LANGUAGE 2008'.

Miranda, O. S. et al. (2017) 'JOM FISIP Vol. 4 No.1 - February 2017 Page 1 ', 4 (1), pp. 1–15.

Nasir, J. A. et al. (2015) 'Drug Management Information System in the Pharmacy Installation of Pekalongan District Health Office'.

Pacitan, K. (2014) 'Microsoft Word - 64 Designing an Online Book Catalog at the Um ... 'Library, pp. 1–6.

Rifqi, M., & Hazmi, A. (2018). Design and Build a Website Finding Artisan Using the Laravel Framework, 71–80. Rini, A., Kom, S., Kom, M., &

Valentina, E. S. (2018). Website Implementation as a Media Promotion on CV Gilang Perkasa Using the Laravel Framework, (2017), 8-9.

MAKING DASHBOARD BASED ON DATA MART USING POWER BI (CASE STUDY : UISI ADMISSION PART)

Andi Prayugo Sumarlin, Yogantara Setya Sharmawan, Catur Wulandari

Universitas Internasional Semen Indonesia
Jln Veteran Gresik Jawa timur 61122

ABSTRACT

UISI Admission is a division that handles the process of student admission and management from existing student data. Student data is an important data for the university because with that data ordinary universities know the distribution of the number of students who are taking a Bachelor degree, with data also the marketing team can determine the strategy to increase the number of students from the previous year. In making a strategy to increase the number of students needed an analysis of previous student data or the number of students available. One approach that can be done is making data mart for the results can then be visualized into the form of a dashboard. There have been previous studies related to making dashboards and data marts that can prove that making a data mart can facilitate the design of a dashboard according to needs. The process is to collect data from the UISI admission process and then process the staging data using SQLYog with the aim of processing the relevant data from the data source. After data collection is carried out, a data mart process is carried out to ensure that the results will be visualized into the dashboard by using the application from Power BI to support decision making.

Keywords : *Admission, Dashboard, Data Mart, Power BI, SQLYog*

1. INTRODUCTION

University of International Semen Indonesia (UISI) is an educational institution that has a bachelor's degree (Strata 1) that is committed to providing quality education. UISI specializes in education in the field of innovation and Occupational Health and Safety (OHS). Semen Indonesia International University (UISI) is an educational institution that has a bachelor's degree (Strata 1) that is committed to providing quality education. UISI specializes in education in the field of innovation and Occupational Health and Safety (OHS).

UISI provides support in business practices that accommodate a number of scientific aspects of the agreement of good governance corporate, development of innovation in information technology, innovation technology in cement, distribution and logistics technology, Student Activity Unit (UKM) for community development and service as well as used agriculture mining (UISI, 2016). Competition in the world of education today has revealed a variety of ways to make attraction and offer various types of services or products in education, so that educational institutions that are unable to compete competitively will have an impact on decreasing stakeholder interest in these institutions and even a combination of institutions education (Muhammad, 2017). A positive image is a strong capital in influencing expectations of stakeholders, so the marketing process carried out by educational institutions can help in deciding products - products that produce satisfaction for relevant stakeholders (Ahmad, 2016).

Marketing management is needed by an educational institution to conduct a good and correct marketing process in order to achieve an increase in the acceptance of new students, and to obtain a favorable level with target buyers or stakeholders to be able to achieve the goals of an organization or company (Ahmad, 2016). In the marketing process at UISI, the marketing team uses 2 ways, namely by promoting using electronic media and by directly

promoting through campus expos or roadshows in major cities throughout Indonesia. But in the data analysis process related to the number of students and the origin of students, the marketing and admissions parties in UISI still do not have data on student distribution in UISI in an integrated manner, the admission party has UISI student data that is recapitulated per year and made into different files making it difficult if you want to do a comparison of the number of students per year in UISI.

In addition, the admissions party still has no special dashboard that displays the number of student distribution in this UISI, so to see the amount of data distribution they have to process it manually with the help of the Microsoft Excel application. Based on this background, the problem statement was made in this study, namely: first, how is the data mart analysis process from the data sources owned by the UISI admission to map students based on the demographic distribution in Indonesia? Second, how to make a UISI admission dashboard using the Power application BI?.

Based on the formulation of existing problems, the objectives of this study are as follows: first, conduct an analysis of student data held by UISI admissions based on demographic distribution in Indonesia by using the data mart method to process data to assist in decision making and increase the number of new student registrants in UISI. Second, creating a dashboard at the UISI admission uses analytic tools, namely Power BI, as a visualization of the built-in data mart. The previous research that can be used as a basis in making this research.

Table 1 Previous research related to data mart and dashboard

No	Title	Method	Result	Research Gap
1	Design and Implementation of Data Warehouse Case Study of Mapping of Disaster Prone Areas in West Sumatra Province (Kurniawan, 2011)	In this study will use the data mart method for data design and OLAP to design the integration structure of the data used, which later the results will be visualized into the form of a dashboard	From the results of this study found several things namely ETL process on each data source according to the design of the data warehouse, the results in making OLAP show that all cubes and dimensions have been formed and are able to provide data marts in disaster mapping that are appropriate to the needs, and which Finally, the data warehouse built has been able to integrate the entire database from various data sources using different platforms.	The absence of the ETL process is conveyed, the ETL process is only displayed in a data warehouse architecture design process. Because the ETL process is the main process in making a data warehouse.
2	Making Data Mart for Executive Dashboards Based on Power BI (Case Study: Personnel Data from the Ten November Institute of Technology)(Rusdi, 2017)	In this study using the data mart method that was built to meet the objectives and benefits of personnel monitoring and the results of the visualization will be displayed in the form of a dashboard using the help of Power BI tools	The results of this study are that the data mart that has been built has functional in managing the data needed in the Personnel Management Information System, the data contains information that can be analyzed so that the results can be used by universities in understanding the conditions of staffing through Power BI in a dashboard visualization.	The gap in this research is the lack of stages for data normalization, where before entering the data staging, the process of normalization and making of the ER-diagram must first be made.

2. MATERIALS AND METHODOLOGY

2.1. Data Warehouse

Data warehouse is a relational database that is designed for the process of analyzing data in the transaction process by using query assistance in a database containing historical data that includes several existing data sources(Oracle, 2002). The database in a data warehouse contains more detailed data and a summary of data that is optimized to support finding different access patterns in each analysis, query tools namely the interface in the end user to ask questions in the analysis in the database where this process is also referred to as On-Line Analytical Processing (OLAP) (Asroni, 2014).

2.2. Data Staging

Data Staging is a process of extracting data, eliminating inconsistencies in data, and integrating various data sources into one common scheme. In carrying out the process, it is assisted by a process that is extraction, transfromation, and loading (ETL) and a cleansing process that helps in the process of combining several data sources, extracting, transforming, cleaning, filtering, and inserting data sources into the data warehouse (Golfarelli and Rizzi, 2009)

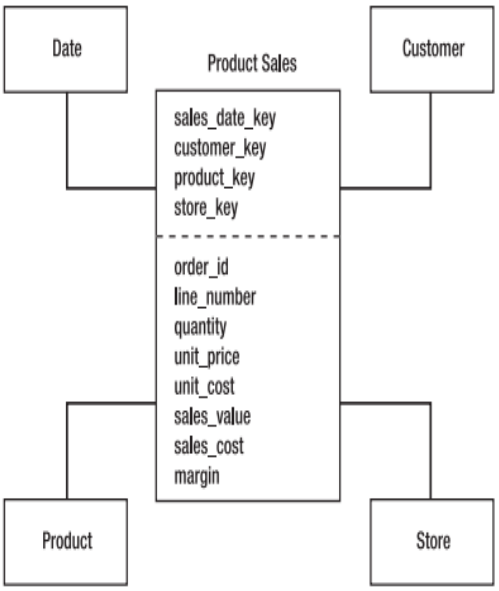
2.3. Data Mart

Data mart is a subset of the data warehouse and is a container for analyzing data at BI, the data in the data mart is designed for certain capabilities and functions, such as product analysis, KPI analysis, demographic analysis, and so on (Imhoff, Galemmo and Geiger, 2003).

Data marts and data warehouses have very thin differences, but in substance the purpose of making a data warehouse and data mart has something in common. There are several characteristics that distinguish between the data mart and the data warehouse as follows. First, a data mart only focuses on data for user-related needs in a department or business function in a company or organization. Second, a data mart does not contain very detailed operational data as in the data warehouse. Third, a data mart only contains little information compared to a data warehouse and also the structure in a data mart is easy to understand (Paramita P., Firdaus and Afrina, 2012). Data marts are arranged by several tables, namely fact tables, dimension tables and are combined with the star schema method to produce a complete data mart scheme.

The fact table is the largest data set that cannot be replicated in many places for various functions in divisions that exist in companies or organizations(Kimball and Ross, 2011). Each line in a fact-table is related to historical data on the business processes of a company or organization, data on each line is at a certain level of detail depending on the data requirements of each organization or company division(Kimball and Ross, 2013). The concept of the fact table is as follows :

Fig. 1. Fact table scheme for product sales



While dimension tables are part of the constituent attributes in fact-tables, dimension-tables

contain a textual descriptor of business data requirements. Dimension tables have many columns or attributes, where these attributes describe a line in dimension tables, A dimension table tends to have a small number of rows (often far less than 1 million rows) but has a large number of columns, each dimension in dimension-table is defined by a single primary key represented by PK notation(Kimball and Ross, 2013). The concept of the dimension table is as follows.

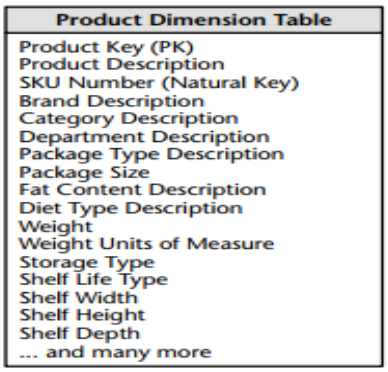


Fig. 2. The concept of dimension tables for product dimension tables

The method of star schema is to combine a data with a single join level, where a fact table will be combined with several entities in a single dimension table(Kimball and Ross, 2013)

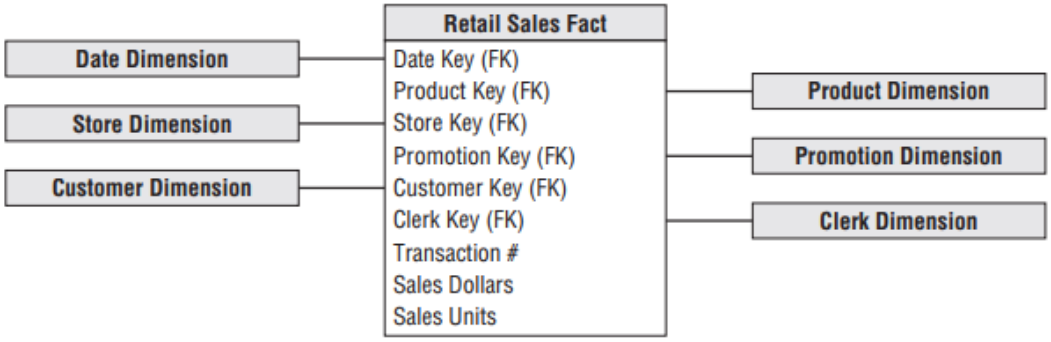


Fig. 3. Star schema in the retail sales fact table

2.4. Dashboard

Dashboard is a visual display of information data that in real time will monitor various information needed by organizations or companies with various display formats such as graphical gadgets, typically gauges, charts, indicators, and color-coded maps that help in making decisions quickly and right(Imelda, 2008). In making the dashboard, first paying attention to things, the dashboard is a visual display consisting of text and graphics, the dashboard only displays information needed to achieve the goals of an organization or company, the dashboard display must be solid, clear and intuitive(Rusdi, 2017).

2.5. Methodology

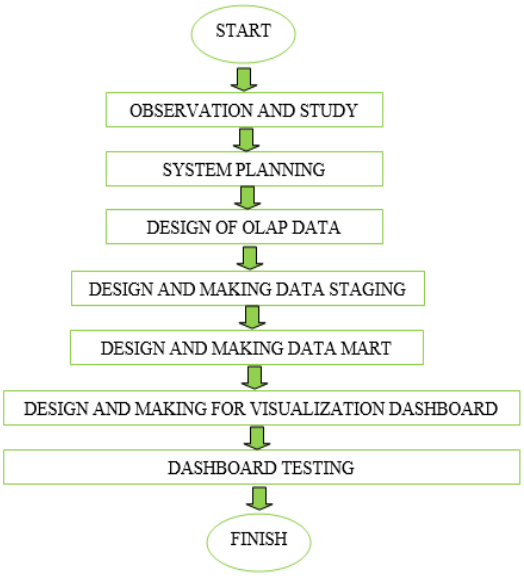


Fig. 4. Flow Chart of Research

3. RESULT AND DISCUSSION

In designing data mart based dashboards using Power BI for student subjects consisting of applicant prospective student data, prospective student data is accepted, and data on prospective student re-registration, student demographic data at UISI, as well as data from student schools in UISI. So that the data mart scheme that is designed consists of demographic data mart scheme for prospective student applicants, data mart scheme for demographics of prospective students accepted, data mart scheme demographics of prospective students to re-register, schema data mart UISI student demographics, and data mart schemes for students from UISI. The data mart scheme is composed of dimension tables and fact tables, along with a data mart scheme that has been created.

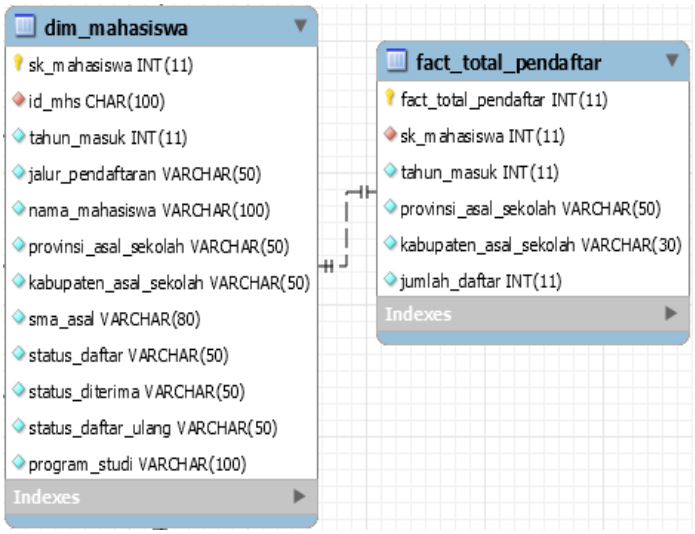


Fig. 5. Data mart scheme demographics of student registrants

Information that can be obtained from the data mart scheme in Figure 5 is the year of entry of prospective students, the province of origin of prospective students, the district from the prospective student, and the number of prospective student registrants in UISI from various cities in Indonesia.

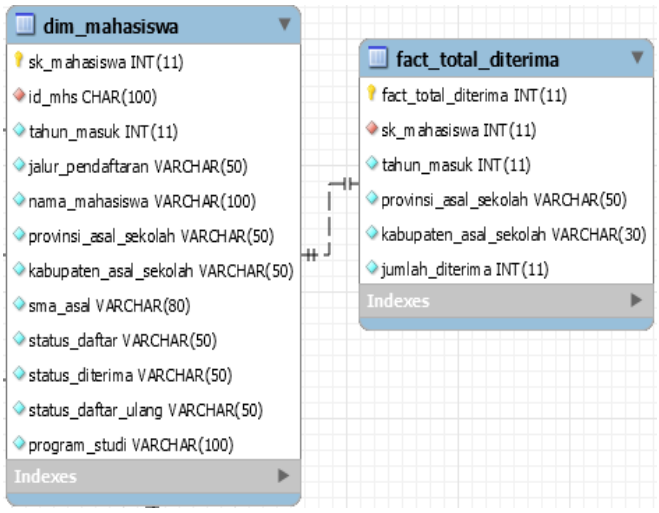


Fig. 6. Student demographic data mart scheme is accepted

Information that can be obtained from the data mart scheme in Figure 6 is the year of entry of prospective students, the province of origin of prospective students, the district of the prospective student, and the number of prospective students who have been accepted in UISI from various cities in Indonesia.

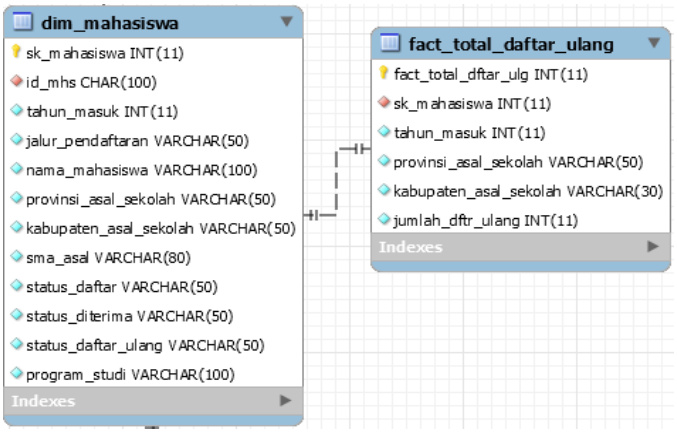


Fig. 7. Student demographic data mart scheme re-registers

Information that can be obtained from the data mart scheme in Figure 7 is the year of entry of prospective students, the province of origin of prospective students, the district of the prospective student, and the number of prospective students who have re-registered in UISI from various cities in Indonesia.

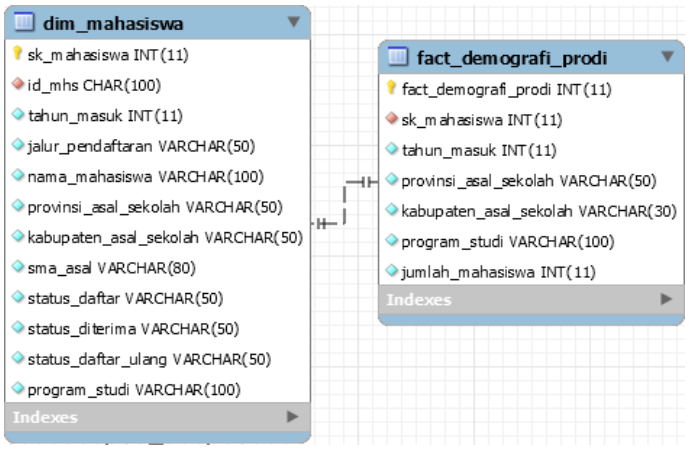


Fig. 8. Data mart scheme for UISI student demographics

The information that can be obtained from the data mart scheme in Figure 8 is the year of entry of prospective students, the province of origin of prospective students, the district of prospective student candidates, study programs in UISI and the number of students based on study programs in UISI.

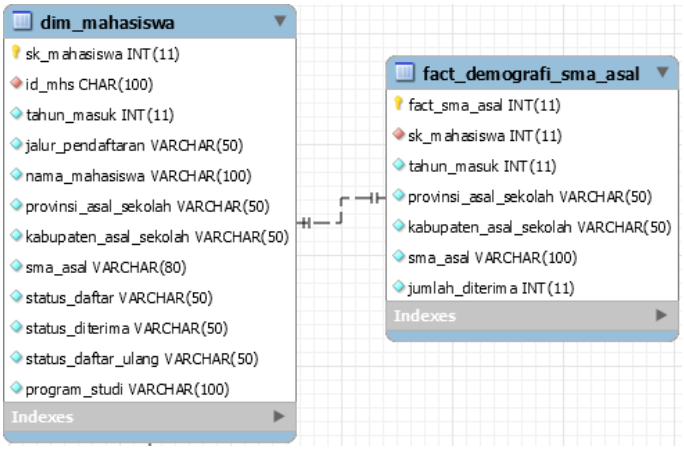


Fig. 9. Data mart scheme for the school of origin of UISI students

Information that can be obtained from the data mart scheme in Figure 9 is the year of entry of prospective students, the province of origin of prospective students, the district of origin of prospective students, the school of origin of students and the number of students based on the school of origin of the student. After the scheme of the required data mart has been made properly and correctly, then next is to make a visualization of the existing data mart scheme into a dashboard display using Power BI, as follows.

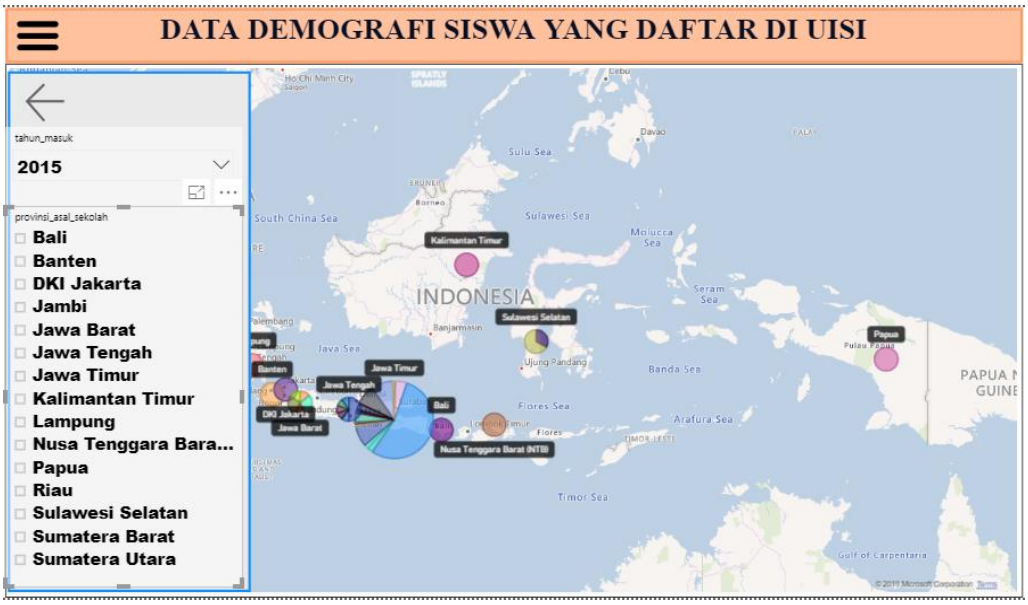


Fig. 10. Dashboard for demographics of registrant students

In Figure 10 displays a dashboard about the demographics of applicant students spread across various provinces and districts in Indonesia, there is a year and province filter on the left to display the number of students based on the filter selected. To see the details of the number of students, just point the pointer at the existing pie chart.

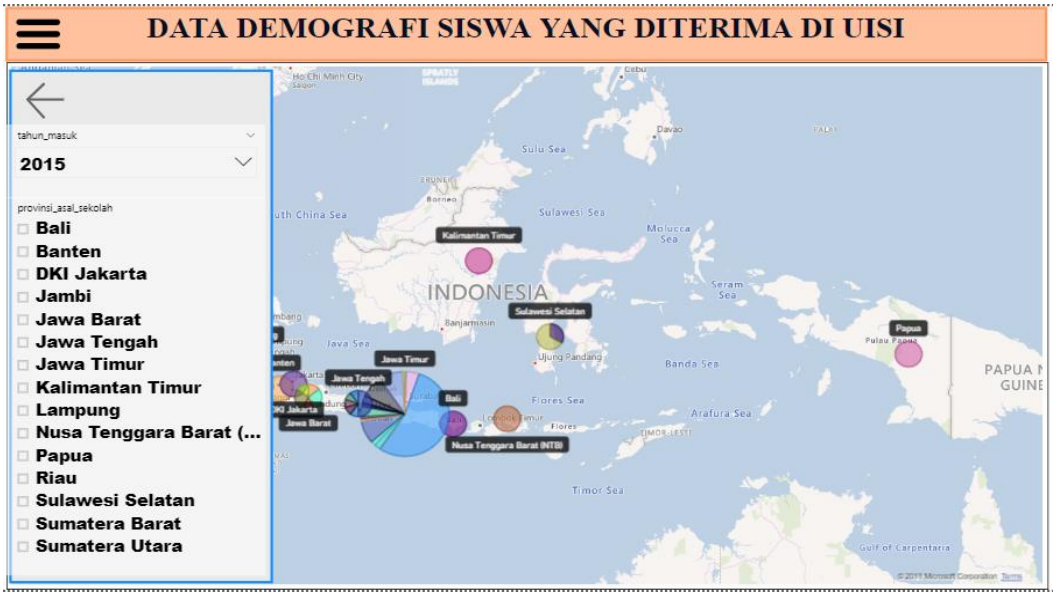


Fig. 11. The dashboard for student demographics is accepted

In Figure 11 shows a dashboard about the demographics of students accepted spread across various provinces and districts in Indonesia, there is a year and province filter on the left to display the number of students based on the filter selected. To see the details of the number of students, just point the pointer at the existing pie chart.

Fig. 12. The dashboard for student demographics is re-register

In Figure 12 displays a dashboard about the demographics of students who re-register scattered in various provinces and districts in Indonesia, there is a year and province filter on the left to display the number of students based on the filter selected. To see the details of the number of students, just point the pointer at the existing pie chart.

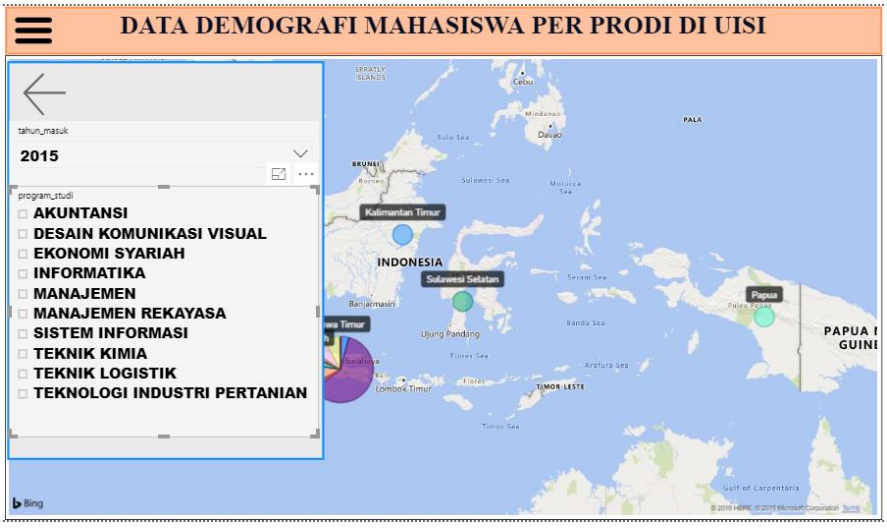


Fig. 13. Dashboard for UISI student demographics

In Figure 13 displays a dashboard about the demographics of UISI students per study program spread across various provinces and districts in Indonesia, there is a year filter and study program on the left to display the number of students based on the filter selected. To see the details of the number of students, just point the pointer at the existing pie chart.

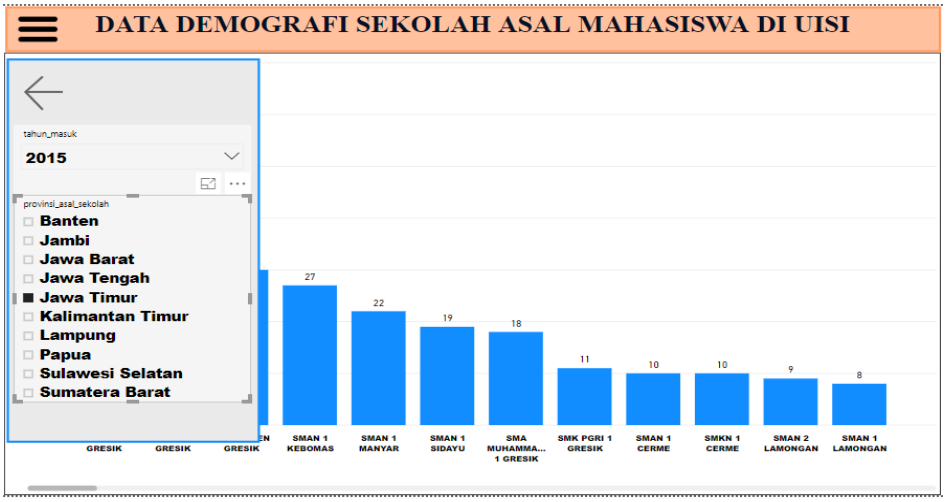


Fig. 14. School dashboard from UISI students

In Figure 14 shows a dashboard about schools from UISI students spread across various provinces and districts in Indonesia, there is a year and province filter on the left to display the number of students based on the filter selected. To see the details of the number of students, just point the pointer to the existing bar diagram.

4. CONCLUSION

Presentation of data and information from student data refers to the OLTP data source owned by the UISI admission. The data source becomes a reference in building staging data, data mart and student demographic dashboards. The collection of data contains information that can be analyzed, so

that a knowledge can be used that can be used for universities in conducting promotional processes through BI Application in the form of dashboards.

The results of the data that have been processed in the data mart, produce a fact table that is displayed in the form of a dashboard visualization with an Indonesian map model. The dashboard that has been created can present an information on demographic data of UISI students accurately based on provinces and districts throughout Indonesia.

Staging data, data mart, and dashboards that have been made are still around student demographics. In the future, it is necessary to build a data staging, data mart, and dashboard in other fields, so that marketing and admissions can explore and analyze even more information. In the process of developing the next dashboard, the pie chart is displayed as a percentage.

REFERENCES

Ahmad, F. (2016) *'Marketing Management in Increasing Student Reception at MI Darul Hikmah Bantarsoka,* Purwokerto Barat District, Banyumas Regency.

Asroni (2014) *'Data Warehouse Design of the Executive Information System Using the Kimball Method* (Case at Muhammadiyah University, Magelang)', p. 308992.

Golfarelli, M. and Rizzi, S. (2009) *Data warehouse design: Modern principles and methodologies.* McGraw-Hill New York.

Imelda (2008) *'Business Intelligence', Business Intelligence,* 11 (Business Intelligence), pp. 111–122.

Imhoff, C., Galemmo, N. and Geiger, J. G. (2003) *Mastering Data Warehousing Design: Relational and Dimensional Techniques*.

Kimball, R. and Ross, M. (2011) *The data warehouse toolkit: the complete guide to dimensional modeling*. John Wiley & Sons.

Kurniawan, N. B. (2011) '*Data Warehouse Design and Implementation Case Study of Mapping Disaster Prone Areas in West Sumatra Province'*. Bandung.

Muhammad, M. S. (2017) *'Hope Of Stakeholders In Islamic Education Institutions'*, 14 (2). Oracle (2002) Oracle9i Data Warehousing Guide, Release 2, A96520-01.

Paramita P., D., Firdaus and Afrina, M. (2012) *'Application of XYZ Hypermarket Sales Data Mart Using the Method From Enterprise Models To Dimensional Models 1,2,3* ', Journal of Information Systems, 4 (2), pp. 503-515.

Rusdi, H. (2017*) Making Data Mart for Power BI-based Executive Dashboard* (Case Study: Personnel Data Institute of Technology, November 10). The Ten November Institute of Technology.

UISI (2016) Profile of UISI - Semen Indonesia International University (UISI), UISI. Available at: https://uisi.ac.id/read/profil-uisi (Accessed: 2 February 2018).

INFORMATION TECNOLOGY GOVERNANCE ANALYSIS USING COBIT 4.1 ON ICT PART SERVICES UNIVERSITY OF XYZ

Mastuty Ayu Ningtyas, Renny Sari Dewi

Universitas Internasional Semen Indonesia
Jln Veteran Gresik Jawa timur 61122

ABSTRACT

The current academic business process has been helped by the existence of several ICT services part, but the current Standard Operating Procedure (SOP) of academic has not implemented the system nicely. As a result, operational on ICT services part are chaotic. Therefore, an IT governance document is needed to overcome these probelms. In this resech, aims to In this resech, aims to analysis of IT governance services with using framework Objective for Information and Related Technology (COBIT) 4.1the domain Deliver and Support (DS1) for define and manage a level of service. He results of this study of IT governance documents on ICT services include documents, policies, procedures, guidelines and forms that refer to the COBIT 4.1 domain DS1 framework. There is 1 manual document on ICT section services, 4 ICT section service policy documents, 4 ICT part service procedure documents, 4 ICT section service guide documents, and 9 form documents on ICT section services.

Keyword: *ICT Services division; COBIT; IT Governance*

1. INTRODUCTION

The development of information technology (IT) currently plays an important role in increasing competitive advantage. IT can also help improve the efficiency of the process that is taking place. For organizations engaged in the business world, profit is a point to be achieved. Likewise with universities or universities. The main activity in higher education in accordance with its main function as an education provider is academic services. XYZ University is one of the educational institutions that has become one of the private universities with an international level of learning and has a role as a place for students who want to improve skills and soft skills and provide innovations that can support the development of the nation and state. XYZ University has a vision of becoming a superior, innovative, high-quality, and internationally competitive higher education institution and supported by the industry's best practices, in achieving this vision XYZ University has a mission, one of which is to provide professional, accountable, and always uphold the image of the institution with the support of information and communication technology.

In achieving this vision and mission, XYZ University has a service in the Information and Communication Technology (ICT) section. The ICT section is one of the units at XYZ University. This unit is responsible for providing services in the field of information and communication technology for students, lecturers, employees and all work units at the XYZ University in 2013. According to the head of the ICT section there are 4 services in the ICT section, including:

a. Application System Development Services.
b. ICT Performance Monitoring Services.
c. Helpdesk services.
d. Hardware Procurement Services

From the results of interviews of 10 students when reporting incidents, students did not know the reporting flow and policies provided by the ICT section for the services reported, in the absence of IT governance documents that resulted in services not running smoothly.

From previous research (Maghfiroh, Murahartawaty and Mulyana, 2016) with the

existence of IT governance can contribute to business and reduce IT risk or incidents that occur. According to (Aulia and Handayaningsih, 2013) IT governance using the COBIT 4.1 framework simplifies the academic process for operating applications and managing change in supporting and driving academic business.

From the analysis of the current conditions, according to the head of the Directorate of HR Development & ICT services, the ICT section at the University of XYZ does not yet have an IT governance document. Based on the description of the previous research, the authors conducted a study to analyze IT governance on the services of ICT sections to run according to the objectives using the Control Objectives for Information and Related Technology framework (COBIT 4.1) (ISACA, 2011).The ICT services section will focus on the Deliver and Support (DS1) domain, which is to identify service requirements aimed at ensuring that services can be monitored and reported continuously.

2. MATERIALS AND METHODOLOGY

2.1 Information Technology Governance (IT)

Information Technology Governance (IT) is a structure of relationship relationships and processes to direct and control a company or agency in achieving its goals by providing added value when balancing risk by adjusting the IT and business processes of the company or agency. IT governance appears as a bridge between business scope and IT (Kaban, 2013).

2.1.1 Document on IT Governance

The IT governance document consists of manual documents, policies, procedures, guidelines and forms. The following is a description of governance documents according to (ISACA, 2011).

a. Manual documents, this document is used to track incidents or risks that have the potential to cause damage or failure to the system. These risks will be in line with the policies that will be made later.

b. Policy documents, this document for determining when and how to carry out IT strategic planning, Policies must include policy intentions; roles and responsibilities; exception process; compliance approach; and references to procedures, standards and guidelines.

c. Procedure Documents, this document is carried out to explain the flows carried out in an activity by stakeholders, and establish responsibility for each activity or activity at the right time and reviewed whether the activity is carried out correctly.

d. Guidance document, this document helps to show the purpose of the business process needed to support activities or activities.

e. Form documents, this document is for recording or recording data in all activity processes (input, processed and output by any information system in any form used in the activity process).

2.2 COBIT

COBIT 4.1 incorporates an operational model and common language for all parts of the business involved in IT is one of the most important and early steps towards good governance. It also provides a framework for measuring and monitoring IT performance, communicating with service providers and integrating best management practices. A process model encourages ownership of processes, allows responsibility and accountability to be defined (ISACA, 2011).

2.3 Analysis of Information Technology Process (IT)

In COBIT 4.1 there are 4 domains, namely: Plan and Organization (PO), Acquire and Implement (AI), Delever and Support (DS), and Monitor and Evaluate (ME).

2.3.1 Plan and Organization (PO)

This domain includes strategies and tactics, and involves identifying how IT can best contribute to achieving business goals. PO domains have 10 Sub domains, among others; PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10.

2.3.2 Acqure and Implement (AI)

This domain is to realize IT strategies, IT solutions need to be identified, developed or acquired and implemented and integrated into business processes. AI domains have 7 sub domains, among others; AI1, AI2, AI3, AI4, AI5, AI6, AI7.

2.3.3 Deliver and Support (DS)

This domain is related to the actual delivery of services needed, which includes service delivery, security and continuity management, service support for users, and data management and operational facilities. Domain DS has 13 sub domains, domains,among others; DS1, DS2, DS3, DS4, DS5, DS6, DS7, DS8, DS9, DS10, DS11, DS12, DS13.

2.3.4 Monitor and Evaluate (ME)

This domain addresses all IT processes must be regularly assessed from time to time for quality and compliance. ME Domain there are 4 sub domains, among others; ME1, ME2, ME3, ME4.

2.4 Application of COBIT-Based IT Governance 4.1

Several studies conducted COBIT 4.1-based IT governance research to ensure compliance with IT implementation. The list of studies is found in Table 1.

Table 4 Implementation of COBIT-Based IT Governance 4.1

No.	Article	Findings	Research gap	Linkages with this research
1.	(Fauzan and Latifah, 2015)	Wanting supervision and evaluation of IT governance has been standardized, documented and communicated and formally and integrated with the COBIT standard 4.1.	This research has not been conducted at the University.	The study examined PT Nikkatsu Electric Work with the ME1 domain, this study will test the success of COBIT 4.1 at the University with the DS1 domain.
2.	(Lesmono and Erica, 2018)	Implication of IT governance by using an information system has achieved the expected targets and improved governance recommendations after knowing the gap between current governance and expected governance.	This research has not been conducted at the University.	The research was conducted at PT IMI using the DS domain. This study will test the success of COBIT 4.1 at universities with DS1 domains.
3	(Aulia and Handayaningsih, 2013)	The IT governance model for the academic process is manifested in the form of proposed policies and procedures.	This study has not used the DS1 domain.	The research was conducted in the academic process using the domains AI1, AI2, AI4, AI6. This study will test the success of COBIT 4.1 at the University by using the DS1 domain.
4.	(Maghfiroh, Murahartawaty and Mulyana, 2016)	The process has run base on practice with individual initiatives, some of which have been documented in the form of standard procedures and other supporting documentation and	This research has not been conducted at the	The research was conducted at PT XYZ using the DS domain. This study will test the success of COBIT 4.1 with the DS1 domain.

No.	Article	Findings	Research gap	Linkages with this research
		Assessment maturyty levels to determine the level of maturity using the Deliver and Support (DS) domain	University.	
5.	(Wardani and Puspitasari, 2014)	Creating a governance infrastructure design that is relevant to the Faculty of ABC's operational activities in accordance with COBIT framework standards, building IT governance that is able to implement and can assess maturity levels.	This research has not been carried out on the ICT Section.	The research was conducted at the ABC Faculty using the domains PO1, PO4, PO7, AI1, AI3, AI6, DS1, DS11, ME1, ME2, ME4. This study will test the success of COBIT 4.1 at universities with DS1 domains.
6.	(Sadikin, Hardi and Haji, 2014)	IT governance recommendations in the field of education at the University of Mercu Buana to improve the level of governance of IT Universities, carry out the University masterplan to guide and direct IT planning and implementation to adapt to the strategies and direction of the University with COBIT 4.1 work borrowing guidelines	This research has not been carried out on the ICT Section	The study was conducted at Mercu Buana University using COBIT 4.1 with DS1, DS13, ME1, ME4 domains. This study will test the success of COBIT 4.1 by using the DS1 domain.

2.4. Methodology

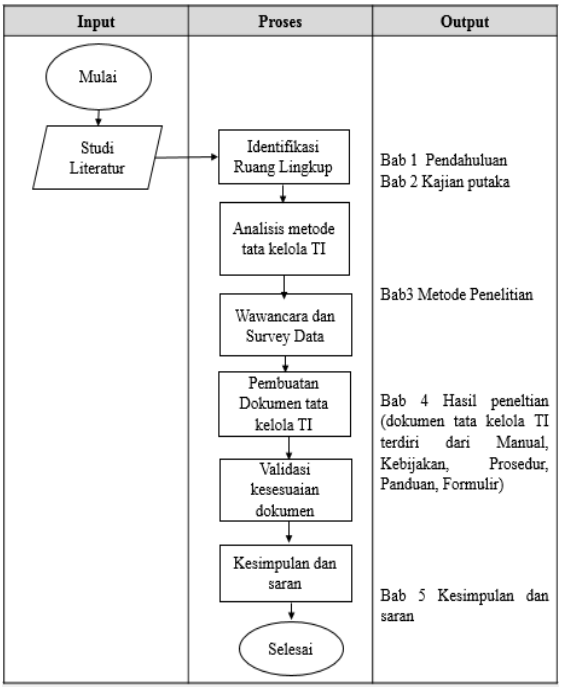


Figure 1. Flowchart Stages of Document Analysis IT Governance

The stages of IT governance analysis in the ICT services section are shown to provide clear and directed direction in the analysis of IT governance so that the documents produced are in accordance with the definition of governance according to COBIT 4.1.

a. Literature Study, this stage is one of the methods used to reference library, books, and voluntary papers.

b. Identification of Scope, this stage aims to limit the scope of problems that are too broad so that research is more focused to be done.

c. Analysis of IT Governance Methods, this stage is one method that is used as a reference that will later be used to produce IT governance documents.

d. Data Interview and Survey, this stage was conducted by interviewing the Directorate of SDMO & ICT Development and the Head of the ICT section related to ICT services to obtain data in making IT governance documents.

e. Preparation of IT Governance Documents, this stage is the making of IT governance documents consisting of manual documents, policies, procedures, forms.

f. Document Conformity Validation, at this stage

the IT governance document that has been made is validated to check compliance with the service objectives of the ICT section.

g. Conclusions and suggestions, this stage makes conclusions from the research that has been done and gives suggestions for further research.

3. RESULT AND DISCUSSION

3.1 Document on IT Governance Services for ICT Section

The governance document on the ICT services section consists of manuals, policies, procedures, guidelines, forms (see section 2.1.1 for descriptions of IT governance documents). Details of explanations regarding governance documents in Table 2.

Table 5 Document on IT Governance Services for ICT Section

Type document	Description	Code	Total
Manual	Manual document on ICT service section	MN	1
Policy	Document series of concepts and principles that guide the implementation of ICT services	KB	4
Procedure	Document procedures for the ICT service process process	PR	4
Guide	Document guide to the ICT section service process	PN	4
Form	Form documentation to support the ICT section service process	FR	8

3.2. Document of the ICT Section Service Manual

The TIK section service manual document contains risk identification on ICT and standard services in the ICT section that has been formulated or defined. The following are the details of the ICT section service manual document in Table 3.

Table 6 Document of the ICT Section Service Manual

No	Code	Document name	Goal
1.	MN/TIK-01	Service manual for the ICT section	To identify risks and structure the policy documents, procedures, guidelines, forms.

3.3 Service Policy Documents for the ICT Section

The ICT section service policy document is a guideline and basic plan for implementing ICT service activities and ensures that every unit within the XYZ University carries out its service and function duties in accordance with established standards. The following are the details of the ICT section service policy document in Table 4.

Table 7 Service Policy Documents for the ICT Section

No	Code	Document Name	Goal
1.	KB/TIK/PSA-01	Service policy for application system development.	To create order in the activities of the application system development services and support the objectives and functions of the ICT section.
2.	KB/TIK/PK-01	ICT performance monitoring service policy.	To create order in the activities of the ICT performance monitoring service process and support the objectives and functions of the ICT section.
3.	KB/TIK/HD-01	Helpdesk service policy.	To create order in the helpdesk service process activities and support the objectives and functions of the ICT section.
4.	KB/TIK/PH-01	Hardware procurement service policy.	To create order in the activities of the hardware procurement service process and support the purpose and function of the ICT section.

3.4 Documents for Service Procedures for the ICT Section

Documents for the ICT part of the service procedure as a guideline for a process, or the stages of a series of ICT part service activities for work units to help carry out an activity in order to achieve the targeted goals. The following are the details of the TIK section service procedure document in Table 5.

Table 8 Documents for Service Procedure for ICT Section

No	Code	Document Name	Goal
1.	PR/TIK/PSA-01	Procedure for application system development services.	To facilitate work units in implementing application system development service activities as well as maintaining consistency of performance in each unit.
2.	PR/TIK/PK-01	Service procedures for monitoring ICT performance.	To facilitate work units in carrying out service activities to monitor ICT performance and maintain consistency of performance in each unit.
3.	PR/TIK/HD-01	Helpdesk service procedure.	To facilitate work units in carrying out helpdesk service activities and maintain consistency of performance in each unit.
4.	PR/TIK/PH-01	Procedure for hardware procurement services.	To facilitate the work unit in carrying out hardware procurement service activities as well as maintaining consistency of performance in each unit.

3.5 Document of the ICT Section Service Guide

The ICT section service guidance document as an guidance document in carrying out activities on the ICT section services and as a basis that provides guidance on how ICT services should be performed. The following are details of the ICT section service guide document in Table 6.

Table 9 Document of the ICT Section Service Guide

No	Code	Document name	Goal
1.	PN/TIK/PSA-01	Guide to application system development services.	To be a joint reference in carrying out service activities for application system development.
2.	PN/TIK/PK-01	Guide to ICT performance monitoring services	To be a joint reference in carrying out ICT performance monitoring service activities.
3.	PN/TIK/HD-01	Guide to helpdesk service.	To be a joint reference in carrying out helpdesk service activities.
4.	PN/TIK/PH-01	Guide to hardware procurement services.	To be a joint reference in carrying out hardware procurement service activities.

3.6 Document of the ICT Section Service Guide

The ICT section service guidance document as an guidance document in carrying out activities on the ICT section services and as a basis that provides guidance on how ICT services should be performed. The following are details of the ICT section service guide document in Table 7.

Table 10 ICT Section Service Form Documents

No	Code	Document name	Goal
1.	FR/TIK/PSA-01	Application system development form.	To record the data requested by the work unit in the construction of the application system that is needed or desired.
2.	FR/TIK/PSA-02	Letter of agreement on application system developmen.	To ensure certainty between the work unit and the ICT section regarding the construction of the application system.
3.	FR/TIK/LBPSA-03	Application system update sheet.	To evaluate the application system being built.
4.	FR/TIK/PK-01	ICT performance monitoring form.	To find out how far (process) the application system or project development has been carried out in the form of a percentage of success.
5.	FR/TIK/PK-02	Weekly ICT performance monitoring form.	To record user complaints on a system developed by various ICT.
6.	FR/TIK/HD-01	Form helpdesk.	To record user complaints on a system developed by various ICT.

7.	FR/TIK/HD-02	Online chat feature form.	To report user complaints on the gate system online.
8.	FR/TIK/HD-03	Email form	To report user complaints on an application system developed by the ICT section online.
9.	FR/TIK/PH-01	Hardware procurement application form.	To record data (hardware recommendations, vendor recommendations) hardware requests submitted by the work unit.

IT governance documents above consisting of manuals, policies, procedures, guidelines, forms referring to COBIT 4.1 DS domain

4. CONCLUSION

This research is proposed to make IT governance documents on the ICT service section with approval on the COBIT 4.1 domain Deliver and Support (DS1) framework. Based on the results and discussion in chapter 4, the conclusions obtained are:

a. The results of IT governance documents consist of manual documents, policies, procedures, guides, and forms on 4 services, namely application system development services, ICT development support services, Helpdesk services, hardware procurement services.

b. There is 1 document on the ICT section of the service manual that contains risks that will arise either well or short on the services in the ICT section of XYZ University.

c. There are 4 policy documents to create order in every service process for ICTs, including application development service policies, ICT performance monitoring service policies, Helpdesk service policies, hardware procurement service policies.

d. There are 4 procedure documents in the ICT services section, including application development service procedures, ICT management support service procedures, helpdesk assistance service procedures, and hardware procurement procedures.

e. There are 4 guidance documents on ICT services, including application system development service guides, ICT installation support service guides, helpdesk assistance service guides, and hardware procurement service guidelines.

f. There are 9 form documents in the ICT services section, including application system development forms, application system development approval forms, ICT performance monitoring forms, helpdesk forms, online chat feature forms, email forms, and hardware procurement applications

Some recommendations can be given in this study namely, Future research can be done to add scope to the services of the XYZ University ICT section and for management between ICT sections and third party people. Starting from planning, implementation, to supervision of work related to ICT.

REFERENCES

Aulia, N. and Handayaningsih, S. (2013) 'Making IT Governance Models for Academic Processes Using Cobit 4.1 (Case Study: XYZ University) ', Journal of Informatics Engineering, 1 (1).

Fauzan, R. and Latifah, R. (2015) 'Information Technology Governance Audit to Control Quality Management Using (Case Study: PT Nikkatsu Electric Works) ', Journal of Information Engineering and Information Systems, 1, pp. 235–244.

ISACA, C. (2011) 'COBIT® 4.1 Process Assessment Model', IL, USA: ISACA. Kaban, I. E. (2013) 'Information technology governance (IT Governance)', Information Technology Governance - Computerized Accounting, 3 (C), pp. 1–5.

Lesmono, I. D. and Erica, D. (2018) 'Information Technology Governance Using the Cobit Method 4. 1 (Case Study: PT. IMI) ', 10 (1).

Maghfiroh, I., Murahartawaty, M. and Mulyana, R. (2016) 'Analysis and Design of Ti Governance Using Cobit 4.1 PT Xyz's Deliver and Support Domain (Ds), Journal of Information Systems, 12 (1), pp. 50–55.

Sadikin, M., Hardi, H. and Haji, W. H. (2014) "IT Governance Self Assessment in Higher Education Based on COBIT Case Study: University of Mercu Buana", Journal of Advanced Management Science, 2 (1), pp. 83–87. doi: 10,12720 / joams.2.2.83-87.

Wardani, S. and Puspitasari, M. (2014) *'Information Technology Governance Audit Using the Cobit Framework With Maturity Level Mode*l', pp. 38–46. Available at: http://jurtek.akprind.ac.id/sites/default/files/38-46_wardani.pdf.

ANALYSIS AND DESIGN OF INFORMATION TECHNOLOGY GOVERNANCE DOCUMENTS BASED ON COBIT 4.1 IN THE DIRECTORATE OF STUDENTS AND ALUMNI OF ABC UNIVERSITY

Nathasya Ratu Fadilah

Universitas Internasional Semen Indonesia
Jln Veteran Gresik Jawa Timur 61122

ABSTRACT

Along with the growth of the era, information technology is able to change human's activities were from manually to automatically and make it easier. Also it happen in ABC University who adjust information technology information system Satuan Kredit Ekstrakurikuler Mahasiswa (SKEM) and tracer study in the academic process or non-academic. In this research have a purpose to make a IT Governance document for manage information system SKEM utilize framework Control Objective for Information and Related Technology (COBIT) 4.1 domain DS (Deliver and Support) 1 which aim to defines and manages a service level. The final results in this research is IT Governance document that is manual document, guideline, procedure, policy, form who could used by system user as reference in the work process. In SI SKEM there are 1 manual document, 2 policies, 4 guidelines, 2 procedures, 7 forms, while at tracer study there are 1 manual document, 1 policy, 2 guidelines, 2 procedures, 2 forms.

Keywords: *University, COBIT, Information Technology Governance, Directorate of Student and Alumni*

1. INTRODUCTION

ABC's Unversity is one of academic instance which is one of the private university with learning level as high as international it has a role as containers for college student who want to increase their hadrskill or softkill as well as give inovation that can support nation and country's development. In ABC's Univeristy there is directorate of student and alumni, to support business process in directorate f student and alumni made a system taht are Sistem Informasi (SI) satuan kredit ekstrakurikuler mahasiswa (SKEM) and tracer study, in SI SKEM nad tracer studt that had been work is still need improvement in terms of services so that required Information Technology (IT) Governance Documents that can use for all user of SI SKEM and tracer study as guideline system using. The formulation of the problem from this research is how to manage the SKEM SI and Tracer study according to the DS1 domain, based on Objective for Information and Related Technology (4.1). Based on the existing problem formulation, the research objective is to document the information technology (IT) on SI SKEM services and tracer studies conducted by COBIT 4.1, in particular the DS1 domain. In COBIT 4.1 there are 4 domains, consisting of 34 processes as control objects.

In Plan and Organize (PO) domain there are 10 process, can be seen in table 1:

Table 1. Domain PO

Code	Process
PO1	Defining IT strategic planning
PO2	Defines information architecture
PO3	Determining the direction of technology
PO4	Defining IT processes, organizations and relationships
PO5	Manage IT investments
PO6	Direction and purpose of communication management
PO7	Managing IT human resources
PO8	Manage quality
PO9	Assess and manage IT risk
PO10	Manage the project

In Acquire and Implement (AI) domain there are 7 process, can be seen in table 2:

Table 2. Domain AI

Code	Process
AI1	Identification of automatic solution
AI2	Obtain and maintain application software
AI3	Obtain and maintain technology infrastructure
AI4	Enables work and uses it
AI5	Obtain IT resources
AI6	Manage changes
AI7	Install and accreditation and change solutions

In Deliver and Support (DS) domain there are 13 process, can be seen in table 3:

Table 3. Domain DS

Code	Process
DS1	Define and manage service levels
DS2	Manage third party services
DS3	Manage performance and capacity
DS4	Manage service continuity
DS5	Ensuring system security
DS6	Identify and allocate costs
DS7	Educate and train users
DS8	Managing service desk and incident
DS9	Manage configuration
DS10	Manage problems
DS11	Manage data
DS12	Manage the physical environment
DS13	Manage operations

In Monitor and Evaluate (ME) domain there are 4 process, can be seen in table 4:

Table 4. Domain ME

Code	Process
ME1	Monitoring and evaluating IT performance
ME2	Internal control monitoring and evaluation
ME3	Ensuring compliance with external needs
ME4	Providing information technology governance

There are several research from previous researchers who became reference in this study to make Information Technology (IT) Governance document, research The Indonesian Ministry of Health's Pusdiklat apparatus currently implements IT governance using COBIT 4.1 as its guideline (Kristiana, 2016). For research in university there is COBIT 4.1 framework as one of the references for analyzing the conditions of IT governance, especially PO and AI domains conducted at the Lombok School of Information and Computer Management with the COBIT 4.1 framework and has provided recommendations for improvements to IT governance (Ashari, 2015).

Domain DS1 usage as a self-assessment of the customer scope, providing recommendations for improving IT governance. Between IT governance and IT master planning are interconnected, because IT parent planning can be a guide and direct IT planning and implementation to be aligned with the strategies and objectives of the university (Sadikin, Hardi and Haji, 2014). And also COBIT 4.1 especially DS1 domain can be use for manage the service in system, The application of IT governance uses deliver and support (DS) as one of the domains for IT management to be better in the future (Hanum, no date). (Lesmono and Erica, 2018) said in their paper that,The research was conducted at PT. IMI which provides recommendations for IT governance in managing IT more intensively by using Domain DS1 as a reference to see the level of maturity. The conclusion is COBIT 4.1 especially DS1 domain can e used in every instantion like university.

2. BASIC THEORY AND METHODOLOGY

This study uses a qualitative method, meaning that the information delivered later in descriptive form, guided by COBIT 4.1.

2.1 INFORMATION TECHNOLOGY (IT) PROCESS ANALYSIS

The main characteristics in COBIT 4.1 are there are several domains grouped according to their information technology objectives, including Plan and Organize (PO), Acquire and Imlement (AI), Deliver and Support (DS), Monitor and Evaluate (ME). Each domain has its own sub-domain and a total of thirty-four (34) IT processes. Each domain has its own uses.

2.2 CONTROL OBJECTIVE FOR INFORMATION AND RELATED TECHNOLOGY (COBIT) 4.1

COBIT 4.1 is an information technology (IT) governance framework and supporting tools that enable managers to bring together the distance between control needs, technical issues and business risks. COBIT enables policy making and good practice for IT control through organizations (Couture, Evans and Polster, 2004). The application of IT governance using the COBIT 4.1 framework can be done referring to the research paper owned (Fauzan and Latifah, 2015)

2.3 INFORMATION TECHNOLOGY (IT) GOVERNANCE

IT governance is the responsibility of the executive and the board of directors, and consists of leadership, organizational structure, and processes that ensure that IT in the company supports and expands from the organization's strategy and organizational goals (Couture, Evans and Polster, 2004).

2.3.1. MANUAL DOCUMENT

Manual documents are documents that are used to identify incidents or risks that have the potential to give damage or failure to the system (Couture, Evans and Polster, 2004).

2.3.2. GUIDELINE

Guidelines are used to help show stakeholders the objectives of business processes that are carried out to support activities or activities (Couture, Evans and Polster, 2004).

2.3.3. PROCEDURE

Procedure is a document that functions as a guide to the flow of activities carried out by stakeholders, and determines the responsibilities of each stakeholder in activities or activities at the right time, and ensures that the activities carried out are appropriate (Couture, Evans and Polster, 2004).

2.3.4. POLICY

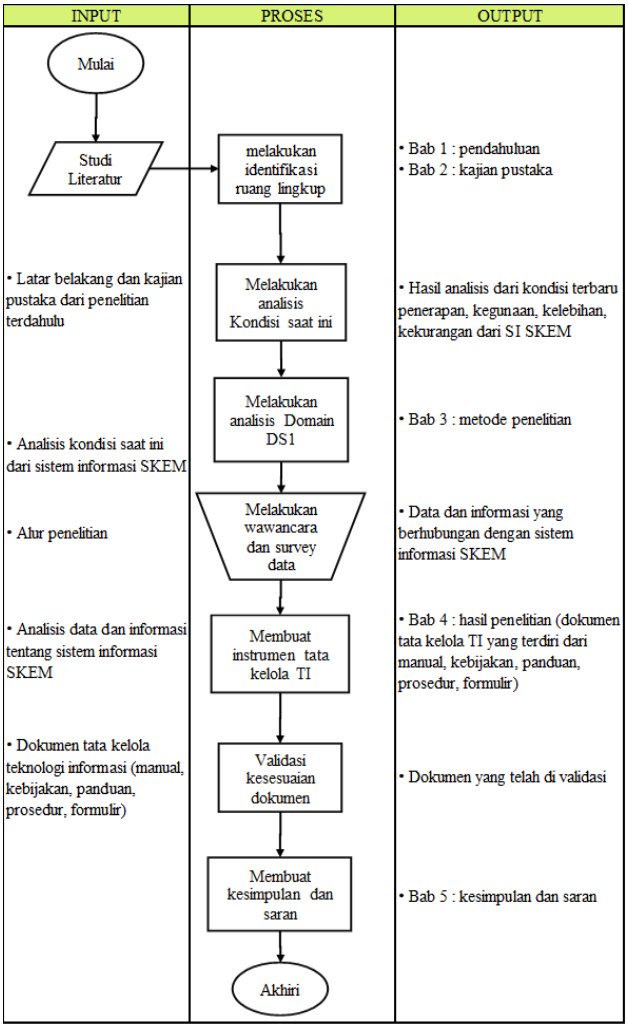
The policy has a function to determine how and when IT strategic planning is carried out, the contents of this document include roles, responsibilities, exclusion processes, compliance approaches, and references to procedures, and guidelines (Couture, Evans and Polster, 2004).

2.3.5. FORM

In its use, the form functions to record data tracks or record data from all activities in the business process covering: input, process and output of the system in any form (Couture, Evans and Polster, 2004).

2.4 STAGES OF PREPARING INFORMATION TECHNOLOGY (IT) DOCUMENTS

The search for various theories, methods and models for making IT governance documents was carried out with literature studies. In making IT governance documents are carried out with various channels so that the documents that are created later can be in accordance with the existing SKEM information system services.



3. RESULT AND DISCUSSION

3.1. Information Technology (IT) Documents for Information System SKEM

The results of this study are the formation of information technology governance documents consisting of manual documents, guidelines, procedures, policies and forms for each information system (SI) of the Student Extracurricular Credit Unit (SKEM). As we can see in table 5.

Table 5. IT Governance document in IS SKEM

Document type	Description	Code	total
Manual document	SKEM's manual document	DM	1
Guideline	1. Student extracurricular credit unit (SKEM) for the Indonesian cement international university 2. SKEM information system management policy 3. Guide to monitoring activities at the directorate of student affairs & alumni 4. Guide to see student activity reports for guardian lecturers	PN	4
Procedure	1. Procedure for submitting activities and verification of activities 2. Monitoring and evaluation procedures for SI SKEM	PD	
Policy	1. Student extracurricular credit unit (SKEM) for the Indonesian cement international university 2. SKEM information system management policy	KJ	
Form	1. Activity submission form and activity verification 2. Activity list form 3. Detailed reports on student activities 4. Student activity report form at the directorate of student affairs 5. A list of activities for all students at the directorate of student affairs 6. Form a list of students submitting activities to guardian lecturers 7. Student activity report form for guardian lecturers	FR	

3.2 Information Technology (IT) Documents for Tracer Study

The results of this study are the formation of information technology governance documents consisting of manual documents, guidelines, procedures, policies and forms for each information in tracer study. As we can see in table 6.

Table 6. IT Governance document in tracer study

Document type	description	Code	total
Manual document	Tracer Study's manual document	DM	1
Guideline	1. Guide to the use of tracer studies 2. Guide to non-active alumni accounts	PN	2
Procedure	1. Procedure for collecting student alumni 2. Procedure for limiting access rights of student alumni	PD	2
Policy	Tracer Study's policy	KJ	1
Form	1. Questionnaire (form) tracer study 2. The Chancellor's Decree regarding the graduation of international cement students at the Indonesian judiciary in the odd semester of the academic year 2018/2019	FR	2

4. CONCLUSIONS

Based on the research that has been done, there are some conclusions. As follows:

a. This IT governance document is expected to be compiled and applied to all existing systems at ABC University so that it is useful in assisting business processes.

b. This document on information technology governance (IT) can be applied to simplify and improve the technical flow of activities in a system.

c. Stakeholders are also facilitated by the existence of IT governance documents because all process processes in the system can be identified through the IT SI SKEM governance document and tracer study.

Suggestions that can be given by the writer for the next researcher are: The scope of research can be carried out in other directorates that already have a system but do not have an IT governance document and making documents more detailed starting from the offline process and the online process carried out by the system.

Thus the conclusions and suggestions that can be made by the next researcher to improve the quality of the research, hopefully the suggestions given can be input and consideration by future researchers and the community.

REFERENCES

Ashari, M. (2015) *'Governance Information Technology (IT) Audit at the Lombok Institute of Information and Computer Management (STMIK) Using the COBIT 4* Framework. 1 ', Bianglala Informatika, 3 (2), pp. 1–9.Couture, R., Evans, S. G. and Polster, A. (2004) *COBIT 4.1*.

Fauzan, R. and Latifah, R. (2015) *'Information Technology Governance Audit to Control Quality Management Using (Case Study: PT Nikkatsu Electric Works)* ', Journal of Information Engineering and Information Systems, 1, pp. 235–244.

Hanum, A. N. (no date) *'IT GOVERNANCE IN BANKING DOMAIN DELIVER & SUPPORT (DS) USING MATURITY MODEL COBIT 4. 1* (Case Study in Semarang City Region Banking) ', 1, pp. 1–10.

Kristiana, 2016 (2016) 'a', XIII (2), pp. 71–79.

Lesmono, I. D. and Erica, D. (2018) *'Information Technology Governance Using the Cobit Method 4. 1* (Case Study: PT. IMI) ', 10 (1).

Sadikin, M., Hardi, H. and Haji, W. H. (2014) *"IT Governance Self Assessment in Higher Education Based on COBIT Case Study: University of Mercu Buana", Journal of Advanced Management Science,* 2 (1), pp. 83–87. doi: 10,12720 / joams.2.2.83-87.

ANALYSIS OF THE INFLUENCE OF INFORMATION QUALITY ON UNIVERSITY XYZ STUDENT EXTRACURRICULAR INFORMATION SYSTEM TOWARDS USER SATISFACTION

Nor Faridah

Universitas Internasional Semen Indonesia
Jln Veteran Gresik Jawa timur 61122

ABSTRACT

This research was conducted to determine the effect of the quality of information on the XYZ University student extracurricular credit unit information system on user satisfaction. The population used in this study were students of 2015, 2016 and 2017, as well as XYZ University lecturers. The sampling technique used is using an automatic sample calculator calculation. The sample obtained was 335 students and 43 lecturers. This study uses a model [1] which consists of six variables namely Content, Connection, Contextual and Interaction, User Satisfaction and Purpose of Using Information Systems. The data analysis method used is Partical Least Square (PLS). The results of this study indicate that the information quality of the SKEM with user satisfaction from students and user satisfaction with the purpose of using the SKEM through a 10% significance has a P value of less than 0.1. It means that the quality of information has a significant effect on student user satisfaction. While user satisfaction has a significant effect on the purpose of using the SKEM SI of students (0,000) and lecturers (0,004). Then, the quality information of the SKEM and lecturer user satisfaction through a 10% significance has a P value of more than 0.1 in the content variable (0.754) and contextual (0.420). This means that the quality of information has no significant effect on lecturer user satisfaction.

Keywords *: Structural Equation Model (SEM), Partical Least Square (PLS), SI SKEM, Information Quality, User Satisfaction.*

1. INTRODUCTION

A successful information system can contribute to an organization in achieving its goals. Conversely, if the information system is said to fail if the system is less or not even utilized by its users. User satisfaction is very important in determining whether an information system is acceptable or not. User satisfaction can also evaluate information systems that are running correctly and correctly. An information system is said to be successful or not seen from the quality of information (information quality) that can be trusted from the information system in order to achieve a user satisfaction [2] .

Not only in organizations or companies that use information systems as media in obtaining information, universities also have their own information systems in providing information to users, namely the Student Extracurricular Credit Unit Information System (SI SKEM). SI SKEM is a program from the Directorate of Student Affairs which aims to monitor, evaluate, and document the potential and achievements of students.

According to the Chancellor's Decree Number: 010 / SK / 01-01 / 03.16, XYZ University applies the use of the SKEM SI since 2016. Provisions of SKEM points are at least 1000 starting from semester 1 to semester which states the student has graduated and then printed as an attachment to academic transcripts. From the last judicial experience there are several factors, namely: XYZ University students do not take advantage of participation in campus activities or outside the campus. As well as the lack of socialization regarding the use of the SI SKEM, only the SKEM guidebook was deemed to be insufficient when applied by the user. The survey results of

researchers, not a few XYZ University students were wrong in inputting SKEM submission data. Then data rejection often occurs from guardian lecturers when submitting SKEM.

In this study, an evaluation of the SI SKEM will be conducted which aims to measure the information quality of the SKEM towards the influence of user satisfaction. As well as providing recommendations for improvements expected by users, so that the quality of information on SI SKEM is better. This research uses model theory [3] which consists of 6 (six) constructs, namely: Connection Quality, quality of content (Content Quality), quality of interaction (Interaction Quality), contextual quality (Contextual Quality) , user satisfaction (User Satisfaction), and Usage Objectives (Intention to Use).

2. MATERIALS AND METHODOLOGY

Structural Equation Modeling (SEM) is a multivariate analysis technique that was developed to cover the limitations possessed by previous analysis models that have been widely used in statistical research [3] . The models in question include regression analysis (path analysis), path analysis (path analysis), and confirmatory factor analysis (confirmatory factor analysis) [4] .

Partial Least Square (PLS) is a powerful analytical method because it can be used on any type of data scale (nominal, ordinal, interval, and ratio) and the terms of assumptions that are more flexible Ibel [5]. PLS is used for confirmation purposes (such as hypothesis testing) and exploration purposes. Although PLS is preferred as exploration rather than confirmation, PLS can also predict whether or not there is a relationship and then pro position for testing. The main purpose is to explain the relationship between constructs and emphasize the notion of the value of the relationship.

The theory of the model used is [3] , which has a connection of 6 variables from Information Quality, which can be seen in Figure 1 .

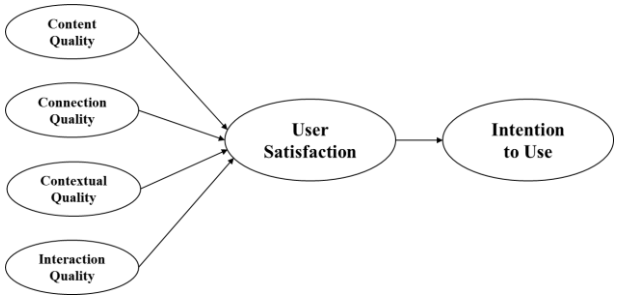


Figure 2. Information Quality Model Theory [1]

The hypotheses that will be raised in this study are as follows.

Premise 1

H 0 : There is no positive influence between the quality of information (Content, Connection, Context and Interaction) on the SKEM with student user satisfaction.

H 1 : There is a positive influence between the quality of information (Content, Connection, Context and Interaction) on the SKEM with student user satisfaction.

Premise 2

H 0 : Student user satisfaction does not have a positive effect on the purpose of using SI SKEM.

H 1 : Student user satisfaction has a positive effect on the purpose of using SI SKEM.

Premise 3

H 0 : There is no positive influence between the quality of information (Content, Connection, Context and Interaction) on the SI SKEM with the satisfaction of the lecturers' users.

H 1 : There is a positive influence between the quality of information (Content, Connections, Context and Interaction) on the SKEM with the satisfaction of the lecturer users.

Premise 4

H 0 : Lecturer user satisfaction does not have a positive effect on the purpose of using SK SK.

H 1 : Lecturer user satisfaction has a positive effect on the purpose of using SK SKEM.

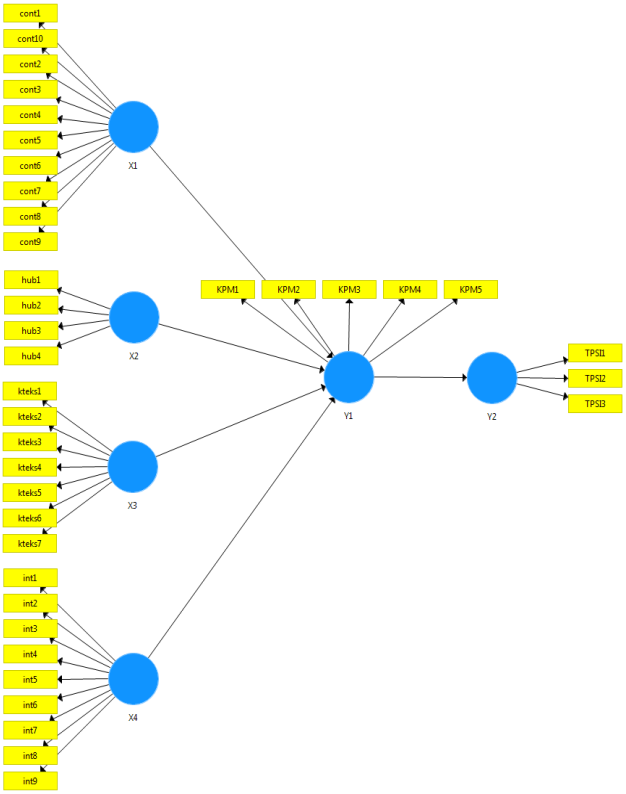


Figure 3. Model Construct

The approach used in this research is quantitative and qualitative approaches. The study was conducted using a survey method. The survey was conducted on 2015, 2016 and 2017 students and XYZ University lecturers. Based on the results of sample calculations using the calculation of the automatic sample calculator at the site http: // ww.raosoft.com/ samplesize.html [6] , the number of student samples is 310 respondents and the sample of lecturers is 37 respondents. Selection of respondents on the basis of respondents who were found at the location of research from each department. This instrument was developed with a rating scale method used to measure respondents' answers. In this case the Likert scale 1-6 will be used to determine the level of perception of students and lecturers relating to the questions asked. Data analysis was carried out by descriptive analysis and model analysis using Structural Equation Modeling - Partial Least Square (SEM-PLS) analysis . For descriptive analysis using Microsoft Excel, while for model analysis using Smart PLS software.

3. RESULT AND DISCUSSION

This section presents the results of studies that include demographic data, descriptive analysis data and analysis of measurement models and structural models.

3.1 Demographic data

In this demographic data descriptive data are presented regarding gender, department, year of force and age of respondents. In more detail the description of demographic data can be seen in the following graph:

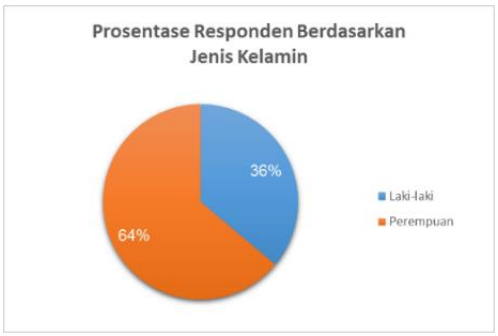


Figure 4. Percentage of Student Respondents by Gender

From Figure 2 that the number of respondents with rounding, the male students were 36% and 64% of women students. Furthermore, judging from the Department of student respondents, determined from shown in Figure 4.

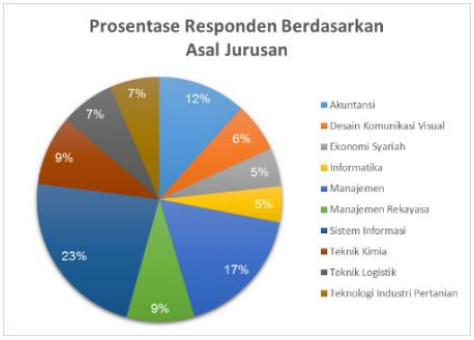


Figure 5. Respondents Percentage Chart Students Based on the Origin of the Department

From Figure 4 shows that the number of respondents who filled out the highest questionnaire from students was majoring in Information Systems, Management and Accounting. Respondents from the

Information System were 23%. Management as much as 17%. Whereas Accounting is 12%. For other majors it is quite balanced. Furthermore, seen from the year of the class Student respondents, determined as shown in Figure 6.

Figure 6. Percentage of Student Respondents Graph by Year Force

From Figure 5 , it is known that the year of the respondent group shows the frequency of submitting SKEM. Because p enulis using random samples, so spreading into 3 parts. For the year 2015, there were 33%. The 2016 class is 32% and for the 2017 class is 35%.

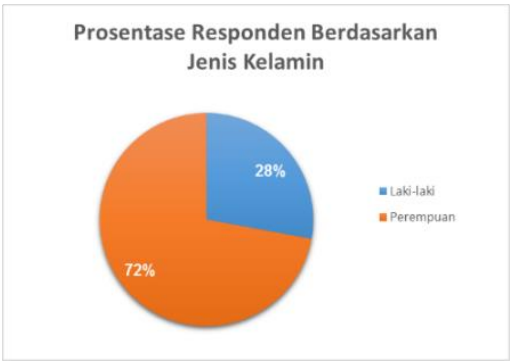


Figure 7. Respondents Percentage Chart Lecturer Based on Gender

From Figure 6 it is known that the number of respondents with rounding, namely Male lecturers as much as 28% and Female lecturers as much as 72%. Furthermore, judging from the Department of respondents lecturers, determined from shown in Figure 7.

Figure 8 Respondents Percentage Chart Lecturers based on the origin of the department

From Figure 5 shows that the number of respondents who filled out the highest questionnaire from lecturers in the Department of Management and Informatics. Respondents from Management lecturers were 21%. While Informatics lecturers are as much as 18%. For the Department of Chemical Engineering and Logistics Engineering, 12% is quite balanced. And the respondents from the Agriculture Industry Technology were the least number, namely 1 person (2%). Furthermore, judging from the age of the lecturer respondents, it is determined as shown in Figure 8.

Figure 9. Respondents Percentage Chart Lecturer by Year of the Force

From Figure 8 shows that the lecturer respondents are at most 72% from the age of 25-30 years. And as many as 26% from 31-35 years old.

3.2 Measurement Model Analysis

32.1. Evaluation of Measurement Model (Outer Model)

There are three criteria in using data analysis

techniques using SmartPLS to test the validity and reliability (Outer Model), namely Convergent Validity, Discriminant Validity and Composite Reliability.

3.2.2. *Convergent Validity*

This value will be accepted if the value of the loading factor is above 0 , 7 . However, the loading factor value that ranges between 0, 5 and 0.6 would be considered sufficient. Conversely, if the value of the loading factor is less than 0.5, then it is removed from the model [3] .

Table 11. Outer Loading of Student Respondents

Indicator	X_1	X_2	X_3	X_4	Y_1	Y_2
cont1	0.665					
cont2	0.748					
cont3	0.686					
cont4	0.563					
cont5	0.734					
cont6	0.704					
cont7	0.688					
cont8	0.679					
cont9	0.626					
cont10	0.568					
hub1		0.822				
hub2		0.883				
hub3		0.664				
hub4		0.788				
kteks1			0.818			
kteks2			0.783			
kteks3			0.802			
kteks4			0.830			
kteks5			0.788			
kteks6			0.654			
kteks7			0.670			
int1				0.687		
int2				0.813		
int3				0.831		
int4				0.863		
int5				0.776		
int6				0.871		
int7				0.865		
int8				0.851		
int9				0.844		
KPM1					0.905	
KPM2					0.912	
KPM3					0.938	
KPM4					0.933	
KPM5					0.911	
TPSI1						0.876
TPSI2						0.865
TPSI3						0.808

Based on *Outer Loading*in Table 1 , it can be concluded that the value of the *loading factor* is greater than 0 , 5 . This means that it meets the criteria of*convergent validity* and can be declared valid.

Table 12. Outer loading Testing stage 3 Respondent Lecturer

Indicator	X_1	X_2	X_3	X_4	Y_1	Y_2
cont1	0.899					
cont2	0.802					
cont3	0.769					
cont4	0.699					
hub1		0.847				
hub2		0.876				
hub4		0.770				
kteks1			0.878			
kteks2			0.878			
kteks3			0.921			
kteks4			0.911			
kteks5			0.713			
int1				0.640		
int2				0.882		
int3				0.875		
int4				0.810		
int5				0.769		
int6				0.776		
int7				0.915		
int8				0.796		
int9				0.798		
KPD1					0.834	
KPD2					0.875	
KPD3					0.933	
KPD4					0.949	
KPD5					0.929	
TPSI1						0.897
TPSI2						0.947
TPSI3						0.925

Based on Outer Loading in Table 2 , testing has been carried out three times, namely:

- The first stage of testing, there are several indicators whose values are invalid or below 0 , 5, namely cont5, cont6, cont7, cont8, cont9, cont10, hub3, and kteks7. Then the indicator must be removed from the model.
- The second stage of testing , there are indicators whose values are invalid or below 0 , 5, namely kteks6. Then the indicator must be removed from the model.
- The third stage of testing, the value of the loading factor is greater than 0.5. This means that it meets the criteria of convergent validity and can be declared valid.

The test of convergent validity is to look at the value of Average Variance Extracted (AVE). The indicator is considered to have good convergent validity if it has an AVE value of more than 0,5 . AVE accrual values can be seen in Table 5 and Table 6.

Table 13. Student Respondent Convergent Validity

Proxy variable	Average Variance Extracted (AVE)
X_1	0.447
X_2	0.630
X_3	0.587
X_4	0.679
Y_1	0.846
Y_2	0.723

Based on Table 3 indicates that the value of Average Variance Extracted (AVE) variable X_1 is0.447. This means that convergent validity on X_1 otherwise not well / not valid.

Table 14. Convergent Validity Responden Dosen

Variabel Proksi	Average Variance Extracted (AVE)
X_1	0,633
X_2	0,692
X_3	0,746
X_4	0,657
Y_1	0,819
Y_2	0,853

Based on Table 4 shows that the value of Average Variance Extracted (AVE) is more than 0.5. This means that the convergent validity of all variables is declared valid.

3.2.3 Discriminant *Validity*

Discriminant validity of the measurement model with reflexive indicators is assessed based on cross-loading measurements in the construct. The criterion in cross-loading is that each indicator that measures its construct must be correlated higher with its extract compared to other constructs [7]. The following table shows the Cross-loading value that each indicator has.

From the results of the analysis all proxy variables already have good*discriminant validity*. Then it can be concluded that the test of *discriminant validity validity* has been fulfilled, and can be declared valid.

3.2.3. Composite Reliability

The construct reliability test is done by measuring two criteria, namely composite reliability and cronbachalpha. Construct declared reliable if the value of composite reliability and Cronbach alpha above 0.7. The reliability composite test results and *cronbach alpha* are found in Table 7 and 8. From the tables that are presented, all variables can have *compositereliability* and *cronbach alpha* abo ve 0,7. So that everything is said to be reliable.

Table 15. Test the Reability of the Student Respondent construct

Proxy variable	Composite Reliability	CronbachsAlpha
X_1	0.889	0.862
X_2	0.871	0.801
X_3	0.908	0.881
X_4	0.950	0.940
Y_1	0.965	0.954
Y_2	0.886	0.808

Table 16. Test the Resability of the Respondent's Construct Lecturer

Proxy variable	Composite Reliability	Cronbach's Alpha
X_1	0.873	0.808
X_2	0.871	0.778
X_3	0.936	0.912
X_4	0.945	0.933
Y_1	0.958	0.944
Y_2	0.945	0.915

From Tables 5 and 6 presented, it can be seen that all variables have *composite reliability* and *cronbach alpha* above 0.7. Then all variables are said to be reliable.

3.3. Evaluation of Structural Models (Inner Model)

After testing the measurement model (outer

model) the next step is testing the structural model (inner model) where to find out whether the hypothesis can be accepted or rejected through the Bootstrapping process [7] .

Bootstrapping is intended to minimize abnormal problems in the research data. This study will use a significant value (α) of 0.1 or 10%.

Table 17. Path Coefficient Estimation in Student RespodentStructural Model

Path diagram	Estimation	P-Value	Conclusion
X 1 → Y 1	0.145	0.005	Significant
X 2 → Y 1	0.178	0,000	Significant
X 3 → Y 1	0.085	0.065	Significant
X 4 → Y 1	0.551	0,000	Significant
Y 1 → Y 2	0.628	0,000	Significant

Based on Table 7, that constructs at X 1 , X 2 , X 3 , and X 4 with User Satisfaction (Y1) as well as constructs of User Satisfaction (Y1) with the Purpose of Using Information Systems (Y2) are stated <0.1, so that these constructs have a significant effect.
From the original sample value or estimated coefficient that all variables have a positive effect. Only X 3 to Y 1 has a weak influence weighing 0.065.

Table 18. Path Coefficient Estimation in the Structural Model of Respondents of Lecturers

Path diagram	Estimation	P-Value	Conclusion
X 1 → Y 1	0.043	0.754	Not significant
X 2 → Y 1	0.327	0.028	Significant
X 3 → Y 1	0.155	0.420	Not significant
X 4 → Y 1	0.449	0,000	Significant
Y 1 → Y 2	0.427	0.004	Significant

Based on Table 12, that constructs at X 2 and X 4 with User Satisfaction (Y1) as well as constructs of User Satisfaction (Y1) with the Purpose of Using Information Systems (Y2) are stated <0.1, so that constructs have an effect significant. Constructions X 1 and X 3 with satisfaction User (Y1) has no significant effect .

From the original sample value or the estimated coefficient only X2 to Y1 , X4 to Y1 and Y1 to Y2 which have a positive influence. Only X1 to Y1 and X3 to Y1 has a weak influence with a weight of 0.754 and 0.420.

3.4. Overall Summary Results

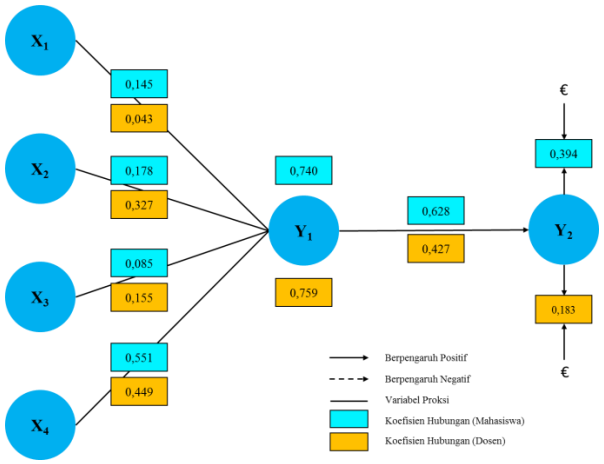


Figure 10. Research Results Model

Information:
X : Information Quality SI SKEM
X_1 : "Content" Proxy Variable
X_2 : Proxy "Connection" variable
X_3 : "Contextual" proxy variable
X_4 : "Interaction" proxy variable
Y_1 : Student / Lecturer User Satisfaction
Y_2 : Purpose of Using Information Systems
€ : Error (*Error*)

Table 19. Summary of Hypothesis Testing

Premise	Hypothesis		Results
Premise 1	H 1	There is a positive influence between the quality of information (Content, Connection, Context and Interaction) on the SKEM with student user satisfaction.	Be accepted
Premise 2	H 1	Student user satisfaction influences the purpose of using SI SKEM.	Be accepted
Premise	H 1	There is a positive	Be

Premise	Hypothesis		Results
3		influence between the quality of information on the SI SKEM and student user satisfaction.	accepted
Premise 4	H_1	Lecturer user satisfaction influences the purpose of using SK SK.	Be accepted

4. CONCLUSION

From the results of the evaluation study of the satisfaction of SI SKEM at the University of XYZ, we can conclude the following: The quality of information has an effect on student user satisfaction of 0.740. As well as the quality of information has an effect on lecturer user satisfaction of 0.759. And the recommendation given is that there is a need to socialize the use of XYZ University SKEM SI to students and lecturers. And the development of systems that can facilitate users.

Based on the results of the study, suggestions that can be submitted for further research include:

a. The need for adding question indicators to the questionnaire so that the assessment and user needs can be explored in more detail.

b. The need for deeper evaluation to find out the causes of the not significant relationship between variables.

c. Need further research on other factors and the addition of indicators that can affect user satisfaction to continue using SI SKEM.

d. Addition of sample numbers of student respondents. If the greater the amount of data taken, the higher the accuracy of the analysis produced.

REFERENCES

A. Kasanah, "Use of Structural Equation Modeling Methods for Analysis of Factors with Libraries with Lisrel 8.80 Program," pp. 1–150, 2015.

A. Rifai, "Partial Least Square-Structural Equation Modeling (PLS-SEM) To Measure Expectation Of The Use Of Institution Repositories (Pilot Study In UIN Syarif Hidayatullah Jakarta)," vol. 14, pp. 56–65, 2015.

I. Ghozali, I. Ulum, and A. Chariri, "Intellectual Capital and Corporate Financial Performance; An Analysis with a Partial Least Squares Approach, " *J. Account. and Investment* , vol. 19, no. 19, pp. 23-24, 2008.

K. Apostolidis, A. Tsolaki, T. Aslanidis, E. Pavlou, G. Koutsoumis, and E. Kontopoulos, "Sleep disorders following brain injury in school aged children - presentation of a Greek survey study," *Open Sci. J. Clin. Med.* , vol. 3, no. 4, pp. 153–157, 2015.

M. Chae, J. Kim, H. Kim, and H. Ryu, "Information Quality for Mobile Internet Services: A Theoretical Model with Empirical Validation," *Spec. Sect. M-COMMERCE Inf. Qual. Mob. Internet Serv. A Theor. Model with Empir. Valid.* , 2002.

S. Devi, "Analysis Of The Effect Of Academic Information Systems (AIA) On User Satisfaction In Students Of Batam State Politechnic Business Management Department," no. March, 2016.

S. Yamin and H. Kurniawan, "New Generation Processes Research Data with Partial Least Square Path Modeling: Applications with XLSTAT Software, SmartPLS, and Visual PLS," *Jakarta: Salemba Infotek* , 2011.

PROPELLER BOSS CAP FIN AS ENERGY SAVING DEVICE IN NAVAL VESSEL

Achmad Baidowi[1], Achdri Fauzi Nugraha Oloan[1], Syafiudin[2], Amiadji[1]

[1]*Departement of Marine Engineering, Institut Teknologi Sepuluh Nopember, Surabaya 60111, Indonesia, email:ahmadbai@gmail.com*

[2]*National Ship Design and Engineering Center, Institut Teknologi Sepuluh Nopember, Surabaya 60111, Indonesia.*

ABSTRACT

PBCF is one of the performance improvement or energy saving device. The performance improvement includes thrust, torque and efficiency. This paper investigate the efect of pitch variation of NACA 16-06 foil on a B4-85 propeller. This paper evaluate the performance of pbcf if using 75° pitch angle. By using Computational Fluid Dynamic (CFD), the thrust, torque,efficieny and the vortex hub can be observed. The simulation results shows that PBCF is achieved the highest efficiency which is 0.45% %, and increases thrust 3.56 %, and torsion increase 3.13 % compared to propeller without PBCF. The fuel saved due to the installation of pbcf is 2.778% or around 1.609 ton per trip with 1200nm distance.

Keywords : *B4-85, Energy, Naca16, pbcf, thrust, torque*

1. INTRODUCTION

The demand of energy efficiency in maritime world is something inevitable, even though the military concept is sometimes prioritize the performance and speed. The scarcity of fossil based fuel, pollution and fuel price are drivers of energy efficiency. Recently, there are several development of energy efficiency devices which can be installed in a newly designed vessel or existing vessel. for existing vessel, the retrofit process requires technological selection ("Netherland maritime technology foundation, 2011). This process must identify the possibilities of retrofit technology for the vessel. Recently there are several options such as bulbous bow optimization, propeller optimization, propeller boss cap fin (PBCF) and other energy saving device technology (Brekke and Gr\a esdal, 2015) (Chen et al., 2018)

Fig.1 Retrofit Technological Selection
(Brekke and Gr\a esdal, 2015)

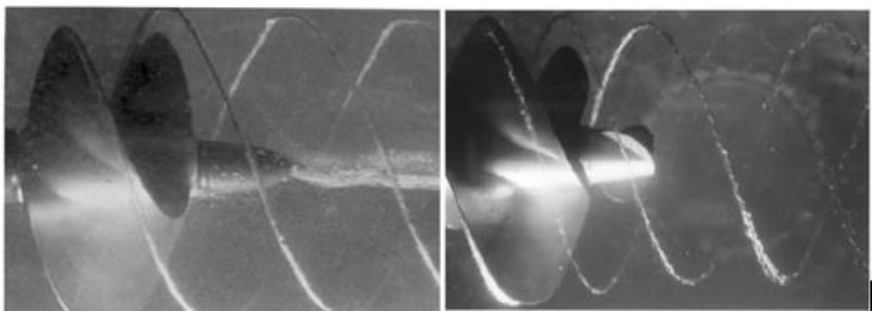


Fig.2 Vortex hub and PBCF

Economic analysis of selected possible technology must be evaluated. Since the early purpose of the retrofit is energy efficiency and operating cost, the cost and benefit of selected technology should provide robust information for the decision making process (Bouman et al., 2017) (Armstrong and Banks, 2015)

This paper focus on the application of PBCF as the selected technology and the performance evaluation. The performance evaluation includes thrust, torque before and after PBCF installation using Computational Fluid Dynamic (CFD). The working principal of pbcf is to reduce the vortex hub formed by the propeller boss and convert the vortex to additional thrust using fin installed at the end of the propeller hub as can be seen in Fig.2 (Mizzi et al., 2017) .

There are several method of design optimization pbcf. Several research has studied the variation of pitch of flat pbcf (Seo et al., 2016), fin chord variation (Seo et al., 2016), and at 70° pitch angle using naca 16-06 foil as pbcf. (Amiadji et al., 2018)

This paper focuses of the usage of naca 16-06 foil as pbcf at pitch angle of 75°. Besides the performance analysis, this paper also provides economical analysis based on fuel consumption and thrust obtained from the CFD result.

2. METHOD

This paper uses naca 16-006 foil as the fin of the PBCF, and installed in a B4-85 series propeller. The complete data of the propeller as follows

Diameter	= 3262 mm
P / Db	= 0.840
Ae / Ao	= 0.45
Rake	= 15 Deg
Blade Section	= B – Series
Number of Blade	= 4
Speed	= 210 Rpm

While the principal dimension of the vessel are LOA 117.2 m, LWL 111.24m, LBP 108m, B 17.2m, H 12.01m, Draft 4.5m, Cb 0.547. max speed 17.5 knots. The vessel is powered by 8 cylinder 6400HP/4772kW diesel engine, sfoc 177gr/kWh.

The pitch angle of the cap fin is 70°, the dimension of the fin used in this paper can be shown in **Table 1.**The variation is based on the pitch angle which can be shown by Fig 3. In order to analyze the model built in CFD, the domain must be determined, the domain calculations based on the diameter of the propeller. The length of the domain is 8D, 8x3.262=26.096m, the diameter of the domain is 6D = 6 x 3.262 m = 19.572 m

And the distance from the inlet wall is 2D = 2 x 3.262 m = 6.524 m

Flow setting of the simulation is using k-ω SST for turbulence model. The total number of the cell for propeller without PBCF is 2,604,431 with 2,844,566 vertices. The meshing quality propeller with pbcf is 3,279,982 cells and 3,593,238 vertices.

3. RESULTS AND DISCUSSION

3.1. Performance of Propeller

The performance of the original propeller can be shown by Table 2. The highest thrust is at 433.252kN for J 0.1 followed by 413.46 for J 0.2. For the efficiency of th B4-85 propeller with diameter 3262mm is varied from 0.12 to 0.585. The torque (Q) of the original propeller is start from 187.774 kNm 89.855 kNm along the J value 0.1 to 0.8.

The vortex of the original propeller can be shown by Fig.6. It can be observed that there is a vortex formed behind the propeller. The dimension of the bulb of the pbcf must be designed also. The hub of the pbcf is 1.2m in length and 0.326m in diameter as can be shown by Fig.5.

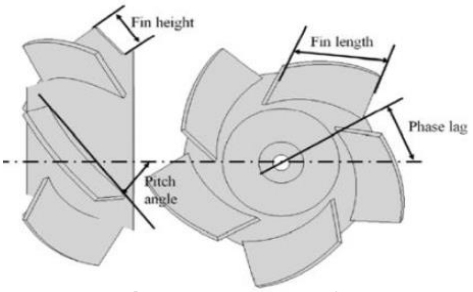


Fig. 3 Geometry of BCF

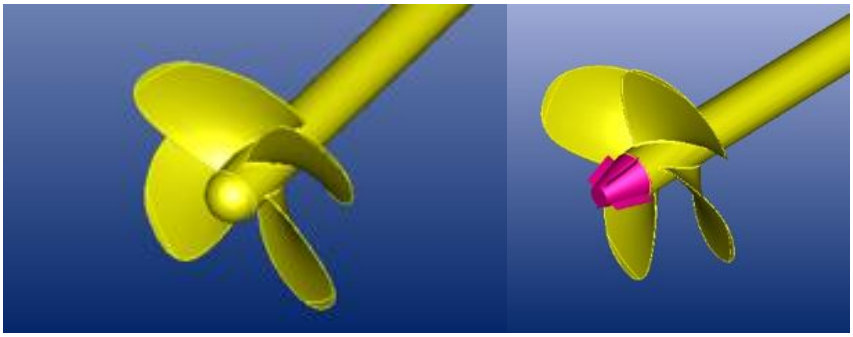


Fig. 4 3D model of B 4-85 Propeller (left) and PBCF (right)

Table 1. Specification Propeller Boss Cap Fins

Diameter	Number	Rotation	Revolution
(m)	Blade	(Direction)	(Rpm)
0.816	4	Left	210

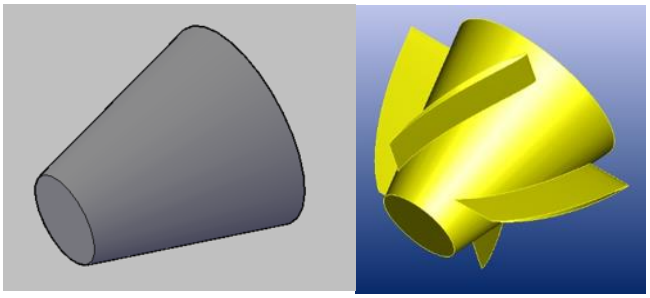


Fig. 5 PBCF Hub and PBCF with 70° Pitch angle

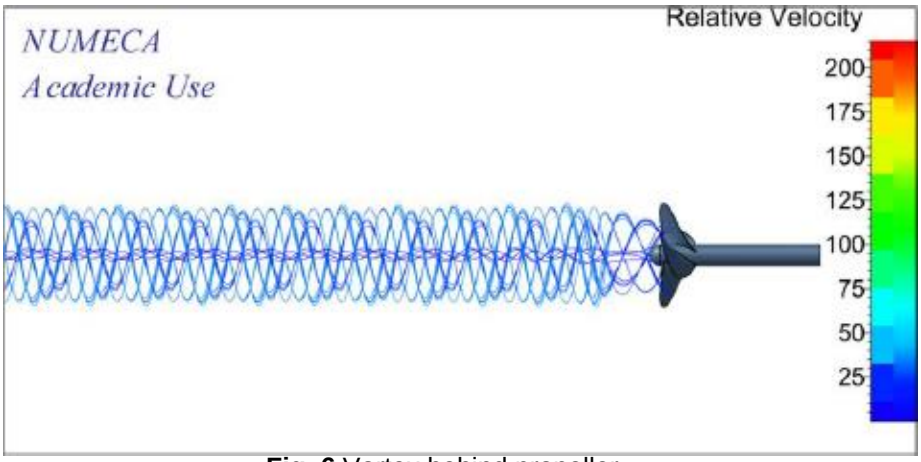


Fig. 6 Vortex behind propeller

Table 2. Characteristic of B4-85 without PBCF

	No PBCF B4-85			PBCF B4-85 pitch 75			Difference		
J	**η_0**	**T (kN)**	**Q (kNm)**	**η_0**	**T (kN)**	**Q (kNm)**	**$\Delta\eta_0$**	**ΔT (kN)**	**ΔQ (kNm)**
0.1	0.12	433.252	187.774	0.12	438.766	190.093	0.04%	1.26%	1.22%
0.2	0.237	413.46	181.564	0.237	419.486	184.073	0.07%	1.44%	1.36%
0.3	0.346	371.775	167.275	0.348	380.445	170.528	0.38%	2.28%	1.91%
0.4	0.446	322.804	150.224	0.45	332.463	153.661	0.68%	2.91%	2.24%
0.5	0.537	270.994	131.064	0.537	278.377	134.655	-0.02%	2.65%	2.67%
0.6	0.599	211.736	110.122	0.603	220.61	114.058	0.59%	4.02%	3.45%
0.7	0.628	151.498	87.737	0.635	160.689	92.027	1.11%	5.72%	4.66%
0.8	0.585	89.855	63.811	0.589	97.877	69.021	0.70%	8.20%	7.55%
							0.45%	3.56%	3.13%

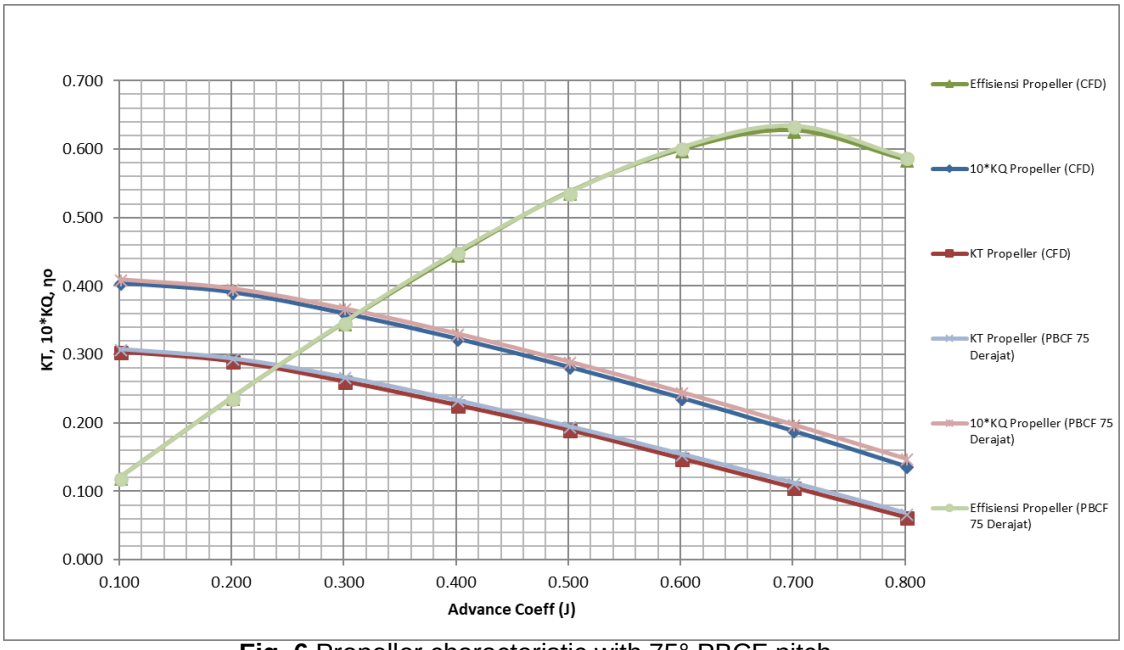


Fig. 6 Propeller characteristic with 75° PBCF pitch

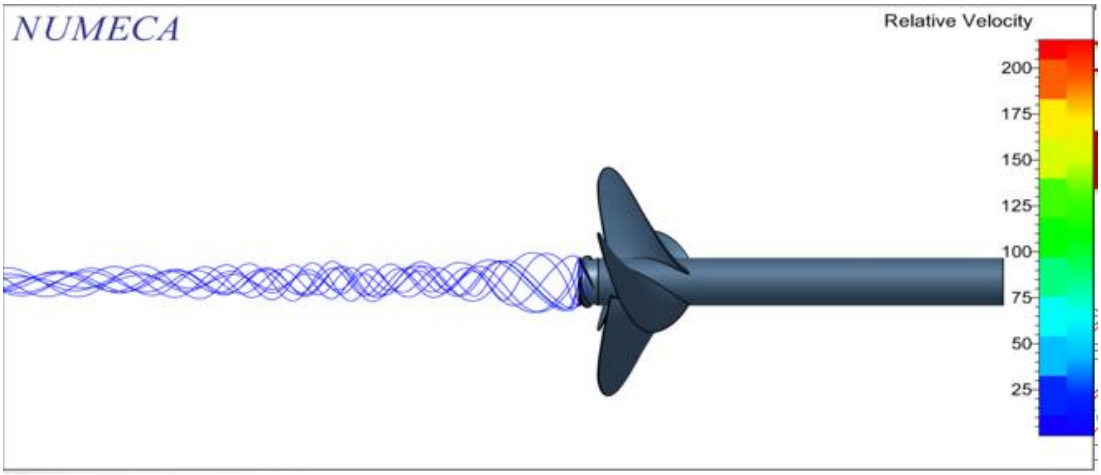


Fig. 7 Vortex phenomena with 75° PBCF pitch

The results of the performance analysis shows that the installation of PBCF have varied results depend on the J number. Table 2. Indicated that the efficiency of the propeller increased along the increase of the J number. The value of the η increases regularly from J 0.1 untill 0.4 (0.04% to 0.68%), but there are several anomaly from J 0.5 to 0.8. but the average of the η increases 0.45% due to the installation of PBCF.

While the value of the value of the η has anomaly, the value of the Thrust (T) and Torque (Q) increases along the increase of the J. The maximum thrust increases 8.20% at J 0.8 and average of the thrust is increase 3.56%. And the maximum increases of the torque (Q) is 7.55% at J 0.8 while the average value of the torque increases 3.13% compared to B4-85 series without PBCF.

The CFD simulation analysis shows that the PBCF able to reduce the vortex hub behind the propeller. This may lead to create additional thrust since the fin of the pbcf acting as additional propeller for the original propeller.

3.2. Economic Analysis

As case study of energy saving, the analysis conducted for a vessel with principal perpendicular as shown in Table 3, and the engine specification as shown at table 4.

For the constant engine power and SFOC, the result of additional thrust due to PBCF is the increase of speed. The additional thrust gives additional force to move the vessel. It's means that the vessel operates at different J value. Therefore, increase the J value while the propeller RPM constant, indicate the increase of vessel speed. As shown at graphic below, the additional of PBCF, gives a 0.5 knot additional speed.

Without PBCF, the vessel will run about 17.5 knot and spend 68.57 hours for 1200 nm distance. Meanwhile, using PBCF the vessel will run at 18 knot and spend 66.67 sailing hours for the same distance. The installation of PBCF do not change the engine output power, therefore do not change the fuel rate, because the engine load still the same. With less sailing hour, the fuel consumption reduced about 1.609 ton per trip or about 2.778% reduction.

Table 3. Vessel specification for case study

Vessel Data		
LOA	117.2	m
LWL	111.24	m
LPP	108	m
Breadth (B)	17.2	m
Depth (H)	12.01	m
Draught (T)	4.5	m
Cb	0.547	
Cp	0.652	
Speed (Vs)	17.5	knot
Wake Fraction (w)	0.326	
Operational	1200	nm

Table 4. Engine specification

Engine Data		
Brand	Hitachi Zosen - B&W	
Type	8L35MC	
Power	4772	kW
Unit	3	
Number of Cylinder	8	
Bore	350	mm
Stroke	1050	mm
RPM	210	rpm
SFOC	177	g/kWH
Fule rate	0.84464	Ton/H

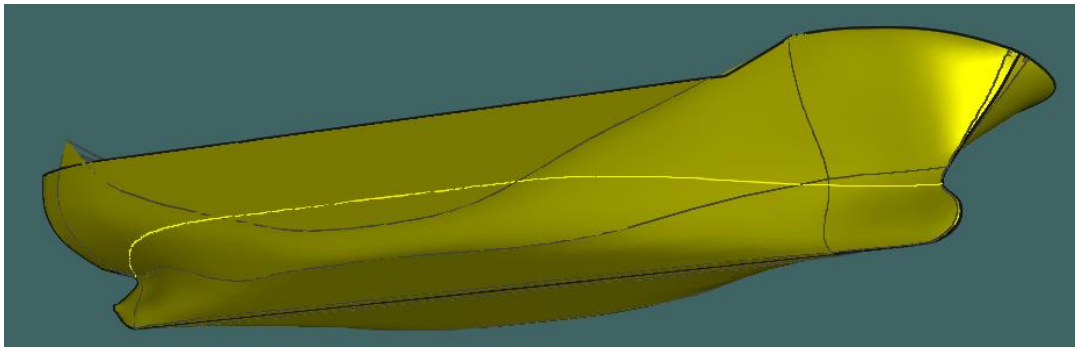


Fig.8 Vessel's Hull

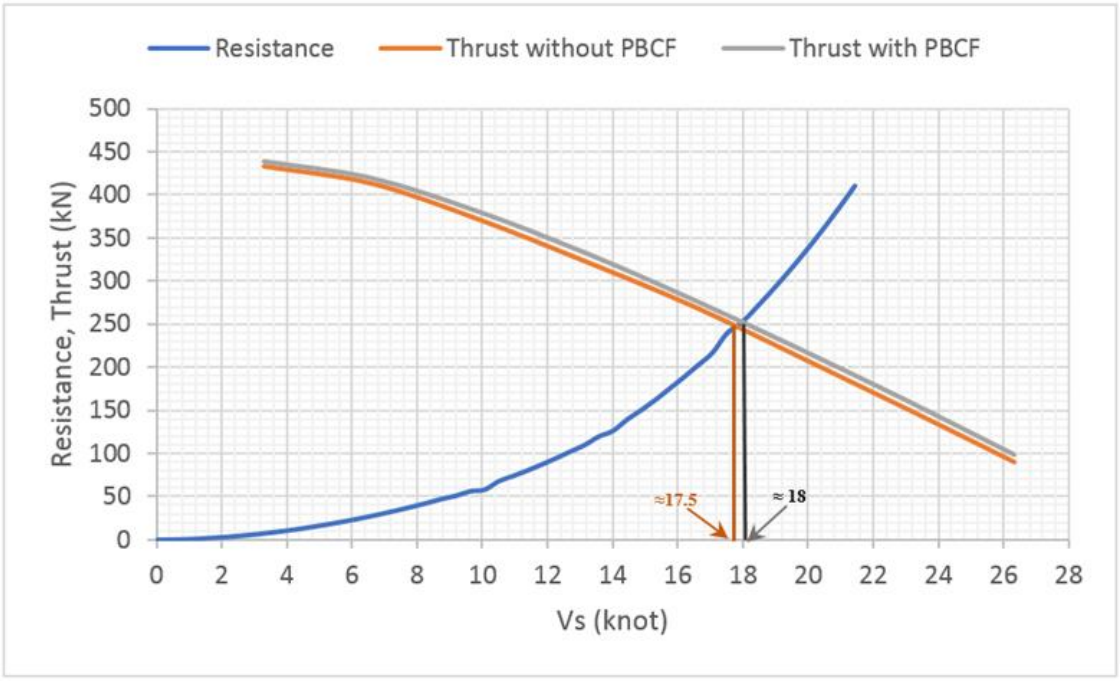


Fig. 9 Hull propeller interaction with and without PBCF

4. CONCLUSION

The installation of PBCF using NACA 16-06 fin as the fin with pitch angle of 75° able to increase the efficiency of the propeller 0.45% in average, while the increase of the thrust is 3.56% in average and the torque around 3.13% in average for B4-85.

The economic analysis shows that there is a increment in speed and reduction in sailing hours for mentioned vessel. 1200 nm distance and using the PBCF, the fuel reduction is about 1.6 ton per trip or about 2.778% fuel reduction.

REFERENCES

Amiadji, A., Baidowi, A., Oloan, A.F.N., 2018. The Effect of Boss Cap Fins to B–Series Propeller Performance With CFD Method. Int. J. Mar. Eng. Innov. Res. 2.

Armstrong, V.N., Banks, C., 2015. Integrated approach to vessel energy efficiency. Ocean Eng. 110, 39–48.

Bouman, E.A., Lindstad, E., Rialland, A.I., Strømman, A.H., 2017. State-of-the-art technologies, measures, and potential for reducing GHG emissions from shipping–a review. Transp. Res. Part Transp. Environ. 52, 408–421.

Brekke, F.Ø., Gr\a esdal, E., 2015. An assessment of optimal investment decision for emission control compliance for Odfjell SE: comparison of traditional DCF valuation and Real Option valuation as decision tools (Master's Thesis).

Chen, H., Tang, T., Ait-Ahmed, N., Benbouzid, M.E.H., Machmoum, M., Zaim, M.E.-H., 2018. Attraction, Challenge and Current Status of Marine Current Energy. IEEE Access 6, 12665–12685. https://doi.org/10.1109/ACCESS.2018.2795708

Mizzi, K., Demirel, Y.K., Banks, C., Turan, O., Kaklis, P., Atlar, M., 2017. Design optimisation of Propeller Boss Cap Fins for enhanced propeller performance. Appl. Ocean Res. 62, 210–222.retrofit-project-final-report-final.pdf, n.d.

Seo, J., Lee, S.J., Han, B., Rhee, S.H., 2016. Influence of design parameter variations for propeller-boss-cap-fins on hub vortex reduction. J. Ship Res. 60, 203–218.

APPLICATION OF TECHNOMETRY METHODS TO MEASURE TECHNOLOGICAL ASPECTS IN AN ORGANIZATION (CASE STUDY: SHIPYARD)

Sutikno Wahyu Hidayat, Avando Bastari, Erpan Sahiri

Indonesian Naval Technology College, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia

ABSTRACT

Today the development of technology and industry is increasingly rapid. It requires facilities and infrastructure that can accommodate the speed of technological and industrial developments. In the context of advancing the economy and equitable development in an island area, it requires transportation facilities to distribute agricultural, fishery and industrial products from one island to another. So that it can use ships as an alternative transportation. Ships as the main means of shifting logistics have a very vital role, so a shipyard is needed that can guarantee the readiness of ships and also to absorb labor in the area. The purpose of this study was to determine the level of technology contained in the whale and shark shipyards, then to give a proposal to the whale and shark shipyards, based on the value of the lowest contribution of technological components. The whale and shark shipyards are two of the many shipyards located in these islands, the Whale Shipyard is a shipyard that has expanded by receiving repairs from other regions or countries, while the Shark Shipyard is a shipyard whose market share is still local. The technometric method is a method used to determine the classification of technology by dividing it into four components, namely technoware, humanware, infoware, and organware that are mutually integrated, which will then be produced TCC (Technology Contribution Coefficient) value which is used to determine the level of technology applied. Based on the results of research on the Whale shipyard, the contribution of the four components of technology is 0.52 technoware, 0.67 humanware, 0.43 infoware, 0.63 organware which means the technology classification is within reasonable limits, while Shark shipyard is 0.32, humanware is 0.42, infoware of 0.25, organware of 0.47 which means that the classification of technology is at a low limit, from the results the lowest contribution value for Hiu shipyard is infoware.

Keywords: *Shipyard, TCC, technometrics.*

1. INTRODUCTION

Today the development of technology and industry is increasingly rapid. It requires facilities and infrastructure that can accommodate the speed of technological and industrial developments. In the context of advancing the economy and equitable development in an island area, it requires transportation facilities to distribute agricultural, fishery and industrial products from one island to another. So that it can use ships as an alternative transportation. For this reason, we need a shipyard that can guarantee the readiness of ships and also to absorb labor in the area. The purpose of this study was to determine the level of technology contained in the whale and shark shipyards, then to give a proposal to the whale and shark shipyards, based on the lowest contribution value of technology components by comparing the calculation of technological content in whale and shark shipyards based on calculations using the technometric method which divides technology into 4 components including technoware, humanware, organware, and infoware. Knowing the level of classification and level of technology in whale and shark shipyards and making efforts to increase the technological content of the components of technology that have the lowest contribution, by implementing technology.

In the writing of this journal is also used a lot of literature as a reference to support the research conducted, such as including the following: Magic of Creativepreneur: Bagaimana Anda Bisa Menjadi inovatif Secara Ajaib dan Menjadi Seorang Bisnis

Enterpreneur Sukses dalam Dunia Industri Ekonomi Kreatif (Delee, 2012), Analisis Pengaruh Komponen Teknologi Technoware, Humanware, Inforware, dan Organware Terhadap Faktor Utama Daya Saing Industri Kecil (Indrawati, 2003), Analisis kontribusi komponen teknologi (*technoware, humanware, infoware, orgaware*) pada perusahaan jasa transportasi dengan pendekatan model Teknometri (Yanthi, 2018), Analisis Performansi Sophisticated Technology Melalui Pendekatan model teknometrik (Sandora R, 2008), Analisis Hubungan Komponen *Technoware*, *Humanware*, *Inforware* dan *Organware* Dengan Kepuasan Karyawan Yang Dimodetor Gaya Kepemimpinan Di PT. Ecogreen Oleochemicals Medan", *Tesis*. Universitas Sumatera Utara (Sabardi, 2008), Analisis Kandungan Teknologi 3G Pada Layanan Telkomsel Flash Dengan Metode Teknometrik di PT. Teklomsel Jakarta Selatan (Sultan, 2017). Technology Atlas Project : Aan Overview of the Framework for Tevhnology-based, Development Economic and Social Commision for Asia and Pasific (ESCAP, 1989), Manajemen Transportasi dalam Kajian dan Teori (Andriansyah, 2005), Assesment teknologi proses produksi press tool di pt. kenza presisi pratama dengan pendekatan teknometrik (Arsyad A, 2005), Penilaian Tingkat Teknologi DOK Pembinaan UPT BTPI Muara Angke Jakarta (Fauzan A, 2009), The Assesment of Technology in Supporting Industry Located at Tegal Industrial Park (Wiraatmaja, 2004), Management of Technology (MS, 1987), Penilaian Teknologi Mengunakan Analytical Hierarchy Process dan Teknometrik di Departemen Produksi (Cahyono, 2015), ICT in multimodal transport and technological trends: Unleashing potential for the future (Harris I, 2015). 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/METHODOLOGY.

The whale and shark shipyards are two of the many shipyards located in these islands, the Whale Shipyard is a shipyard that has expanded by receiving repairs from other regions or countries, while the Shark Shipyard is a shipyard whose market share is still local. The technology in it will be approached by a technometric approach method. The technometric method is a method used to determine the classification of technology that is applied by dividing it into four components, namely technoware, humanware, infoware, and organware that are integrated with each other, which then results from the calculation of the four components will result in TCC (Technology Contribution Coefficient) which is used to determine the level of technology applied by whale and shark shipyards. According to UNESCAP (1989), there are five steps to estimating the values of T, H, I, O, βt, βh, βi, βo as follows.

a. Estimated degree of sophistication The value of the degree of sophistication shows the level of sophistication of each component of technology that will be calculated based on the results of observations and interviews in the field.

b. Assessment of state of the art (SOTA) Determination of technological components of the state of the art requires in-depth technical knowledge (Hany, 2000). The approach to completing state of the art technology components is based on generic criteria, with the determination of a score of 10 on each criterion.

The formula of the state of the art is

$$S = \frac{1}{10}\left[\frac{\sum k\ tik}{kt}\right] \quad \text{.....(1)}$$

Where:

S : state of the art

Kt : Number of component criteria

K : 1, 2, ……., kt

T*ic*k : The first criterion value of the technology component.

c. Determination of component contributions This step is done by using the values obtained in the previous step, namely the degree of sophistication and rating of the state of the art. The resulting value is the contribution value of each component of technology that will be used in the calculation of TCC.

The formula is as follows:

$$K = [L + S (U - L)] \quad .....(2)$$

Where:

K : Contribution of components

U : The upper value of the degree of sophistication of the component

L : Value lower level of component sophistication

S : The value of the state of the art.

d. Determination of the intensity of component contributions This step is done by doing a pairwise comparison matrix, such as using AHP and other methods.

e. TCC (Technology Contribution Coefficient) Calculation Based on the values of T, H, I, O and β values that have been obtained in the previous step, then the coefficient of technological contribution can be calculated, with the maximum value of TCC being one. The formulas for TCC calculations are:

$$TCC = T\beta t \times H\beta h \times I\, \beta i \times O\, \beta o \quad .....(3)$$

Where:

TCC

H : Value of contribution of humanware components.

I : Value of contribution of infoware components

O : Value of contribution of organware components

βt : Value of intensity of technoware contributions

βh : Value of the intensity of humanware contributions

βi : Value of intensity of infoware contributions

βo : Value of intensity of organware contributions

2.1. 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:

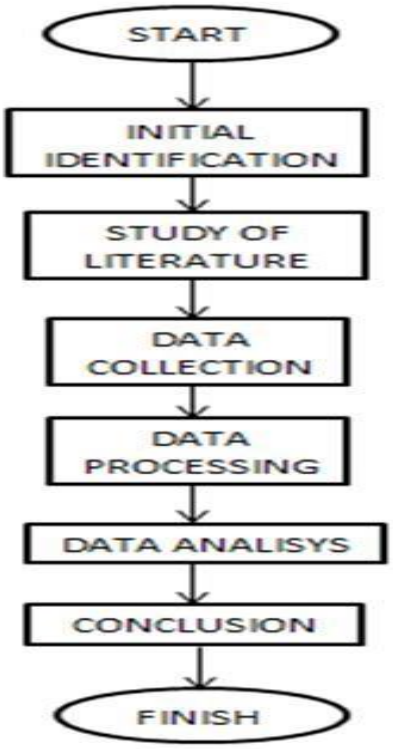


Fig. 2.1. Research Methodology Flowchart.

Target: the aim of this research is to produce a decision support system to find out the level of technology and provide proposals based on the value of the lowest contribution of technological components found in whale and shark shipyards. The stages can be explained as follows:

a. Defining the problem

Before a decision support system is built, problems in research must be precisely defined so that the results obtained are in accordance with the problems at hand.

b. Data collection.

Data collection was obtained by conducting a literature study of the technometric methods used in the study to find out the level of technology from several literatures such as journals, books and other

scientific sources related to and relevant to research.

c. Identification and processing of data at this stage identification and processing of data that has been obtained will be carried out.

d. System Analysis and Design Perform analysis and system design according to the problems that have been identified. The technometric method is to find out the level of technology.

e. System Implementation.

At this stage, the system will be implemented in accordance with the concepts that have been prepared in the previous stage. The last step provides suggestions for improvement and conclusion.

3. RESULT AND DISCUSSION.

3.1. Technology level measurement

The measurement of the level of technological aspects in the shipyard uses a scoring method based on the subjective assessment of the experts who have worked for a long time in the research location on several criteria including technoware, humanware, infoware, and organware components. After getting the score for each component, then it is processed so that the contribution value of each criterion is obtained by using the technometric model. The technometric model is used to get the TCC (Technology Contribution Coefficient) value. Based on the formulation of the problem, the author will only compare two shipyards, namely the whale shipyard (outside market share), and sharks (local market share) to find out how far the technological aspects are applied to the two shipyards, then after that the shipyard is determined ships whose marketing is still local in order to be able to carry out repairs on ships from regions or outside countries as well, in terms of the technological aspects applied.

3.2. Data of Respondents

Data of respondents interviewed came from Whale and Shark Shipyard workers. The number of respondents who have been studied is 13 respondents.

a. Whale shipyard. Data collection is done to calculate the technological content applied by the shipyard. The respondent data on the measurement of the application of Whale shipyard technology can be seen in table 1. The following.

Table 1. Respondents' data on the measurement of the application of Whale shipyard technology

NO	NAME	GENDER	AGE	LENGTH OF WORK	DEPARTEMENT
1	Santoso	Man	40	33	Business Owner
2	Setiawan	Man	40	25	Infrastructure
3	Totok	Man	34	15	Docking
4	Yusuf Mansyur	Man	40	10	Machine
5	Heriyanto Wibowo	Man	37	10	Painting
6	Fitriana Cahyani	Woman	31	9	Office
7	Ana Putri	Woman	45	4	Materials
8	Eko Wibisono	Man	38	3	Checking
9	Endang	Woman	45	3	Treatment Product

b. Shark Shipyard. Data collection is done to calculate the technological content applied by the shipyard. The respondent data measuring the application of Shark shipyard technology can be seen in table 2. The following.

Table 2. Respondents' data on the measurement of shark shipyard technology

NO	NAME	GENDER	AGE	LENGTH OF WORK	DEPARTEMENT
1	Rina	Woman	46	25	Business Owner
2	Budiono	Man	47	25	Docking
3	Agustina	Woman	27	5	Machine
4	Sudarmin	Man	46	2	Infrastructure

3.2.2. Results and Measurement Analysis of Technology Aspects.

From some of the respondents' samples taken from both shipyards whose market share has gone

international and that is still local, the values obtained are part of the TCC (Technology Contribution Coefficient) calculation, while the values obtained are as follows:

a. Estimated degree of sophistication

1) Technoware

Table 3. Results of assessment of the sophistication of technoware

NO	DEPARTMENT	WHALE SHIPYARD		SHARK SHIPYARD	
		LOWER	UPPER	LOWER	UPPER
1	INFRASTRUCTURE	3	7	2	4
2	DOCKING	2	5	2	3
3	MACHINE	3	4	2	3

The use of tools or machinery in shipyards with a local market share is still very low, using only manual production equipment and some tools used are traditional equipment and so on, while at the Whale shipyard which is a shipyard whose market share has gone international, the level the highest production equipment used is sophisticated and automatic equipment.

2) *Humanware*

Table 4. Results of assessment of humanware sophistication

NO	DEPARTMENT	WHALE SHIPYARD		SHARK SHIPYARD	
		LOWER	UPPER	LOWER	UPPER
1	INFRASTRUCTURE	2	8	2	6
2	DOCKING	2	6	2	4
3	MACHINE	2	7	2	5
DEGREE OF SOPHISTICATION		2	7	2	5

In the humanware section, the highest level for shark shipyards is that workers in the infrastructure section are able to repair damaged production equipment, with an upper 6 value, because equipment that is still at a standard level is different from the whale shipyard. This shipyard also has a level of humanware, namely workers in the infrastructure section are able to repair damaged production equipment, the points given are 8, because the equipment in the infrastructure section has a high level of complexity, and also because the production equipment used in the frame is a sophisticated type and automatic.

3) *Infoware*

Table 5. Results of assessment of infoware sophistication

NO	DEPARTMENT	WHALE SHIPYARD		SHARK SHIPYARD	
		LOWER	UPPER	LOWER	UPPER
1	BUSINESS OWNER	2	4	2	3
2	OFFICE	2	3	-	-
DEGREE OF SOPHISTICATION		2	4	2	3

In the Sharks shipyard, having a low inforware value of only 3, and also the expert who plays a role in the information section in the rattan industry is only the owner / owner, because there are no office or administrative parts, while the Whale shipyard is competent in the field information, with the existence of a website and a clear flow of information, so that shipyards are easily recognized by consumers.

4) *Organware*

Table 6. Results of assessment of the degree of sophistication of organware

NO	DEPARTMENT	WHALE SHIPYARD		SHARK SHIPYARD	
		LOWER	UPPER	LOWER	UPPER
1	BUSINESS OWNER	3	7	2	5
2	OFFICE	3	5	-	-
DEGREE OF SOPHISTICATION		3	6	2	5

The organware assessment was also won by the Pope's shipyard, because the organization in this company was very clear, the job desk was clear, while in the Sharks shipyard it was not so

concerned with the organization, because the workers in this shipyard were still family.

b. Assessment of state of the art (SOTA)

1) Technoware

Table 7. Calculation of SOTA Whale (International) and Shark (Local) shipyard technoware

NO	CRITERIA TECHNO WARE	WHALE SHIPYARD			SHARK SHIPYARD		
		INFRA STRUCTURE	MACHINE	FINISHING	INFRA STRUCTURE	MACHINE	FINISHING
1	SHIP TYPE	10	5	3	0	0	0
2	WORK TYPE	7,5	2,5	4	7,5	2,5	5
3	OPS TYPE	10	7,5	3	7,5	5	2,5
4	AVERAGE ERROR	10	10	9	10	10	10
5	FREQ. OF DOCKING TREATMENT	0	10	1	0	0	5
6	SKILL	5	5	8	5	5	5
7	INSPECTION	5	5	4	5	5	0
8	MEASURING WORKMANSHIP	0	0	0	0	0	0
9	WORK SAFETY & SECURITY	10	10	10	5	10	5
OVERALL AVERAGE		5,56			4,22		
RATING SOTA		0,556			0,422		

Based on table 7. above it is concluded that the rating value of SOTA (State of the Art) in the whale shipyard is greater than that of the shark shipyard. The rating value of SOTA for the assessment of technoware in the Sumber jaya Rattan industry is 0.556, while for the Sharks shipyard is 0.422.

2) Humanware

Table 8. Calculation of SOTA humanware

NO	CRITERIA HUMAN WARE	WHALE SHIPYARD			SHARK SHIPYARD		
		INFRA STRUCTURE	MACHINE	FINISHING	INFRA STRUCTURE	MACHINE	FINISHING
1	AWARENESS	10	10	10	10	0	5
2	DISCIPLINE	10	5	8	10	5	5
3	CREATIVE	5	5	3	5	5	5
4	MAINTAIN	10	10	7	5	5	5
5	TEAM WORK	10	5	7	5	5	5
6	SKILL	10	10	10	10	10	10
7	PROBLEM SOLVING	10	10	9	5	0	10
8	COOPERATION	10	10	6	5	10	5
9	LEADERSHIP	100	5	6	5	0	10
OVERALL AVERAGE		8,11			6		
RATING SOTA		0,811			0,6		

Based on table 8. above it is concluded that the rating value of SOTA (State of the Art) in the whale shipyard is greater than that of the Sharks shipyard. The rating value of SOTA for the assessment of humanware at the Whale shipyard is 0.811, while for shipyard Sharks is 0.6.

3) Infoware

Table 9. Calculations of SOTA infoware Whale Shipyards (International) and Sharks (Local)

NO	CRITERIA INFOWARE	WHALE SHIPYARD		SHARK SHIPYARD
		BUSINESS OWNER	OFFICE	BUSINESS OWNER
1	INFORMATION MANAGEMENT	5	5	0
2	INFORMATION TO EMPLOYEES	10	10	5
3	INFORMATION NETWORK	10	10	0
4	INFORMATION PROCEDURE	10	10	10
5	INFORMATION SYSTEM	10	10	0
6	INFORMATION STORAGE & RETRIEVAL	10	10	0
OVERALL AVERAGE		9,17		2,5
RATING SOTA		0,917		0,25

Based on table 9. above it is concluded that the rating value of SOTA (State of The Art) in the whale shipyard is greater than that of the Sharks shipyard. The rating value of SOTA for the infoware assessment at the whale shipyard is 0.917, while for the shipyard Shark is 0.25.

4) Humaware

Table 10. Calculation of SOTA infoware Whale shipyards (International) and Sharks (Local).

NO	CRITERIA ORGANWARE	WHALE SHIPYARD		SHARK SHIPYARD
		BUSINESS OWNER	OFFICE	BUSINESS OWNER
1	OTONOMY	10	10	10
2	VISION	10	10	10
3	THE CRAETIVE ABILITY OF THE ENVIRONMENT IS CONDUCIVE	5	10	5
4	ABILITY TO MOTIVATE EMPLOYEE	10	10	0
5	SHIPYARD CAPABILITY ADAPT TO CHANGING ENVIRONMENT	5	10	10
6	ABILITY TO COOPERATE WITH SUPPLIERS	10	10	10
7	ABILITY TO COOPERATE WITH CUSTOMERS	10	5	10
8	ABILITY TO GET OUTSIDE RESOURCES	5	5	5
OVERALL AVERAGE		8,75		7,86
RATING SOTA		0,875		0,79

Based on table 10. above it is concluded that the rating value of SOTA (State of the Art) in the whale shipyard is greater than that of the Sharks shipyard. The rating value of SOTA for the assessment of organware at the whale

shipyard is 0.875, while for shipyard sharks is 0.79.

c. Calculation of component contributions

1) Calculation of component contributions to the Pope's shipyard.

Table 11. Calculation of component contributions to the Whale shipyard

NO	COMPONENT	LIMIT		VALUE	VALUE
		LOWER	UPPER	SOTA	CONTRIBUTION
1	TECHNOWARE	3	6	0,56	0,52
2	HUMANWARE	2	7	0,81	0,67
3	INFOWARE	2	4	0,92	0,43
4	ORGANWARE	3	6	0,88	0,63

Based on the calculations in table 11. It is known that the highest contribution value in the whale shipyard is humanware with a contribution value of 0.67, and the lowest contribution value is infoware with a contribution value of 0.43.

2) Calculation of the contribution of components in the shark shipyard.

Table 12. Calculation of component contributions in Shark shipyard

NO	COMPONENT	LIMIT		VALUE	VALUE
		LOWER	UPPER	SOTA	CONTRIBUTION
1	TECHNOWARE	2	4	0,42	0,32
2	HUMANWARE	2	5	0,6	0,42
3	INFOWARE	2	3	0,25	0,25
4	ORGANWARE	3	5	0,75	0,47

d. Intensity calculation of component contributions In this step, the thing that is done is to compare the technological components in pairs and in the form of hierarchy, and the method used is the Analytic Hierarchy Process (AHP) method.

1) Whale shipyard.

Table 13. The results of the intensity calculation of the contribution of the components of the Whale shipyard

NO	COMPONENT	PAIRWAISE COMPARISON				WEIGHT	RANK
		TECHNO WARE	HUMAN WARE	INFO WARE	ORGA WARE		
1	TECHNOWARE	0,48	0,6	0,36	0,40	0,45	1
2	HUMANWARE	0,24	0,28	0,36	0,40	0,32	2
3	INFOWARE	0,12	0,07	0,09	0,07	0,09	3
4	ORGANWARE	0,16	0,1	0,18	0,13	0,14	4

Based on table 13. it can be concluded that the technoware component has the highest weight of 0.45, which means that the technoware component is the most important component for the whale shipyard, while the infoware component has a weight of 0.09 and is the lowest weight, which means that the infoware component does not get more attention from the company. This may be caused by various factors, such as websites with less optimal use, information on the use of tools that are not yet available, and other information that has not been delivered to workers.

2) Shark Shipyard.

Table 14. Results of the intensity calculation of the contribution components of the Sharks shipyard

NO	COMPONENT	PAIRWAISE COMPARISON				WEIGHT	RANK
		TECHNO WARE	HUMAN WARE	INFO WARE	ORGA WARE		
1	TECHNOWARE	0,29	0,3	0,31	0,42	0,32	2
2	HUMANWARE	0,57	0,52	0,46	0,42	0,49	1
3	INFOWARE	0,07	0,09	0,08	0,05	0,07	4
4	ORGANWARE	0,07	0,1	0,15	0,11	0,12	3

Based on table 14. it can be concluded that, the humanware component has the highest weight of 0.49, which means that the humanware component is important for shark shipyards, this is probably the shark shipyard that is more concerned with the welfare of its

workers, with prosperous workers productivity will increase, while infoware components the lowest weight is 0.07, which means that this infoware component does not get more attention from the company. This may be caused by various factors such as the unavailability of a website that is a tool to introduce the rattan industry itself to the global community, it is unclear how many orders will be produced because manual storage is not computerized.

e. TCC Calculation (Technology Coefficient Contribution)

Table 15. Calculation of TCC Whale shipyards.

NO	COMPONENT	LIMIT		VALUE			TCC
		LOWER	UPPER	SOTA	CONTRI BUTION	CONTRIBUTION INTENSITY	
1	TECHNOWARE	3	6	0,56	0,52	0,45	0,57
2	HUMANWARE	2	7	0,81	0,67	0,32	
3	INFOWARE	2	4	0,92	0,43	0,09	
4	ORGANWARE	3	6	0,88	0,63	0,14	

Tabel 16. Calculation of TCC Shark shipyards.

NO	COMPONENT	LIMIT		VALUE			TCC
		LOWER	UPPER	SOTA	CONTRI BUTION	CONTRIBUTION INTENSITY	
1	TECHNOWARE	2	4	0,42	0,32	0,32	0,38
2	HUMANWARE	2	5	0,60	0,42	0,49	
3	INFOWARE	2	3	0,25	0,25	0,07	
4	ORGANWARE	2	5	0,75	0,47	0,12	

Based on table 15. and 16. It can be concluded that, the TCC value for the Whale shipyard is 0.57 which means that the classification of technology is within reasonable limits, while in the Sharks shipyard it is 0.38 which means that the classification of technology is low. Whereas when viewed from the level of technology, based on the TCC values above it can be concluded that the Whale shipyard, the level of its technology is semi-modern, and for the shipyard of the Sharks, the level of technology is semi-modern as well.

f. THIO Diagram

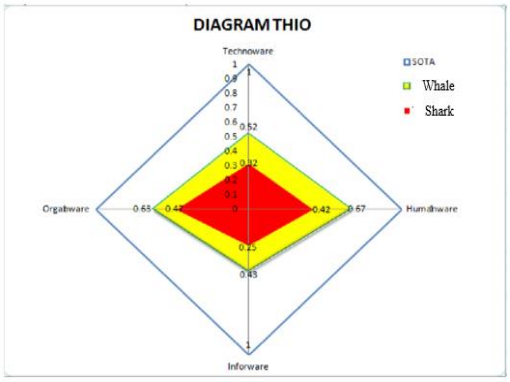


Figure 1. THIO diagram results

Based on the picture 1. THIO diagram results above can be concluded that the level of sophistication of each criterion of technological components ranges from 0.2 to 0.6. Based on the comparison of the two, the lowest contribution value of technology for Shark shipyard is infoware with a value of 0.25, and in the Whale shipyard the lowest contribution value of technology is infoware with a contribution value of 0.43, whereas for the highest contribution value of technology for Shark shipyard is Organware with 0.47, and in the Whale shipyard the highest contribution of technology is humanware with a contribution value of 0.67.

4. CONCLUSION

Based on the results of research carried out on two shipyards namely the Whale (International) and Shark (Local) shipyards, related to the measurement of technological content using the technometric method, it can be concluded as follows:

a. Based on the results of calculations and comparisons of technological content in Whale (International) and Sharks (Local) shipyards, it can be seen that the component that has the lowest technological component contribution value is Infoware in Shark shipyard which is 0.25 and the lowest contribution value of technology components is Humanware in shipyards The pope is equal to 0.67. There is a significant comparison between the

technological content of the whale shipyard and the shark shipyard.

b. Based on the TCC rating scale, it can be concluded that the TCC value of the Whale shipyard is 0.57 which means that the classification of technology is within reasonable limits and when viewed from the technological level, based on the TCC values above it can be concluded that the whale shipyard is semi-modern, while the TCC value is Shark shipyard is 0.38, which means the classification of technology is at a low limit and when viewed from the level of technology, based on the TCC values above it can be concluded that the shark shipyard, the level of technology is semi modern as well. Based on the above comparison it can be concluded that, Shark shipyard needs to be improved in the level of technological components, especially the technology component with the lowest contribution value, namely infoware. Implementation implemented as an effort to increase the contribution of infoware components, one of which is by creating a website that is used as a medium to introduce and market products more globally, and it is hoped that with this website Sharks shipyards can increase sales, in addition to creating websites to increase technological content, especially the technoware component is to advertise on professional sites or websites.

REFERENCE

Andriansyah. (2005). *Transportation Management in Studies and Theories.*

Arsyad A, M. U. (2005). *Technology assessment of the press tool production process at PT. precision kenza pratama with technometric approach.* Surabaya: ITS Surabaya.

Cahyono. (2015). Technology Assessment Using Analytical Hierarchy Process and Technometrics in the Production Department. 122–129.

Delee. (2012). *Magic of Creativepreneur: How You Can Be Innovatively Miraculous and Become an Entrepreneur Business Success in the Creative Economy Industry World.*

ESCAP. (1989). *Technology Atlas Project : Aan Overview of the Framework for Tevhnology-based, Development Economic and Social Commision for Asia and Pasific .* United Nations.

Fauzan A, N. Y. (2009). Technology Level Assessment of DOK Guidance for BTPI UPT Muara Angke Jakarta. XVIII:93–101.

Hany, I. (2000). *Content Analysis of Technology on Small-Scale Industrial Business Performance. Thesis.*

Harris I, W. Y. (2015). ICT in multimodal transport and technological trends: Unleashing potential for the future. *Int. J. Prod. Econ.*, 159: 88–103.

Indrawati. (2003). *Analysis of the Effect of Technological Components on Technoware, Humanware, Inforware, and Organware on the Main Factors of Small Industry Competitiveness ". Thesis.*

MS, B. (1987). Management of Technology. Washington DC: National Academy of Sciences .

Sabardi, W. (2008). *Analysis of Relationship between Technoware Components, Humanware, Inforware and Organware with Employee Satisfaction Dimodetor Leadership Style at PT. Ecogreen Oleochemicals Medan. Medan: University of North Sumatra.*

Sandora R. (2008). *Sophisticated Technology Performance Analysis Through a Technometric Model Approach.*

Sultan, A. C. (2017). *3G Technology Content Analysis on Telkomsel Flash Services With Techometric Methods at PT. South Jakarta Telkomsel ". Jakarta.*

Wiraatmaja, I. M. (2004). The Assesment of Technology in Supporting Industry Located at Tegal Industrial Park. *Proceddings of Marine Transportation Engineering Seminar*.

Yanthi, E. R. (2018). *Analysis of the contribution of technological components (technoware, humanware, infoware, orgaware) to freight train service companies with a model approach. Bogor: Bogor Agricultural Institute.*

DETERMINATION OF CRITICAL COMPONENTS ON CENTRAL AIR CONDITIONING MACHINE IN SHIP USING FMECA APPROACH

Syaiful Hasan, Abdul Rahman, Sunarta

Indonesian Naval Technology College, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia

ABSTRACT

The existence of an air conditioning machine on the ship is needed to make the air temperature of the ship's room more comfortable as desired. The air condition of the room can affect the psychological condition of the crew. Air conditioning with continuous operational conditions, resulting in reduced component reliability with increasing operating time. This study applies the use of FMECA to identify opportunities for failure in central air conditioning systems on ships. The results of FMECA can be obtained by assessing the risk level of a failure model and giving priority scale to preventive maintenance that will be carried out. FMECA analysis of 23 components in the central air cooling machine, obtained 4 components that have the highest critical value. The component is Discharge Valve RPN value 411,4; Pump Bearing RPN value 405,3; Suction Valve RPN value 394,4; and Pump Shaft value RPN 356,1. Components that have high RPN values require more attention, such as routine checks and periodic maintenance.

Keywords: *Central Air Conditioning Machine, FMECA, RPN.*

1. INTRODUCTION.

The air temperature of an area is strongly influenced by the climate in which the area is located, the height of the sea level, and the conditions of the surrounding conditions that can affect it. The refrigeration or cooling process is the process of transferring heat energy contained in a room. In accordance with the law of conservation of energy, we cannot eliminate energy but can only move it from one substance to another. The simplest refrigeration system has main components, namely compressors, condensers, expansion valves, and evaporators (Arismunandar and Saito, 2002). For the purposes of transferring heat energy, it takes a heat exchanger fluid, hereinafter called Refrigerant. Air conditioning in a room is regulating humidity, heating and cooling air in the room. This conditioning aims to provide comfort, so as to reduce fatigue. Human productivity tends to decrease or below in uncomfortable air conditions such as too cold or too hot. Human work productivity increases in comfortable temperature conditions (Idealistina, 1991). The comfortable thermal temperature for Indonesians is in the temperature range of 22.8 ° C - 25.8 ° C with a humidity of 70%. The easiest step to accommodate these comforts is to do mechanical conditioning (use of AC) in the room (Talarosha, 2005).

To increase the productivity of the crew, the room air temperature must be comfortable. To cool the air temperature on the ship using a central air conditioner. The use of air conditioning machines that will continuously reduce the value of reliability, so it is necessary to make a preventive maintenance schedule. Maintenance planning for a system, it is necessary to identify the components of the system that can cause system failure, how to model the failure and what the consequences of this failure are.

Xiaoqing Cheng (2013), researching about Reliability Analysis of Metro Door System Based on FMECA. Dewi Mulyasari (2017), researching about Application of Failure Mode Effect And Criticality Analysis (FMECA) Method in Rail Conveyor Transport Station Drive Station. Jaspreet Singh (2019), researching about Distribution Transformer Failure Modes, Effects And Criticality Analysis (FMECA).

In this research, FMECA was used to identify the causes of failure and their effects on the system, then the risk was assessed using Severity, Occurrence and Detection assessments so that the most critical part was known. The highest part of the Risk Priority Number (RPN) is categorized as the riskiest component so that the priority for repairs is higher than the component that has a low RPN value.

2. METHODOLOGY.

2.1. Working Principle of Cooling Machine.

Refrigerant is a heat transfer media in a refrigeration system, where the refrigerant absorbs heat at low pressure through the evaporator and releases heat at high pressure through the condenser. The evaporator absorbs heat from the conditioned room so that the room temperature cools and the low pressure refrigerant inside the evaporator undergoes evaporation. The refrigerant vapor is then compressed by a high pressure compressor so that the temperature of the refrigerant vapor also increases so that the heat of the refrigerant can be released into the environment through the condenser while the refrigerant experiences condensation, so that the refrigerant turns phase into a liquid at high pressure. The liquid of the refrigerant is then expanded to the evaporator pressure for the next cycle by the expansion device (Stoecker, Jerold and Hara, 1996).

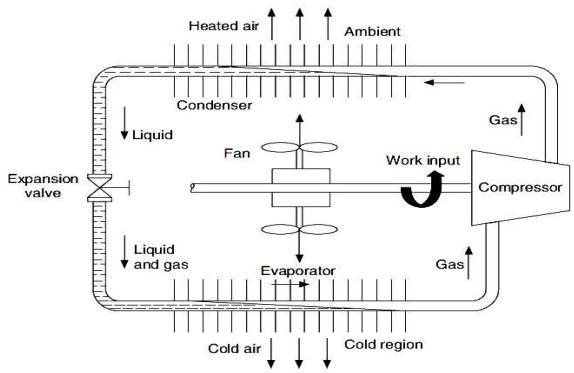


Fig. 1 Basic Vapour Compression Refrigeration System

(Arora, 2010)

The Air Conditioning Machine on board is carefully used by the Semihermatic compressor. Compressor and drive motor in one section. The condenser used is cooling using sea water distributed by a sea water pump. The expansion valve used is an expansion valve that is compatible with R404a refrigerant. The evaporator used is a grid that is blown by a central blower to be circulated to the rooms on the ship.

2.2. FMECA.

Failure Mode, Effect and Critical Analysis (FMECA), which is a technique for evaluating or designing the reliability of components in a system by examining the potential mode of failure to determine the impact, both on the success of the system and the safety of users and equipment. the most critical condition possible for these components. FMECA consists of two separate analyses, the Effect Failure and Analysis Mode (FMEA) and the Critical Analysis (CA). FMEA analyzes various failure modes and their effects on the system while CA classifies or prioritizes their importance based on failure rates and severity of the effects of failure. The CA ranking process can be achieved by utilizing existing failure data or by subjective ranking procedures carried out by several people with an understanding of the system (ARMY, 2006).

Table 1. FMECA's Severity, Occurrence, and Detection.

Severity	Occurrence	Detection	Score
Dangerously High	$\lambda > 0.01$	Absolute Uncertainty	10
Extremely High	$0.01 > \lambda > 5*10^{-3}$	Very Remote	9
Very High	$5*10^{-3} > \lambda > 2.5*10^{-3}$	Remote	8
High	$2.5*10^{-3} > \lambda > 10^{-3}$	Very Low	7
Moderate	$10^{-3} > \lambda > 5*10^{-4}$	Low	6
Low	$5*10^{-4} > \lambda > 10^{-4}$	Moderate	5
Very Low	$10^{-4} > \lambda > 5*10^{-5}$	Moderately High	4
Minor	$5*10^{-5} > \lambda > 10^{-6}$	High	3
Very Minor	$10^{-6} > \lambda > 10^{-7}$	Very High	2
None	$10^{-7} > \lambda$	Almost Certain	1

(Melani et al., 2018)

2.3. 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:

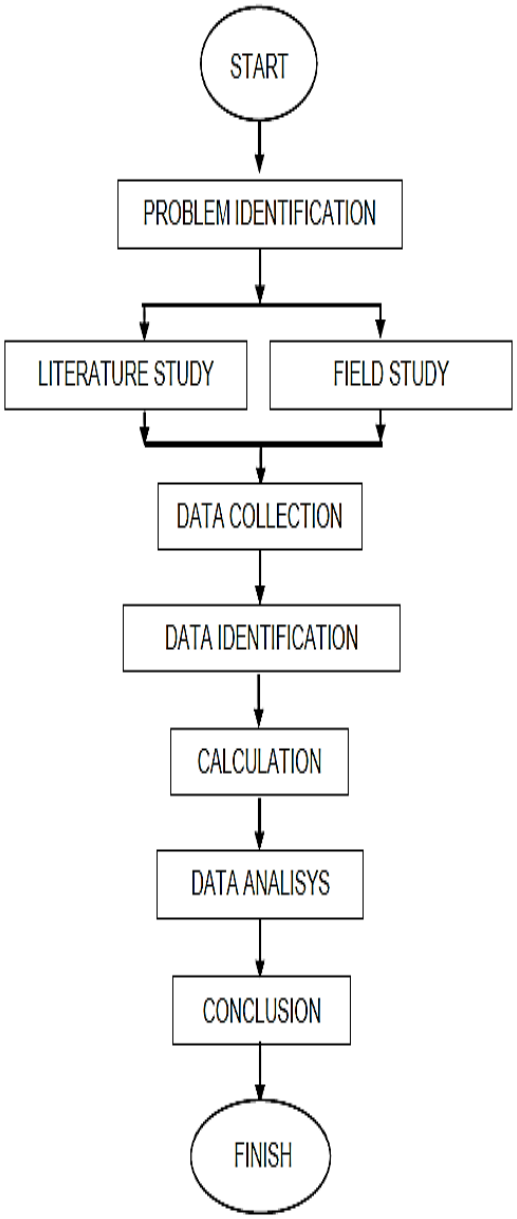


Fig. 2 Research Methodology

3. RESULT AND DISCUSSION.

Identification of potential component failure data that affects the operation of the central air conditioning machine on the ship, the data below is obtained:

Table 2. Identification of Potential Failure

COMPONENT	FUNCTION	POTENTIAL FAILURE	DAMAGE	PART COMPONENT	CODE
Compressor	Compressing Refrigerant	The Compression Ring is broken	Low compression pressure	Compression Ring	R1
		The Oil Ring is broken	Oil mixed with Refrigerant	oil Ring	R2
		Discharge Valve is broken	Low compression pressure	Discharge Valve	R3
		The Suction Valve is broken	Low Suction pressure	Suction Valve	R4
		The coil of the compressor burns	Shutdown	Compressor Coil	R5
Condensor	Condensing Refrigerant	The capillary pipe is leaking	Refrigerant is decreases	Capillary pipe of Condensor	R6
		Clogged capillary tube	The heat transfer process is interrupted	Capillary pipe of Condensor	R7
		The coil of the Pump burns	There is no sea water flow	Pump Coil	R8
		The Pump Bearing is broken	The sea water flow is not optimal	Pump Bearing	R9
		The Pump Shaft is broken	The sea water flow is not optimal	Pump Shaft	R10
		The Impeller Pump is corroded	The sea water flow is not optimal	Pump Impeller	R11
Expansion Valve	Atomizes refrigerant	Expansion valve is blocked	Cannot Atomizes refrigerant	Nozzle	R12
		Expansion Valve Regulator is not appropriate	Atomizes refrigerant is not optimal	Expansion Valve Regulator	R13
Evaporator	Absorb of heat	Mat Filters is dirty	The air enters to suction Blower part is a few	Mat Filters	R14
		The capillary pipe is leaking	Refrigerant is decreases	Capillary pipe of Evaporator	R15
		Capillary pipes Evaporators are covered with ice flowers	The cooling process is not optimal	Heater Element	R16
		V-Belt breaks	The blower fan does not rotate	V-Belt	R17
		The motor blower coil burns	There is no heat transfer	Motor Blower Coil	R18
		The Blower Bearing is broken	The blower fan does not rotate maximally	Blower Bearing	R19
		The Blower Shaft is broken	The blower fan does not rotate maximally	Blower Shaft	R20
Receiver	collect oil mixed with Refrigerant	Clogged oil capillary tube	A lot of oil is stored, the oil in the compressor is a few	Capillary pipe of Receiver Tube	R21
		The Receiver tube is leaking	Refrigerant is decreases	Receiver Tube	R22
Filter Drier	Filtering Refrigerant	Drier Filter is dirty	Refrigerant flow is not smooth	Drier Filter	R23

From the table above, the values of Severity (S), Occurrence (O), and Detection (D) from each component causing failure are based on the assessment of three experts. Then it is calculated to find out the Risk Priority Number (RPN). In the following table the results of the calculation:

Table 3. Data Calculation

CODE	S			O			D			RPN
R1	8	7	7	6	7	6	7	6	7	309,6
R2	7	8	7	5	5	5	6	6	7	232,2
R3	8	7	8	7	8	6	8	8	7	411,4
R4	7	8	7	7	8	7	8	7	7	394,4
R5	8	7	7	4	5	4	6	6	7	201,3
R6	7	6	7	6	7	6	4	5	3	168,9
R7	4	3	4	7	8	7	7	7	8	197,2
R8	6	7	6	5	5	5	7	6	6	200,6
R9	6	6	7	8	8	8	8	8	8	405,3
R10	6	6	7	7	8	7	7	8	8	356,1
R11	5	5	4	6	6	7	7	6	7	197,0
R12	5	5	6	4	5	4	8	8	9	192,6
R13	3	4	4	4	5	3	7	8	7	107,6
R14	3	4	3	8	9	9	7	8	6	202,2
R15	6	6	6	7	7	6	4	3	3	133,3
R16	4	3	4	4	5	6	5	4	5	85,6
R17	5	6	6	8	7	8	4	3	3	144,8
R18	7	6	7	4	4	4	7	7	6	177,8
R19	6	7	7	7	6	6	8	7	8	323,7
R20	6	6	7	6	5	5	7	7	8	247,7
R21	4	5	6	4	4	3	5	5	4	85,6
R22	7	6	7	4	3	4	3	4	4	89,6
R23	3	3	4	7	7	7	6	8	7	163,3

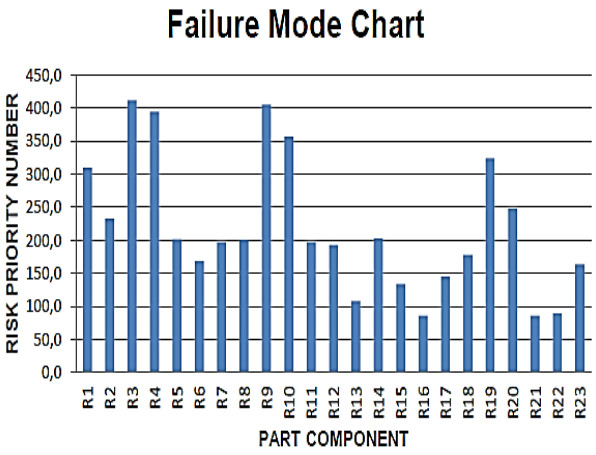


Fig. 3 Failure Mode Char

4. CONCLUSION.

The results of the analysis of 23 components in the central air cooling machine, obtained 4 components that have the highest critical value. The component is Discharge Valve RPN value 411,4; Pump Bearing RPN value 405,3; Suction Valve RPN value 394,4; and Pump Shaft value RPN 356,1. Components that have high RPN values require more attention, such as routine checks and periodic maintenance, so that the machine's lifetime will increase.

REFFERENCES

Arismunandar, W. and Saito, H. (2002) *Air Refreshing*, 6th edition, Jakarta: PT. Pradnya Paramita.

ARMY, D.o.t. (2006) *Failure Modes, Effect and Criticality Analysis (FMECA) For Command, Control, Communication, Computer, Intelligence, Surveillance, and Reconnaissance (C4ISR) Facilities*, Washington D.C.

Arora, R.C. (2010) *Refrigeration And Air Conditioning*, New Delhi: PHI Learning Private Limited.

Cheng, X., Xing, Z., Qin, Y., Zhang, Y., Pang, S. and Xia, J. (2013) 'Reliability Analysis of Metro Door System Based on FMECA', *Journal of Intelligent Learning Systems and Applications*, vol. 5, pp. 216-220.

Idealistina, F. (1991) *Body Thermoregulation Model for Determining the Best Thermal Impression in Relation to Human Performance*, Bandung, Indonesia: Institut Teknologi Bandung.

Melani, A.H.A., Murad, C.A., Netto, A.C., Souza, G.F.M.d. and Nabeta, S.I. (2018*) 'Criticality-based Maintenance of a Coal-fired Power Plant', Energy,* vol. 147, pp. 767-781.

Singh, J., Singh, S. and Singh, A. (2019) *'Distribution Transformer Failure Modes, Effects And Criticality Analysis (FMECA)', Engineering Failure Analysis*, vol. 99, pp. 180–191.

Stoecker, W.F., Jerold, W..J. and Hara, S. (1996) *Refrigeration and Air Conditioning*, 2nd edition, Jakarta: Erlangga.

Sumarta, D.M., Suweca, I.W. and Setiawan, R. (2017) *'Application of Failure Mode Effect And Criticality Analysis (FMECA) Method in Rail Conveyor Transport Station Drive Station'*, *INFOMATEK*, vol. 19.

READINESS CONCEPT OF TECHNOLOGY WARSHIP MAINTENANCE FACILITIES CONTRY FOR FAST PATROL SHIP PROJECT IN MASSAL

Novi Shobi Hendri, I Nengah Putra A, Okol Sri Suharyo

Indonesian Naval Technology College, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia

ABSTRACT

Warship Maintenance Facilities Contry has considerable potential when viewed from its purpose as a ship maintenance and fabrication. In parliamentary law to complete the needs it needs to be implemented to improve the capacities of the Maintenance Facility both in terms of infrastructure and all its supporting components. With the many needs of a country's Fast Patrol Vessel today, it is very possible to develop massively with a modular system, where modular technology is the implementation of a technology PWBS (Product Oriented Work Breakdown Structure) which has been applied a lot in non-military shipyard companies. This paper aims to formulate the technological readiness of a Navy Ship Maintenance Facility with the method of measuring technometric models for the construction of mass Rapid Patrol vessels with a modular system, where technometrics divides four components of technology consisting of technoware, humanware, inforware, Dan orgaware. With the hope that the resolutions of the measurements will be capable to offer recommendations for the growth of a country's Navy Ship Maintenance Facility, including the employment of land as a buffer region, conducting transfer of technology in Human Resources, integrating data systems, and increasing research and development in the defense industry.

Keyword: *Modular Technology, Technometric, Warship Maintenance Facilities*

1. INTRODUCTION

Warship Maintenance Facilities have a very important role in supporting combat power in the marine defense sector in a country and one of the important components in creating a sovereignty within the territorial boundary and efforts to increase capacity, productivity of Warship Maintenance Facilities. Through the utilization of knowledge, it is really useful for the evolution of technology for the independence and competitiveness of nations with other states.

In order to support government policies to encourage domestic ship production, it is necessary to implement technological improvements in Warship Maintenance Facilities using descriptive analysis methods using technometric models by assessing the contribution of technological components (technoware, humanware, infoware, and orgaware). To support this paper the author has taken several sources and literature to support this research, among others; More effective planning of early ship outfitting (Bruce, G., Nielsen, T., 2003), Integrated Hull Construction Outfitting and Painting (Chirillo, 1983), Modular payload ships (Abbott, 2006), State-of-the-art Shipbuilding : Towards Unique and Integrated Lean Production Systems (Dugnas, K., Oterhals, O., 2008), Development Economic and Social Commision for Asia and Pasific (ESCAP, 1989), Institutionalizing Modular Adaptable Ship Technologies (Doerry, 2014), Modularization of Ships (Bertram, 2005), Seven Wastes Elimination Targeted by Lean Manufacturing (El-Namrouty, K.,A., Abushaaban, M.,S., 2013), Ship Construction Sixth edition (Eyrers, 2007), D.,Storch, R.L., Fafandjel, N. (2011), “Lean Manufacturing in Shipbuilding with Monte Carlo Simulation (Kolich, D., Storch, R.L., Fafandjel, N., 2011), “The Foundation of Lean Costruction”, Design and Construction: Building in Value (Koskela, L., Howell, G., Ballard, G., Tommelein, I., 2002), Environment-Based Strategic Management Model for Indonesia’s Medium-Sized Shipyards” (Ma’ruf, B., Okumoto, Y.,

Widjaja, S., 2006), Modularity Shipdesign And Construction (Perez, R., Gonzalez, C., Sanchez, F., Alonso, F., 2015), Measuring Contribution of Technology for Policy Analysis (Sharif, 1991), Ship Production: Second Edition (Storch, R.L., Hammon, C.P., Bunch, H.M., Moore, R.C, 1995), In This research is organized as follows, chapter 1 introduction, chapter 2 shows material and methodology, chapter 3 Research Methodology, chapter 4 Result And Discussion And chapter 5 Conclusion.

2. MATERIAL DAN METHODOLOGI

2.1 Product Oriented Work Breakdown Structure (PWBS)

Product Oriented Work Breakdown Structure adalah is an application of Group Technology, where the details of the work breakdown structure are oriented towards the results of the product, so that the division can be done by zoning.

The application of group technology on ship building involves integration between hull construction, equipment, and painting or also called Integrated Hull Construction, Outfitting, and Painting (IHOP) (Anonymous, 1983). Components of this integration include :

- *Hull Block Construction Method* (HBCM)
- *Zone Outfitting Method* (ZOFM)
- *Zone Painting Method* (ZPTM)

2.2 Modularization of Shipbuilding

Modular technology will sustain the lean manufacturing concept for ship construction. By improving performance at the planning level (engineering process) it will improve performance at the production process level. One of the ways to improve performance at the planning level is to modularize design and design for production. This will improve performance at the project level because it will directly reduce process variation, reduce work cycle times, reduce the number of steps in material flows, and increase output flexibility.

The definition of modularization in the ship production process is to divide the system in ship production into stand-alone systems that are standard or equal (can replace each other) and a system can be combined with other systems and complement each other.

Modular technology in ship building is an implementation of PWBS and the concept of lean manufacturing, where there are processes of grand block joining which form integrated modules with outfitting.

2.3 Technometry Concept

This study uses a technometric based method (ESCAP, 1989). Every process in the ship construction industry takes the engineering components of Technoware, Humanware, Infoware and Orgaware measuring the degree of sophistication of technological components obtained by taking a study of technological components in the Warship Maintenance Facility and collecting data on the technology employed.

The estimation of the degree of sophistication of this component of the technology is done by a scoring system. The whole process of measuring and identifying the main criteria of the technology component, there are five steps to estimating the values of T, H, I, O, βt, βh, βi, βo as follows.

a. The estimated degree of sophistication The value of the degree of sophistication shows the level of sophistication of each component of the technology that will be calculated based on the results of observations and interviews in the field.

b. Assessment of the state of the art (SOTA) Determination of the technological components of the state of the art requires in-depth technical knowledge (Hany, 2000). The approach to completing state of the art technology components

is based on generic criteria, with the determination of a score of 10 on each criterion. The formula of the state of the art is

$$S = \frac{1}{10}\left[\frac{\sum k\ tik}{kt}\right] \quad \text{.....(1)}$$

Where:

S : state of the art

Kt : Number of component criteria

K : 1, 2, ……., kt

T*ic*k : The first criterion value of the technology component.

c. Determination of component contributions This step is done by using the values obtained in the previous step, namely the degree of sophistication and The rating of the state of the art. The resulting value is the contribution value of each component of The technology that will be used in the calculation of TCC.

The formula is as follows:

K = [L + S (U - L)] .....(2)

Where:

K : Contribution of components

U : The upper value of the degree of sophistication of the component

L : Value lower level of component sophistication

S : The value of the state of the art d. Determination of the intensity of component contributions This step is done by doing a pairwise comparison matrix, such as using AHP and other methods.

d. TCC (Technology Contribution Coefficient) Calculation Based on the values of T, H, I, O and β values that have been obtained in the previous step, then the coefficient of technological contribution can be calculated, with the maximum value of TCC being one. The formulas for TCC calculations are:

TCC = Tβt x Hβh x I βi x O βo .....(3)

Where:

TCC :Technology Coefficient Contribution Q: Value of contribution of technoware components.

H : Value of contribution of humanware components.

I : Value of contribution of infoware components

O : Value of contribution of organware components

βt : Value of intensity of technoware contributions

βh : Value of the intensity of humanware contributions

βi : Value of intensity of infoware contributions

βo : Value of intensity of organware contributions

3. Research Methodology

This paper focuses on measuring the technological readiness of the Warship Maintenance Facility for the construction of mass patrol boats with modular technology.

The discussion in this paper is carried out with a mindset as shown in Figure 3.1 below.

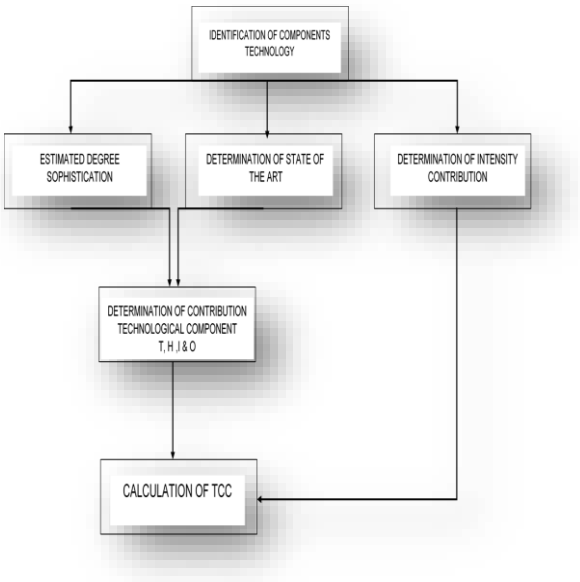


Fig. 3.1. Research Methodology Flowchart.

a. Identification Phase

At this stage is implemented identification of the problem, the search for information sources

(study literature and field studies). The next is to study, evaluate, review, and identify technical aspects of the construction of fast-paced patrol ships in a modular way from the results of literature studies and field studies.

b. Data Collection Phase

After being able to understand the concept, the author is collecting data on the condition of the latest warship maintenance facilities about 4 technological components (Technoware, Humanware, Infoware, and Organware) that can support research by using Teknometrik.

c. System Analysis and Design

Perform analysis and system design according to the problems that have been identified. The technometric method is to find out the level of capability of The technology.

d. System Implementation.

At this stage, the system will be implemented in accordance with the concepts prepared in the previous stage. The final step is to provide suggestions for improvements and conclusions for decision makers.

4. RESULT AND DISCUSSION.

4.1 Measurement of Contribution of Each Component of Technology.

In the technology readiness study for the construction of mass patrol boats with a modular system, the first time the grouping of technological components was carried out in accordance with technometric concepts, namely technoware, humanware, inforware, and orgaware. The criteria for assessing the sophistication level of each component of the technology in the Warship Maintenance Facility are determined based on the concept of shipbuilding technology with the Product-oriented Work Breakdown Structure (PWBS), where the technology is the basis of the technology of building ships with a modular system.

After grouping the components of technology, it is necessary to determine the level of sotistification or level of sophistication in each component of technology to conduct qualitative research and obtain the value of State of the Art (SOTA).

The results of qualitative research that have been carried out are then normalized by considering the weight assessed by pairing comparisons in each aspect to obtain the contribution value of the technology component or The contribution component according to the step of the technometric method.

4.2 Contribution Assessment

Technoware Technology Components As explained earlier, technoware is an object-embodied technology engineering facility that includes tools (tools), equipment (machines), machines (vehicles), transportation equipment (vehicles), and physical infrastructure (physical infrastructure). In the concept of shipbuilding technology with Product-oriented Work Breakdown Structure (PWBS), which is included in the technological components of technoware are equipment, equipment, methods, machinery, including software, hardware, and shipyard infrastructure that is used directly starting from the process of engineering, fabrication, assembly, to the testing process. The aspects assessed can be seen in the following Figure 4.1:

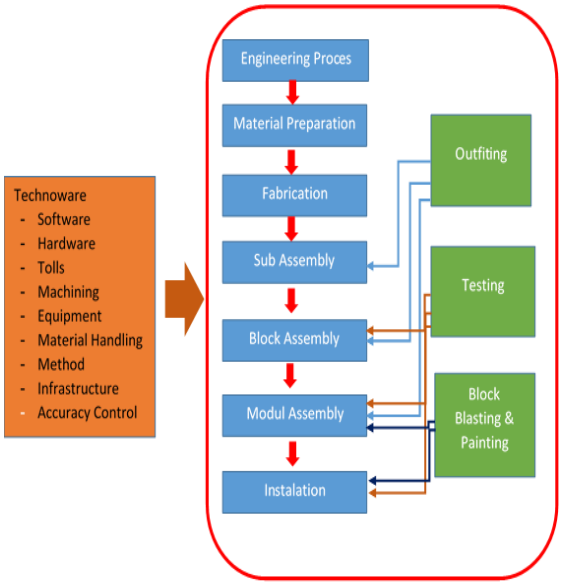


Fig.4.1. Main Aspects of Technoware Assessment

In Figure 4.1 are the main aspects that are used to assess the level of sophistication or sophistication of The technological components of technoware.

The intensity or weight of each major aspect of technoware technology components is obtained by analyzing using pairwise comparisons with the Analytical Hierarchy Process method.

After going through the calculation of the weight or intensity of each aspect of the component evaluation of inforware technology. There will be things that have the most influence in the component of inforware technology.

Then a state of the art (SOTA) assessment is carried out to obtain a weighted rating value using the formula described above. From the calculation of the state of the art (SOTA) the gap price is obtained to reach the state of the art. To improve the assessment, improvements or improvements can be made to the highest weighted aspects, from the results of the state of the art (SOTA) assessment.

The same thing is done by other technological components, Humanware, Infoware and Orgaware.

Below will be shown the sub-aspects of the components from Humanware, Infoware and Orgaware.

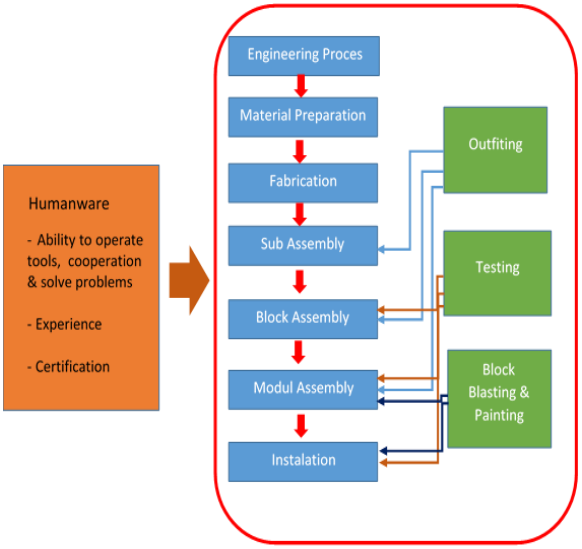


Fig.4.2. Main Aspects of Humanware Assessment

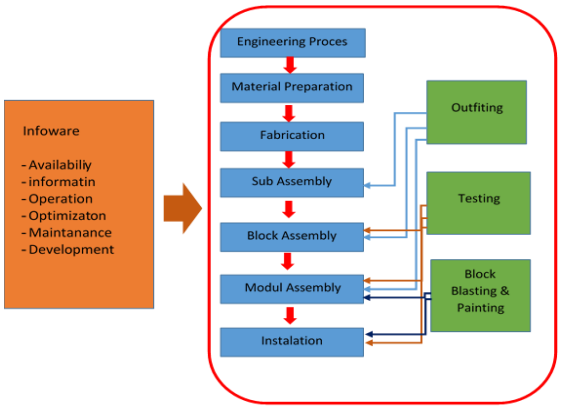


Fig.4.3. Main Aspects of Infoware Assessment

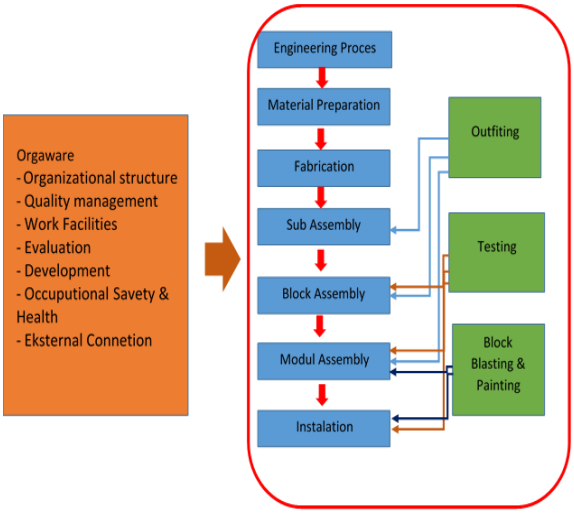


Fig.4.4. Main Aspects of Infoware Assessment

4.2 *Technology Contribution Coefficient* (TCC) Assessment

Based on the results of measuring the contribution of each component of technology, it can be described in graphical form as shown in Figure 4.5 below:

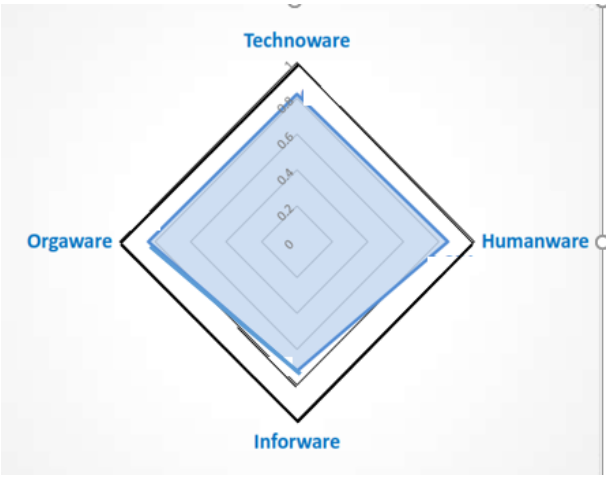


Fig.4.3. T, H, I & O Of Graphical

After measuring the contribution value of each component of technology, the next step in accordance with the step of the technometric method is to determine the intensity of each component of the technology. The process of measuring the intensity of technological components is carried out by a pairwise comparison matrix (AHP) analysis. After the contribution value and intensity of each component of the technology is obtained, then the TCC value can then be determined by the equation:

$$TCC = T^{bt} \, x \, H^{bh} \, x \, I^{bi} \, x \, O^{bo}$$

Based on the results of the measurement of each component of technology, an analysis of the most priority development can be carried out to increase the value of technological readiness to be planned or which will be a policy direction.

5. CONCLUSION

Can be concluded based on this paper in the process of building ships can be done centrally on an integrated information system. Information Technology Development in Warship Maintenance Facilities of a country is expected to be able to achieve the following objectives:

✓ Existing data can be transparent, accurate, and integrated so that it supports decision.

✓ Data input is enough once to produce various reports.

✓ Because the system is integrated, reports can be made easily and quickly, besides that the reports produced can be used by various divisions that need it

✓ Data maintenance is easier because it uses the right processing and database types.

✓ New systems with the help of vendors allow for customization according to technological developments.

By using measurements using the technometric method, to improve the technological readiness of the Warship Maintenance Facility, a number of minor improvements and improvements are needed, among others, solving software synchronization problems, improving production facilities, and utilizing areas to add buffer areas and fast access to shiplifts, transfer of technology to human resources, integrating information systems, and establishing a navy's research and development body.

REFERENCE

Abbott, J. (2006). Modular payload ships. *Proceedings, ASNE Engineering the Total Ship Symposium*, 1975-2005.

Anonymous. (1983). Integrated Hull construction, Outfitting and Painting. *U.S. Departmen of Transportation, MD.*

Bertram, V. (2005). Modularization of Ships. *Report within the framework of Project 'Intermodule' s/03/G IntermareC, France*.

Bruce, G., Nielsen, T. (2003). More effective planning of early ship outfitting. *SNAME World Maritime Technology Conference*, 1-8.

Chirillo. (1983). Integrated Hull Construction Outfitting and Painting. *Integrated Hull Construction Outfitting and Painting, US-NSRP*.

Doerry, N. (2014). Institutionalizing Modular Adaptable Ship Technologies. *SNAME Journal of Ship Production and Design, 30*(3), 125-141.

Dugnas, K., Oterhals, O. (2008). State-of-the-art Shipbuilding: Towards Unique and Integrated Lean Production System. *Proceedings for The 16th Annual Conference of The International Group for Lean Construction*, 321-331.

El-Namrouty, K.,A., Abushaaban, M.,S. (2013). Seven Wastes Elimination Targeted by Lean Manufacturing. *International Journal of Economics Finance and Management Sciences, 1*(2), 68-80.

ESCAP. (1989). *Technology Atlas Project : Aan Overview of the Framework for Tevhnology-based, Development Economic and Social Commision for Asia and Pasific .* United Nations.

Eyrers, D. (2007). Ship Construction Sixth edition. *Elsevier, Linacre House, Jordan Hill, Oxford*.

Hany, I. (2000). *Analisis Kandungan Teknologi Terhadap Performansi Bisnis Industri Skala Kecil.* Tesis.

Kolich, D., Storch, R.L., Fafandjel, N. (2011). Lean Manufacturing in hipbuilding with Monte Carlo Simulation. *International Conference on Computer Application in Shipbuilding, Trieste*.

Koskela, L., Howell, G., Ballard, G., Tommelein, I. (2002). ”The Foundation of Lean Costruction”, Design and Construction: Building in Value. *Elsevier, Oxford*.

Ma’ruf, B., Okumoto, Y., Widjaja, S. (2006). 'Environment-Based Strategic Management Model for Indonesia’s Medium-Sized Shipyards”. *Journal Of hip Production, SNAME-USA, 22*(4), 195-202.

Perez, R., Gonzalez, C., Sanchez, F., Alonso, F. (2015). Modularity In Shipdesign And Construction. *SENER Spain*.

Sharif, N. (1991). Sharif, N. *School of Management Asian Institute of Technology*.

Storch, R.L., Hammon, C.P., Bunch, H.M., Moore, R.C. (1995). *Ship Production : Second Edition.* New Jersey City: SNAME.

FIELD III

POLICY AND STRATEGY

THE EVALUATION OF NURTURING MANAGEMENT ON INDONESIAN NAVAL ACADEMY CADETS

OC Budi Susanto[1], April Kukuh Susilo[2]

[1]Sekolah Tinggi Ilmu Ekonomi Indonesia, STIESIA Surabaya Indonesia
[2]Indonesia Naval Technology College, STTAL Surabaya Indonesia

ABSTRACT

The Navy as part of the national defense system has established a blueprint of its strength posture, namely the minimum basic force of the Minimum Essential Force (MEF) defense. Empowerment of superior human resources determines the success rate of achieving excellence in the fields of technology, organization, and operational capabilities. The Naval Academy is the first educational institution of the Indonesian Navy Officers to educate cadets to become Navy officers with the spirit of Pancasila and Sapta Marga and have the ability to use, practice their knowledge and skills in accordance with the demands of technical functions directed at the spectrum of work in initial assignments and able to develop personally as cadres of Indonesian Navy leaders. This preliminary study aims to provide a preliminary analysis of the current conditions regarding the management of nurturing the Indonesian Naval Academy cadets as part of strengthening the capabilities of the Indonesian Navy's human resources. The approach method used is directing the implementation of formative evaluation and summative evaluation of the objects of the program, projects, personnel, products, institutions, and systems using the CIPP evaluation method and the Analytical Hierarchy Process (AHP) method. The results of the study show that the evaluation in the research analysis of the input and process aspects of the pattern of care for Naval Academy cadets is currently included in the sufficient category.

Keyword: *Nurturing of Cadets, CIPP evaluation method, Analytical Hierarchy Process (AHP)*

1. INTRODUCTION

The era of globalization requires the Navy to always be dynamic and always make improvements, changes, and developments for the future. The successful implementation of the Indonesian Navy's tasks in the future will be very beneficial for the Indonesian Navy's Posture. The development of the Indonesian Navy's strength as a fighting instrument must be carried out following national defense policies, namely the minimum basic strength of the Minimum Essential Force (MEF) defense. One of the backgrounds of the MEF that was born was the development and development of the Indonesian Navy's Human Resources faced with challenges and development that developed dynamically, the development of the strength of fighting instruments. According to Marsetio (2013) who argued about the four aspects of character appearance that must be possessed by the Navy in the framework of achieving the MEF posture, it contains superiority of Human Resources (HR), superior technology (extraordinary technology), organizational excellence (superior organization) and operational capability superiority. Among the four fields, the HR field is the most influential in other fields.

Empowerment of superior human resources determines the success rate of achieving excellence in the fields of technology, organization, and operational capabilities. Excellence in HR as a final result that is expected to require a touch of human resource management (HRM) that is managed effectively and efficiently. This is in line with the opinion of Kania and Spilka (2010) that a new management philosophy, methods, procedures, and practices in the field of management will make organizations more competitive in facing the challenges of globalization. Systemic superiority of the Navy's HR depends on how the Navy's institution can implement a coaching management system for its soldiers, especially at the officer level appropriately and correctly.

The Indonesian Naval Academy as an Academy of Education's first naval officer, aims to educate cadets to become Navy officers who have the spirit of Pancasila and Sapta Marga fighters and have the ability to use, practice knowledge and skills in accordance with the demands of technical functions directed at the spectrum of work within initial assignment on warships and in the staff and able to develop personally as cadres of the Indonesian Navy Leaders. To achieve these educational goals, the implementation of education at Indonesian Naval Academy is divided into three aspects of activities, namely Teaching, Training, and Nurturing. The three aspects of the activity are one round and the whole unit that is complementary and interdependent with one another to produce professional student outcomes. This pattern of practice is very interesting to study because where the pattern of practice is different from the pattern of educational practices carried out in higher education institutions or other universities in general, which only emphasizes the aspects of education/teaching and training only.

Nurturing is one of the programs in implementing the Indonesian Naval Academy cadets education focuses on forming leadership characters. To be able to create a Navy officer, a future leader with the spirit of Pancasila and Sapta Marga, the implementation of the cadet nurturing program at Naval Academy by paying attention to character formation is a learning that leads to strengthening and developing whole individual behavior based on certain values referred to by educational institutions (Permana, 2012).

The first goal of character building is to facilitate the strengthening and development of certain values so that they manifest in the behavior of students, both during education and after graduating from education. Strengthening also means that there is a relationship between strengthening behavior through habituation in the family and community environment. Thus, based on the output formation character of educational institutions at each level, graduates of Educational Institutions will have several distinctive behaviors as the educational institution's reference values are based on three Character Building Ability domains (Josephson, 2013). The three domains of character building capabilities include Excellence, Professionalism, and Ethics.

However, there are still many problems in nurturing at the Indonesian Naval Academy Cadet. One of the fundamental problems is that there are still many violations that occur in the life of the Academy. Some examples of problems or violations that occur are violations of discipline, discourse, and violence against juniors. This is strictly prohibited in the Rules of Life of Midshipmen at Indonesian Naval Academy because it can have a systemic impact on the education process in the Academy. This is what underlies this research, to evaluate the Taruna training and nurturing program at Indonesian Naval Academy.

Furthermore, based on the mapping of existing problems and complexity in the nurturing of nurturing of the Indonesian Naval Academy Cadets and the desire to obtain a model of Midshipman Nurturing or prospective HR Navy Officers that are superior, the authors are interested in conducting a Dissertation research with the title "Management Evaluation of Nurturing Indonesian Naval Academy Cadets".

This study emphasizes the evaluation of the implementation of the policy of the Navy Academy Midshipman Nurturing Program which culminates in a recommendation relating to the updating of mechanisms, procedures, and benchmarks adapted to the dynamics of Teaching, Training and Nurturing within the Indonesian Naval Academy are Intellectual, personality and physique

.This preliminary study aims to provide a preliminary analysis of the current conditions

regarding the management of nurturing the cadet as part of strengthening the capabilities of the Indonesian Navy's human resources. In the evaluation analysis study, this preliminary study uses the CIPP evaluation method (Context, Input, Process, Product). Furthermore, there are two initial aspects which are the object of the study of preliminary studies, namely the evaluation of aspects of Input and implementation (process). Furthermore, the CIPP method is integrated with the Analytical Hierarchy Process (AHP) Method as weighting the aspect criteria to determine the conditions of quantitative results.

The results of this preliminary study are expected to be used as a source of study in supporting dissertation research. So, it can be used as an initial reference in the concept of developing the management of nurturing the cadets

2. MATERIALS AND METHODS

2.1 Program Evaluation.

It is a systematic process to describe, obtain, report and apply descriptive information and evaluate quality, cost-effectiveness, feasibility, security, legality, sustainability, transferability, fairness, interests, and the like. Program evaluation can be improved and maintained insofar as supporting evaluations are relevant, systematic, rigorous, and timely, and to the extent that users pay attention to and use responsible findings.

Evaluations that lack the aspects of the discipline are usually fruitless, wasteful, and misleading. The evaluator can only do the best and try to involve the user. In evaluation, there is no certainty that the user will heed and act on the findings of the evaluation results. If evaluation makes a positive difference, users must play their part by helping to evaluate the focus, support their behavior, and make good use of the findings.

2.2. Management of the Indonesian Naval Academy cadets' Nurturing Pattern.

Nurturing is one of the programs in the implementation of Indonesian Naval Academy cadets education focuses on the formation of leadership characters to be able to realize Navy officers as future leaders with the spirit of the Pancasila and Sapta Marga. Nurturing is a process/method in terms of guiding, caring for, assisting and training individual cadets so that they can stand alone / mature and be able to carry out their duties as a soldier of the Indonesian Navy Officer. The Nurturing was carried out by Caregivers on the Indonesian Naval Academy Cadets.

Caregivers are Navy personnel who carry out a process/method in terms of guiding, caring for, helping and training cadets so that they can stand alone / mature and be able to carry out the tasks of an Indonesian Navy Officer. The cadets are soldiers of the Indonesian Navy Academy students as individuals who are guided, cared for, assisted and trained to be able to stand alone / mature.

Character is a characteristic that is owned by an individual and rooted in personality and a driver for someone to act, behave, say and respond to something. Some things related to the formation of cadet characters are as follows:

a. Definition of Character Formation.

Character formation is learning that leads to the strengthening and development of whole individual behavior based on certain values referred to by educational institutions (Dr. H. Johar Permana, MA. Et al., 2011). The definition means:

1) Character formation is a process that is integrated with learning that occurs in all subjects.
2) Directed on strengthening and developing individual behavior as a whole.
3) Strengthening and developing individual behavior is based on the values referred to by educational institutions.

b. Purpose of Character Formation.

The formation of characters in the scope of educational institutions has the following objectives:

1) Strengthening and developing the values of life that are considered important and necessary so that they become the distinctive personality/ownership of students as the values developed.
2) Correcting student behavior that does not correspond to the values developed by educational institutions.
3) Building a harmonious relationship with family and community in acting out the responsibility for forming character together.

2.3. Three Domain Character Building Capabilities.

Based on the Decree of the Governor of the Naval Academy Number: Kep / 02/2014 concerning the Implementation Guidelines for Nurturing the Indonesian Naval Academy, there are three domains of the capability to be achieved in character formation (Josephson Institute of Ethics), namely:

a. Excellence.

Excellence is an attitude that allows cadets to always give the best in every work. A cadet who has an attitude of excellence will always be a role model for the community because that person is believed to be the leader in his field.

b. Professionalism.

Professionalism is a discipline in the profession and the desire to always be better in the daily process. Professionalism is a discipline in the profession that encourages a cadet to behave appropriately and following the circumstances and has adequate abilities.

c. Ethics.

Ethics is the internalization of values that are the key to becoming human beings who have the nobility of cadet character. Ethics values are grouped into six pillars as follows:

1) The first pillar, Trustworthiness (Honesty). Get used to dare to defend the truth and not lie.
2) The second Pillar, Respect. Get used to respect others.
3) The third Pillar, Responsibility. Familiarize a disciplined attitude and be responsible for the choices taken and think before acting.
4) The fourth Pillar, Fairness (Justice). Getting used to not being prejudiced negatively and not carelessly blaming others.
5) the fifth Pillar, Caring. Getting used to acting with love and caring for others.
6) The sixth Pillar, Citizenship. Getting used to playing an active role in developing the surrounding community.

2.4. CIPP Evaluation Method.

The CIPP model provides direction for agreeing on the context, program of an Input, Process, and Product. Not liking other evaluations, the CIPP Model not only assesses the company's results but also its environment, objectives, plans, resources, and implementation. Proactive active orientation in guiding assessment needs, goal setting, planning, implementation and quality assurance, with agreement on continuous improvement. This is also a retrospective in reviewing, completing, and assessing the accountability and value of the finished program.

The CIPP evaluation model is a discussion that discusses discussing the implementation of formative evaluations and summative evaluations of program objects, projects, personnel, products, relationships, and systems. This evaluation model is designed to be used by internal evaluators conducted by organizational evaluators, self-evaluations carried out by project teams or contracted individual service providers or external evaluators.

The CIPP evaluation model consists of 4 types of criteria, namely:

a. Context Evaluation.

This evaluation identifies and assesses the needs that underlie the preparation of a program.

b. Input Evaluation.

This evaluation identifies problems, assets, and opportunities to help decision-makers define and help to assess the objectives, priorities, and benefits of the program, assess alternative approaches, action plans, staff plans, and budgets for cost-effectiveness and potential to meet needs and targeted goals.

c. Process Evaluation.

This evaluation seeks to access the implementation of the plan to help program staff carry out activities and then help user groups to more broadly assess the program and interpret benefits.

d. Product Evaluation.

This evaluation seeks to identify and access outputs and benefits, both planned and unplanned, both short and long term.

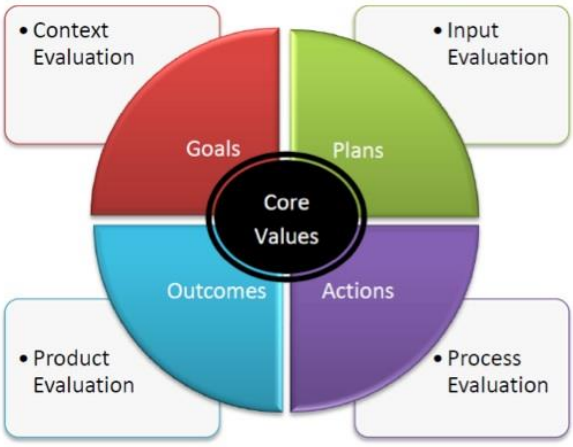


Figure 1. CIPP Evaluation Model.

2.5. Analytical Hierarchy Process (AHP) Method.

AHP method can be done with the following steps, including:

a. Define the problem and determine the desired solution.

b. Create a hierarchical structure that starts with the main goal.

c. Make a paired comparison matrix that describes the relative contribution or influence of each element to the objectives or criteria that are above it.

d. Perform pairwise comparisons so that the total number of judgments is n x [(n-1) / 2], with n being the number of elements compared.

e. Calculate eigenvalues and test their consistency

f. Repeat steps 3,4 and 5 for all levels of the hierarchy.

g. Calculates the eigenvectors of each paired comparison matrix.

h. Check hierarchy consistency.

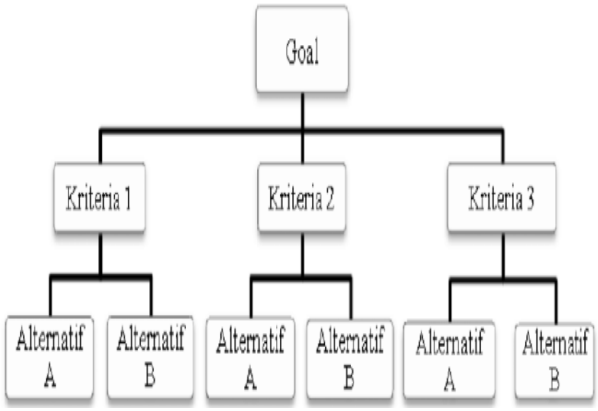


Figure 2. AHP structural model. (Saaty, 1980)

2.6. Data Collection Technique.

Sources of data are obtained from several previous research literature, books, and journals. Data is taken from two sources, namely the respondent and expert. Expert sources are needed to obtain criteria weighting data and determination of evaluation recommendations. Respondent data was used to obtain evaluation values from the Indonesian Naval Academy cadets' nurturing program.

2.7. Stages of Research.

This preliminary study consists of 2 stages. The first and second stages are the determination and weighting of criteria by the expert. Expert was taken from 4 personnel who were experts in the field of management nurturing of Naval Academy cadets by conducting questionnaires and interviews. 4 experts namely Governor of Naval Academy (E1), Deputy Governor of Naval academy (E2), Commander of Naval Academy Regiment (E3), Commander of Regiment Battalion (E4).

Table 1. List of Research Experts

Expert Name	Total	Codes
Governor	1	E1
Deputy governor	1	E2
Regiment Commander	1	E3
Deputy Commander of the Regiment	1	E4

Table 2. List of Research Respondents.

Name of Respondent	Total	Codes
Governor	1	R1
Deputy governor	1	R2
Regiment Commander	1	R3
Deputy Commander of the Regiment	1	R4
Battalion Commander	3	R5-R7
Company Commander	3	R8-R10

The second stage is the evaluation of the Cadets nurturing program evaluation. At this stage, the evaluation of the evaluation was carried out using the value of the respondents consisting of 10 personnel involved in the management of the Naval Academy nurturing. Assessment is done using a Likert scale score of 1-5.

Table 3. Research Score Analysis.

AHP Score	Likert Score	Percent (100%)	Description
9	5	91-100	Very Good (SB)
7-8	4	81-90	Good (B)
5-6	3	71-80	Enough (C)
3-4	2	61-70	Less (K)
1-2	1	0-50	Very less (SK)

Table 4. Initial Evaluation Criteria.

CRITERIA	SUB CRITERIA EVALUATION	CODES
INPUT	Caregivers	I1
	Nurturing Program	I2
	Cadets	I3
	Infrastructure	I4
	Budget	I5
PROSES	Accountability	P11
	Commitment	P12
	Communication	P13
	Suitability	P14
	Trust	P15
	Leadership	P16

3. RESULTS AND DISCUSSION

3.1. Results of the evaluation of Input aspects.

Table 5. Results of Input Aspect Evaluation.

Criteria	Weight	Score	Result	%	Mark
Caregivers	0,142	3,723	0,529	74,456	Enough
Nurturing Program	0,099	3,420	0,339	68,404	Less
Cadets	0,230	4,101	0,943	82,022	Well
Infrastructure	0,166	3,956	0,657	79,117	Enough
Budget	0,364	4,180	1,521	83,593	Well
Evaluation result			3,989	79,771	Enough

In evaluating input in the research that has been carried out obtained; decision making, determining the available sources, what alternatives are taken, what plans and strategies to achieve the program objectives fall into sufficient categories. In evaluating the input it is translated into 5 (five) sub-criteria, namely: 1) Caregiver; 2) Nurturing Program; 3) Cadets; 4) Infrastructure; 5) Budget.

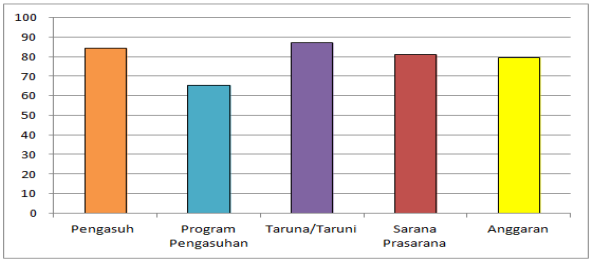


Figure 3. Graph of Input Aspect Evaluation Results.

From the results of data analysis shows that the input component gets an average percentage of 79.77%. From these results, the input component is included in the sufficient category. The sub-criteria of caregivers have an evaluation value of 74, 47% with sufficient categories. The sub-criteria for the nurturing program get an evaluation result value of 68.4% with fewer categories, so there needs to be some improvement in the current nurturing pattern. Sub criteria Cadets get the evaluation result value of 82.02% in the good category. The sub-criteria for facilities and infrastructure received an evaluation result value of 79.11% with sufficient categories. The budget sub-criteria get an evaluation result value of 83.59% in the good category.

3.2. Results of The Evaluation Aspects of Implementation.

Table 6. Results of Process Aspect Evaluation.

Criteria	Score	Result	%	Mark	Weight
Accountability	0,083	3,350	0,278	67,009	Less
Commitment	0,130	4,004	0,521	80,087	Well
Communication	0,209	3,369	0,704	67,371	Less
Suitability	0,298	3,732	1,112	74,641	Enough
Trust	0,152	4,343	0,660	86,855	Well
Leadership	0,130	4,185	0,544	83,701	Well
Evaluation result			3,819	76,380	Enough

Process aspects are aspects of evaluation that are designed and applied in the practice of nurturing the implementation of activities. Every activity is monitored and recorded changes that occur honestly and carefully. Recording of daily activities is so important. Without a recordkeeping system, the program will run poorly. These notes will prove useful in the future in detecting the strengths or advantages and disadvantages of the program that explain the results of his observations.

The pattern of nurturing that takes place at the Indonesian Navy Academy, especially the process of caring for the Midshipman Regiment, will be described based on the results of interviews and observations made during the activity. Process Aspects consist of 6 (six) sub-criteria namely: 1) Accountability; 2) commitment; 3) Communication; 4) Conformity; 5) Trust; 6) Leadership.

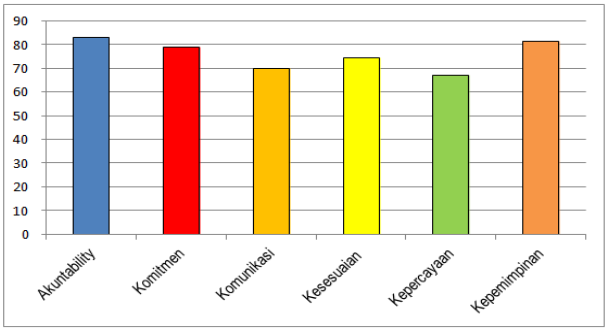


Figure 4. Graph of Process Aspect Evaluation Results.

From the results of data analysis shows that the process component gets an average percentage of 76.38%. From these results, the input component is included in the sufficient category. Accountability sub-criteria have an evaluation result value of 67% with fewer categories. Commitment sub-criteria gets an evaluation result value of 80.08% with a good category. The communication sub-criteria get an evaluation result value of 67.37% with fewer categories. The suitability sub-criteria received an evaluation result value of 74.64% with sufficient categories. The trust sub-criteria received an evaluation result value of 86.85% in the good category. The leadership sub-criteria obtained an evaluation result value of 83.7 with good categories.

3.3. Results of the Initial Evaluation of the Midshipman Nurturing Program.

Table 7. Preliminary Identification Results of Midshipman Nurturing Program Evaluation.

Criteria	Result	%	Mark
Input	3,819	76,380	Enough
Process	3,989	79,771	Enough
Evaluation result	**3,904**	**78,075**	Enough

Analysis of the results of management evaluation of the pattern of nurturing Indonesia

Naval Academy in the aspects of Input and Process has a value of 78.07% with sufficient categories. Evaluation of input (input) has sufficient category value, Acceptance of cadets according to criteria and procedures, the suitability of education and training materials, use of facilities and infrastructure are sufficient and according to standards. The budget obtained and the management are also good.

The process evaluation (process) is included in a sufficient category, with an evaluation of 79.77%. Based on the results of the analysis, there are two aspects with fewer categories, namely aspects of accountability and communication. The three sub-criteria are categorized as good, namely commitment, trust, and leadership. One category is sufficient, namely aspects of conformity.

4. CONCLUSION.

Based on the results of the assessments conducted at the Indonesian Naval Academy about evaluating the cadets nurturing program with the CIPP model with two aspects (Input and Process), it can be concluded as follows:

In evaluating input (input) in data analysis research shows that the input component gets an average percentage of 79.77%. From these results, the input component is included in the sufficient category.

The pattern of nurturing that takes place at the Indonesian Naval Academy, especially the process of caring for the cadets of the Regiment, will be described based on the results of the evaluation conducted. From the results of data analysis shows that the process component gets an average percentage of 76.38%. From these results, the input component is included in the sufficient category.

5. ACKNOWLEDGEMENT

The authors greatly acknowledge the support from Indonesian Naval Academy and Indonesian Navy Institution for providing necessary resources to carry out this research work. This paper is the result of the author research for the purposes of education only because the data used is confidential, without reducing the substance of study interests.

REFERENCES

Unsupported source type (DocumentFromInternetSite) for source ETH.

Amin, S.H., Yan, N. and Morris, D. (2018) 'Analysis of Transportation Modes by Evaluating SWOT Factors and Pairwise Comparisons: A Case Study', *Multi-Criteria Methods and Techniques Applied to Supply Chain Management*, pp. 57-72.

Augustin, D.S. and Akossiwa, D.L. (2018) 'SWOT Analysis for Developing Dry Ports in Togo', *American Journal of Industrial and Business Management*, pp. 1407-1417.

Bentaleb, F., Mabrouk, C. and Semma, A. (2015) 'Dry Port Development: A Systematic Review', *Journal of ETA Maritime Science*, pp. 75-96.

Elentably, A. (2015) 'Strategic and Operational Plan Implementation of Seaports (Utilization Jeddah Port)', *the International Journal on Marine Navigation and Safety of Sea Transportation* , pp. 489-497.

Ercui, Z. and Man, Q. (2012) 'The SWOT Analysis of Qingdao Marine Culture Industry', *Advances in Asian Social Science (AASS)*, pp. 629-634.

Farsi, M. and Sharif, M. (2014) 'Stufflebeam's CIPP Model & Program Theory : A Systematic Review', *International Journal of Language Learning and Applied Linguistics World*, p. 403.

Guo, L. (2014) 'Supply Chain Strategic Alliances Partner Selection for Rizhao Port', *International Journal of Scientific and Research Publications*, pp. 1-9.

Huang, W.-C., Kuo, T.-C., Wu, C.-T. and Kuo, C.-C. (2012) 'Port Management Improvement Strategies Based on Simulating Model', *Journal of Marine Science and Technology*, pp. 492-507.

Kakderi, C. (2017) 'Regional economic resilience: the role of national and regional policies', *European Planning Studies*, pp. 1435-1453.

Kalutara, P., Zhang, G., Setunge, S. and Wakefield, R. (2018) 'Prioritising Sustainability Factors For Australian Community Buildings' Management Using Analytical Hierarchy Process (AHP) ', *International Journal of Strategic Property Management* , vol. 22, no. 1, pp. 37-50.

Mutmainah, Marfuah, U. and Panudju, A.T. (2017) 'Employee Performance Appraisal Model Using Human Resources Scorecard And Analytical Hierarchy Process (AHP)', *Journal of Scienctific & Technology Research*, vol. 6, no. 11, pp. 81-84.

Olesen, P.B., Dukovska, I., Hvolby, H.-H. and Jensen, K.S. (2014) 'Strategic port development: identifying a development approach for small and medium-sized ports', *Proceedings from the Annual Transport Conference*, pp. 1-16.

Permana, J. (2012) *Pendidikan Karakter*, Bandung: PT REMAJA ROSDAKARYA.

PPN-Brondong (2016) *Profile Pelabuhan Perikanan Brondong, Lamongan*, 1st edition, Lamongan: PPN Brondong.

Razikin, M.A.M., Arep, H., Mahmood, R. and Halim, I. (2013) 'The Use Analytical Hierarchy Process (AHP) in Product Development Process', *Proceedings of the International Symposium on the Analytic Hierarchy Process*, pp. 1-3.

Saaty, T.L. (1980) *The Analytical Hierarchy Process*, New York: McGraw Hill.

Singh.Z (2016) 'Sustainable development goals: Challenges and opportunities', *Indian Journal of Public Health*, pp. 247-250.

Stufflebeam, D.L. (1971) *The Relevance of the CIPP Evaluation Model for Educational Accountable*, New Jersey: American Association of Scholl Administrators.

Tan, J., Lo, K., Liu, W., Li, J. and Zhang, P. (2017) 'Regional Economic Resilience: Resistance and Recoverability of Resource-Based Cities during Economic Crises in Northeast China', *Journal of Sustainability*, pp. 1-11.

Vladi, E. (2014) 'Tourism Development Strategies, SWOT analysis and improvement of Albania's image', *European Journal of Sustainable Development* , pp. 167-178.

Wibowo, H., Ciptomulyono, U.S. and Singgih, M.L. (2011) 'Penentuan Strategi Pengembangan Sub Sektor Ekonomi Unggulan di Kabupaten Jombang dengan Pendekatan Metode Locatien Quotien dan Analytical Hierarchy Process (AHP)', Surabaya.

Yahaya, A.H. (2001) 'The Using of Model Context. Input, Process and Products (CIPP) In Learning Programs Assessment', *International Conference on Challenges and Prospects in Teacher Education*, pp. 6-10.

THE DEVELOPMENT OF NAVY PERSONNEL BASED ON COMPETENCE TO REALIZE OPTIMAL PERFORMANCE

Heribertus Yudho Warsono [1], Budiyanto [2], Akhmad Riduwan [3]

[1,2,3] *Sekolah Tinggi Ilmu Ekonomi Indonesia, STIESIA*
Surabaya, Indonesia

ABSTRACT

This scientific work is motivated by the importance of the role of management of Human Resources which is closely related to performance, in this case, the Navy soldiers. There are things that must be owned for every soldier to improve optimal performance, namely the development of competence. Based on the results of the study, a person who has adequate experience and technical qualifications do not necessarily have a good performance, if the person concerned is not able to show behavior that supports the implementation of the task. For this reason, the need for technical competencies can be developed through education and training aimed at improving knowledge and skills. For behavioral competencies alone can be done through various training programs and individual development aimed at changing behavior. Whereas organizational values that form institutional competencies can be instilled through indoctrination. Management of competency-based warrior performance is a current method in the field of behavioral science, which can be used to improve the quality of Navy human capital in order to support the realization of a minimum essential force. Considering that as part of the government's bureaucratic reform program, the Indonesian Ministry of Defense has adopted a competency-based personnel management system, so the Navy Institution must inevitably integrate it into the Navy personnel development system.

Keywords: *Human Resources, Competence, Personnel Performance of Indonesian Navy*

1. INTRODUCTION

The position and role of the Navy as the main element of defense forces in the Sea which has the main tasks and functions according to Law No. 34 of 2004, namely the Navy Institution is required to play an active role in maintaining and maintaining the sovereignty of the Republic of Indonesia by being based on loyalty and obedience to Pancasila and the 1945 Indonesian Constitution.

In order to be able to carry out their main tasks and functions properly, the formation of Navy personnel is directed at improving the quality of human resources, in order to have an attitude and behavior so as to provide the best service (excellent service) and high performance for the glory of the nation and the State.

The implementation of national defense relies on the strength and ability of human resources, namely the Indonesian people, both military and non-military, who are supported by a reliable weapon system and defense management, so that qualified human resources are a center of strength for National Defense.

Human resources (HR) are often referred to as human resources, power or human strength (energy or power). Resources are also called sources of energy, ability, strength, expertise possessed by humans. Along with the development of technology and changes in the world that are increasingly complex, demanding someone to always refresh their abilities in accordance with the capacity of these changes. Basically, humans have basic potential and abilities that will ideally continue to develop if continuously and continuously honed (Mashood, 2014).

In the 2008 Indonesian Defense White Paper it was stated that improving the quality and welfare of defense human resources became one of the main targets in addition to efforts to increase defense capability, rejuvenation and addition of defense equipment and improvement of domestic defense technology and industry (Indonesian Defense White Paper 2008, Ministry of Defense Republic of Indonesia, Jakarta)

Based on the background above, several problems can be formulated which underlie this research as follows: what factors influence the performance of Navy soldiers, how the relationship and influence of HR on the performance of the Navy, how to improve the performance of Navy soldiers, and how is the relationship of competence to the performance support tools of the Navy to find out and analyze the strong influence of HR on Navy performance.

The final goal of this research is to obtain key factors that can be carried out by the Indonesian Navy management in order to improve and realize the competency-based optimal performance of Indonesian Navy personnel.

2. MATERIAL AND METHODS

2.1. The Indonesian Navy

The Indonesian National Navy Forces are part of the Indonesian Military Forces (TNI) which are responsible for the defense operations of the Republic of Indonesia in the Sea. The Navy was formed on September 10, 1945. Nowadays The Indonesian Navy is led by a Navy Chief of Staff who is the highest leader in Naval Headquarters.

The strength of the Navy is currently divided into 3 (three) Co-operatives, Command Fleet I based in Tanjung Priok, Jakarta, Command Fleet II which is based in Tanjung Perak Surabaya, and Command Fleet III which is based in Sorong Papua, besides that, it also oversees the Marine Corps. In accordance with Law No. 34 of 2004 concerning the TNI in Article 9, the Navy is in charge of:

a. Carry out the tasks of the TNI in the defense sector;

b. Enforce the law and maintain security in the sea area of national jurisdiction in accordance with the provisions of national law and international law that has been ratified;

c. Carry out the duties of the Navy's diplomacy in the framework of supporting foreign policy set by the government;

d. Carry out the duties of the TNI in the development and development of the power of the sea dimension, and

e. Carry out empowerment of sea defense areas;

In carrying out its main duties, the Navy has a defense function and enforces Marine law carried out by the Main command in the Navy. The Main command in the ranks of the Navy has the Fleet Command, under the Koarmada there is the Main Base of the Navy, besides that the Fleet Command also has an Operation Unit (Combat Group / Security Group) and Implementing Unit (Fast Ship, Ship Amphibians, Submarines). Under the Main Base of the Navy, there is the Naval Base. While for the Implementing Unit in charge of the Fleets, namely the Republic of Indonesia Warship

2.2. Human Resources

Human Resources is an integrated ability of the mind and physical power possessed by an individual. Actors and their characteristics are carried out by their offspring and environment, while their work performance is motivated by the desire to fulfill their satisfaction. Human Resources consists of the power of thought and physical power of every human being, (Iqbal, 2015). Strictly the ability of every human being is determined by the power of thought and physical power. HR or humans are the main elements in every activity carried out. Reliable

or sophisticated equipment without active HR roles does not mean anything. Thinking power is intelligence that is carried out from birth (basic capital) while skills are obtained from business (learning and training). Measuring intelligence is Intelligence Quotient (IQ) and Emotion Quality (EQ).

Human resources are very critical factors as the main assets in an agency. Its existence in the system with all its uniqueness which greatly determines success becomes very important to note. For this reason, agencies must develop their management strategies well and orderly (Zameer, 2014). The human ability factor in carrying out its work is strongly influenced by the competencies that are in each of them so that Human Resource Management (HR Management) based on competency management sees that the need for output from each worker makes competency the main foundation for all functions in HRM, (Khan, 2014).

Competence drives the work system design process, recruitment, placement, performance management, and with all functions in HRM. Therefore, each person certainly has criteria and measures of competency, each of which is different and has its own characteristics (Vosloban, 2012).

But not everyone can fulfill the demands of their competency. For this reason, it is also necessary to identify, measure and analyze these competencies and their management so that the functions of competency development programs for human resources can be prepared through appropriate competency improvement programs, for example through training, coaching and/or programs counseling (Parvin, 2011).

Some goals for agencies related to competency-based human resource management, (Singh, 2013), for example:

a. All positions within the organization can function properly (according to the demands of their work).

b. Provide guidance to all officeholders in order to meet the prescribed measures of position competency standards.

c. As a basis for HRD to develop competency and career development programs based on the results of competency measurements compared to the requirements on job competencies held by them.

d. To improve one's competence if at the time of competency measurement it is found that the competencies have not been able to meet the position of competency requirements through training programs, coaching, and counseling.

2.3. Factors Affecting Performance

Research in the field of personnel management shows the performance of an individual determined by four factors, namely, experience, technical competence (hard skills), behavioral competencies (soft skills) and personality (Latif, 2013). Experience is related to what has been done by someone and can be measured through job history analysis, results of performance appraisal, and track record owned. On the other hand, technical competence refers to what someone already knows, and can be measured through professional qualifications (for example, from certificates and diplomas), or through ability tests or competency tests. Behavioral and personality competencies, which are more related to psychological aspects, are related to what can be done by someone (Shmailan, 2016).

A person who has adequate technical experience and qualifications does not necessarily have a good performance if the person concerned is not able to demonstrate the behavior that supports the implementation of his duties and position. Behavioral competencies can basically be measured through what is called the Assessment Center (Rania, 2011)

Of these four factors (experience, technical competence, behavioral competencies, and

personality), personality is regarded as the center of optimal sources of performance and influences all other factors. In addition to these four factors, there is actually still one more factor, namely institutional competence, which includes typical organizational values, so that it can influence one's performance. However, until today, there is no scientific measurement tool, it can be used to measure how far someone has made certain values as a handle of his life (Sageer, 2012).

2.4. Relationship between Human Resources and the Navy Institution

State sovereignty, national defense, and the Navy are three things that cannot be separated because in carrying out national defense in order to guarantee the upholding of the Republic of Indonesia, the main component is the Navy. Therefore building the Navy and its ranks to be strong, solid and professional is a necessity at this time.

But building the Navy, especially the Navy is not as easy as it says, because building the Navy as a large military organization requires attention and cooperation from all components of the nation. Because building the Navy requires policy, regulation, budget and posture reform. Whereas we know after the reform, the Navy faced a lot of blasphemy and criticism from various circles, besides that the state's own financial condition had not fully improved, so the budget support to the defense sector was also very limited which eventually became an obstacle in the development of the Navy.

The Navy as one of the dimensions in the Indonesian Military is currently experiencing a period, where between the demands of the task and the threat of the threat to put the Navy in a difficult position, because until now to be able to meet the minimum essential force needs it is still difficult to achieve, while the nature of the threat is increasingly complex along with the times. The real threat currently faced by the nation and state of Indonesia is a large number of internal conflicts both vertical and horizontal conflicts that can threaten the integrity of the Republic of Indonesia, not to mention the threat from outside countries trying to tamper with the sovereignty of the Republic of Indonesia through shifting regional borders, annexation and claimants. and islands, as well as guarding our outer islands which are very vulnerable to disruption and control by other countries.

Such things eventually led to a contemplation, could the Navy maintain the sovereignty of the Republic of Indonesia, and could we build a reliable and respected Navy and world-class Navy. This kind of reflection must be realized, because the Navy which is reliable and respected and world class, is one of the tools to achieve the national goals and ideals of the Indonesian nation even though it requires time but at least there are solutions that can be used and applied to lead to the achievement of a reliable and respected and world-class Navy organization.

The development of a military organization as an institution in charge of the defense sector has its own peculiarities, because military organizations besides having 3 (three) main factors forming the organization, namely: 1) People, 2) Cooperation and 3) Specific objectives, where all three factors it is interrelated and inseparable, it also has additional factors according to its characteristics, in this case, there is a doctrine in carrying out national defense strategies. It is from this doctrine that then gives birth to policies, basic principles and strategic steps for managing defense resources to build military organizations in order to achieve national goals, (Elqadri, 2015).

Likewise with the Navy as a military organization that has a main task, among others, carrying out the tasks of the military in the defense sector, carrying out the tasks of the TNI in the

development and development of the power of the sea, all forms of activities carried out by the Navy the management of its defense resources is directed towards forming a reliable and respected Navy and world-class organization. Therefore the Navy's defense resource management policy must refer to the national defense strategy. So that the translation can be integrated with each other.

3. RESULT AND DISCUSSION

3.1. Development of Navy Personnel Competency Based on Excellence Character

In terms of competency development, basically, the experience can be improved by providing opportunities in various positions, while technical competencies can be developed through education and training aimed at improving knowledge and skills. For behavioral competencies, development programs that can be carried out are through various training and individual development programs that aim to change behavior, while organizational values that shape institutional competence can be instilled through indoctrination. However, human personality, both from inheritance (personality or IQ), or formed from the past, is something that is relatively settled and difficult to change, namely the development of character, (Chukwuma, 2014).

To build a World-Class Navy, the priority is to build character, both individual characters, units and organizations of the Navy in its entirety and thoroughly. The characters needed are superior, special, and high quality or called "Excellent". Excellent in four fields, namely in the fields of Organization, Operations, Human Resources, and Technology, as shown in Figure 1 below:

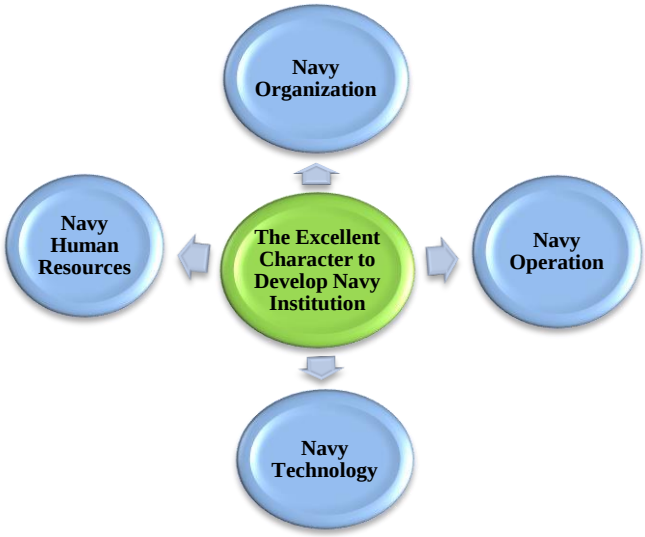


Figure 1. The Excellent Character to Develop Navy Institution

In Figure 1, it can be explained that to develop the Indonesian Navy it is necessary to build character in all fields related to the basic tasks of the Indonesian Navy, namely organization, operations, human resources, and technology. This is very necessary to be able to make the Navy become a world-class Navy institution.

3.2. Excellence Based Approach

Behavioral scientists have formulated the concept of the strengths-based approach, which aims to place an individual according to his personality, and then develop his competence and experience. According to this thought, it is more

useful to look for a personality that can be someone's strength, and then develop competencies that can be supported by that personality. For example, extroverted innate traits are known to support interpersonal competence, so extroverted individuals are easier to develop in positions that require interaction with other humans (Al-Mzary, 2015).

In the context of behavioral competencies, the main goal in developing behaviors that support optimal performance is mapping the relationship between personalities that can support behavioral competencies that are expected to exist within the organization. For individuals who have inadequate behavioral competencies, they can be included in the development program so that in the future they can show optimal performance. For example, based on research, it is known that competencies related to interpersonal flexibility are strongly influenced by the inherent traits of extroversion and adaptability, while competencies associated with innovative thinking abilities are influenced by the level of intelligence (IQ) possessed and the innate nature of new experiences. Therefore, if an individual with a supportive personality has been found, the individual can be included in a behavioral competency development program that is related to interpersonal flexibility and innovative thinking, so that ultimately an individual can be flexible and innovative, (Awadh, 2013).

3.3. Key Factors for Increasing the Professionalism of the Navy

The development of the human resources of the Navy is emphasized on the modernization of the human aspect where humans are placed in important positions in the Navy's organization. Thus, the development of human resources is a central point in the development of the strength and capability of the Navy which is expected to determine the success of carrying out basic tasks. Referring to this reasoning, the Navy's human resource development must be carried out conceptually, systematically, planning and continuing. In this context, coaching must be carried out under any circumstances, either with full budget support or limited budget support, because basically, humans are living things that have specificities, namely feelings, thoughts and reason, and dynamic knowledge.

To be able to answer the challenges of an increasingly complex task, the Navy must be able to carry out improvements and empowerment of its human resources to be able to create superior and professional Navy personnel, the description can be described by some key factors as shown in Figure 2 below:

Figure 2. Improving the Quality of Navy Human Resources

For this reason, several key factors can be formulated that can improve the professionalism of Navy personnel by improving the quality of human resources through a. Improving the quality of education and training, b. Improving work ethics, c. Improving the relationship between commanders and subordinates, and d. Good leadership at every level of office.

First, Education and training that aim to equip, maintain and improve the quality of personnel basically have been carried out within the Navy, only in the present context and the influence of the strategic environment of education and training that they are improved by connecting issues around the world of defense with material and curriculum in the military education world. Especially if it is associated with the RMA where the development of science and technology is very influential on the defense sector, education and training naturally in the environment of the Navy are developed and adapted based on mastery of technology, because the development of RMA has influenced the strategy and tactics of operations.

Second, Improving work ethics. A good work ethos will produce productive, efficient personnel who are capable of completing tasks and job responsibilities proportionally and professionally. So far, the Navy still looks ineffective and efficient in the way the personnel work so productivity is not optimally achieved. To be able to improve the work ethic, there is a need for a fundamental change in the work environment of each unit at each level of office by making work standards and personnel who work on them by paying attention to:

a. Conformity, the right personnel in the right job so that productivity can be achieved.

b. Guarantees, the trust, and confidence that every work achievement will get a decent award.

c. Attention, that none of the work is important even though the work is very easy to do.

d. Supervision, the most important part of the mechanism of a job because it relates to the timeliness of work completion and the quality of work.

e. Evaluation, an important factor to determine the extent of achieving the task.

f. Actions, sanctions if there is a delay or the task is not resolved. By paying attention to these six factors, the reward and punishment system can be enforced and a better work ethic can be implemented.

Third, improving Commander and subordinate relations. That the success of the unit in carrying out its main duties is not solely the duties and responsibilities of the Commander, but rather is a joint responsibility. This is where there is a need for teamwork or cooperation between commanders and subordinates. In cooperation here is needed a) honesty in each personnel, b) responsibility of each person to carry out the task properly and correctly, c) initiatives of the leadership elements to make changes and d) mutual assistance between the commander and subordinates in realizing the main goal or task unit. Good cooperation can be realized through increasing the relationship of commanders and subordinates, because if the commander element is more intensive to pay attention to his subordinates, then the reciprocity that will be obtained is the existence of high awareness and responsibility from subordinates to carry out each job properly and correctly.

Fourth, Leadership. The most decisive factor in forming a superior organization is good leadership. Likewise with the Navy, as a military organization in order to become a strong, solid and professional organization in addition to carrying out the guidance of its personnel, the last factor that can be fostered and directed towards better change is the presence of strong and reliable leadership factors in every level of position in the Navy. Establishing strong and reliable leadership has often been discussed and discussed within the Navy because policyholders in the Navy are well aware of the importance of leadership. But the implementation still feels lacking, this can be seen from the still small portion of subjects about leadership in educational institutions within the Navy. Although there are those who say that a reliable leader is born of his era, there are also leaders who are prepared. This prepared leader needs attention from the Navy to try to realize it through educational institutions or leadership training. By placing a greater portion on the formation of an earlier leadership, it is hoped that good leaders will emerge in the Navy who will be able to build the Navy into a reliable and respected world-class organization.

4. CONCLUSION

The dynamics of The Navy organization are in line with the dynamics of other RI government institutions. One of the national dynamics that influenced the TNI organization was the national reform movement as a result of the fall of the New Order regime in 1998 (Indonesian Ministry of Defense, 2012). This dynamic has brought the Navy to carry out the same reform program in order to position itself appropriately and optimize its role in the national life order. Bureaucratic reform carried out within the TNI includes aspects of doctrine, structure, and culture that are in line with the national bureaucratic reform policy to realize clean and authoritative governance occur nationally, in order to create effective and efficient governance. While the cultural aspects are directed at changing the mindset of Personnel and compliance with the law and human rights and Personnel discipline in carrying out basic tasks as mandated in Republic of Indonesia Law Number 34 of 2004 concerning the Navy.

The development of science and technology in the field of personnel management, civil and military organizations in various countries, including in Indonesia, has adopted the method of managing competency-based personnel in order to improve the performance of their organizations. The Ministry of Defense of the Republic of Indonesia itself, as part of the Government's Bureaucratic Reformation,

has launched the concept of competency-based personnel development in the ranks of the Navy Institution. Thus, the Navy certainly needs to make various improvements in the field of personal development so that it can properly implement the competency-based personnel management method. Through the implementation of appropriate competency-based personnel management methods, it is expected that in the future the performance of the Navy personnel will be more optimal.

REFERENCES

Al-Mzary, M. M., Al-rifai, & AlMomany, M. O. (2015). Training and its Impact on the Performance of Employees at Jordanian Universities from the Perspective of Employees: The Case of Yarmouk University. *Journal of Education and Practice*, 128-140.

Awadh, A. M., & Alyahya, M. S. (2013). Impact of Organizational Culture on Employee Performance. *International Review and Business Research*, 168-174.

Chukwuma, Maduka, Edwin, Okafor, & Obiefuna, D. (2014). Effect of motivation on employee Productivity: A study of Manufacturing Companies in Nnewi. *International Journal of Managerial Studies and Research*, 137-147.

Elqadri, Mustafa, Z., Wardoyo, Wijayanti, D. T., & Priyono. (2015). The Influence of motivation and discipline work against Employee work productivity Tonaan Market. *Review of European Studies*, 59-66.

Iqbal, A., Ijaz, M., Latif, F., & Mushtaq, H. (2015). Factors Affecting The Employee's Performance: A Case Study Of Banking Sector In Pakistan. *European Journal of Business and Social Sciences*, 309-318.

Khan, Hussain, A., Aleem, & Muhammad. (2014). Impact of satisfaction on employee turnover: An empirical study of Autonomous Medical Institution of Pakistan. *Journal of International Studies*, 122-132.

Latif, & Shahzad, M. (2013). Impact of Employees Job Satisfaction on Organizational Performance. *European Journal of Business and Management*, 166-171.

Mashood, & Ayesha. (2014). Factors Affecting Employee Satisfaction of Public and private sector organization of Pakistan. *International Journal of Human Resources Studies*, 97-121.

Parvin, & Mahamuda, M. (2011). Factors Affecting Employee Job Satisfaction in the Pharmaceutical Sector. *Australian Journal of Business and Management Research*, 113-123.

Rania, Sakthivel, Kamalanabhan, & Selvarina. (2011). Work/Life balance Reflection on Employees Satisfaction. *Serbian Journal of Mangement*, 85-96.

Sageer, Alam, Rafat, Sameena, D., Agarwal, & Puja, M. (2012). Identification of Variables Affecting Employees Satisfaction. *IOSR Journal of Business and Management (IOSR-JBM)*, 32-39.

Shmailan, & Bin, A. S. (2016). The relationship between job satisfaction, job performance, and employee engagement. *Issues in Business Management and Economics*, 1-8.

Singh, Kumar, J., Jain, & Mini, D. (2013). A Study of Employees Job Satisfaction and its Impact on their Performance. *Journal of Indian Research*, 105-111.

Vosloban, R. I. (2012). The Influence of the Employee's Performance on the company's growth - a managerial perspective. *Procedia Economics and Finance Journal*, 660-665.

Zameer, H., Ali, S., Nisar, W., & Amir, M. (2014). The Impact of the Motivation on the Employee's Performance in Beverage Industry of Pakistan. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 293-298.

EFFECT OF LEADER MEMBER EXCHANGE (LMX) AND WORK MOTIVATION ON EMPLOYEE LOYALTY

Titin[1], Evi Fitrotun Najiah[2], Rivatul Ridho Elvierayani[3], Fahmi mayasari[4]

[1,2,3]Major of Management, Faculty Economy, Universitas Islam Lamongan
[4]Major of Accounting, Faculty Economy, Universitas Setia Budi

ABSTRACT

This study aims to determine the effect of Leader Member Exchanges and Work Motivation on Loyalty at PT. Ladang hijau . This study uses descriptive quantitative, data obtained from questionnaires that have been filled by respondents. Data analysis methods used are Validity Test, Reliability Test, Classical Assumption Test, Multiple Linear Regression Test, Correlation Test, Determination Test, T Test, F Test. The results of this study indicate that the Leader Member Exchange (LMX) and Work Motivation have an effect on simultaneously and significant to Employee Loyalty. Of the two independent variables Work Motivation is the most dominant variable influencing LMX. Obtained multiple linear regression equations for LMX and Work Motivation namely $Y = 0.661 + 0.552\,X_1 + 0.706\,X_2$. This shows that the increasing LMX and work motivation given by employees and leaders, the greater the employee loyalty in behaving at PT. Ladang hijau .

Keywords*: Leader Member Exchange (LMX), Work Motivation and Employee Loyalty*

1. INTRODUCTION

In an organization, there can be a different relationship between the leader and the employees who are his subordinates. The level of closeness of this relationship is usually called the exchange of member leaders. According to Welliam (2003, p. 1) .In the globalization era, many companies are growing very rapidly. The number of companies that developed in this modern era, the tighter competition between companies. It does not rule out the possibility that many fertilizer companies have emerged triggered by the fact that from 2015 to October 2018, the company recorded export value of 4.22 million tons of fertilizer products and 2.45 million tons of ammonia with fertilizer product sales of up to US $ 985 million. In 2015, total fertilizer exports reached 844,000 tons and in October 2018 it reached 995,000 tons. (Rini, A. S, 2018: Bisnis.com).

Human resources are valuable assets in a company to be able to compete in competitive competition. Human resources in question are leaders and employees who have the skills and abilities that are appropriate for the success of the company. In order to achieve the company's goals need to pay attention to the processing of good human resources and company leaders play a role in the processing.

According to Almansour (2012) the important thing that needs to be given to employees is a sense of justice in the organization because it can increase employee motivation in working. In addition, organizational justice is an important factor that will determine employees to work effectively (Cropanzano, Bowen & Gilliand, 2007). The relationship between subordinates will affect employee loyalty, the poor relationship can lead to low employee loyalty. Poor relationships between superiors and subordinates are indicated by lack of attention and superiors. According to Gary Yukl (2015: 19) LMX Theory focuses on leadership behavior as a source of influence, and on changes in attitudes and behavior of subordinates as a process of influence. The better the leader's relationship and the more loyal the employee's subordinates. Other factors that can affect loyalty are work motivation. According to Torang (2013: 57) motivation is energy that moves individuals to try to

achieve the expected goals in doing their work. Every individual has a basic motivational drive that is different. A person's motivation is determined by the intensity of the motives in the form of needs and desires. When employees are motivated, the employee will work hard and do his job in the company very well for the success of the company.

Based on the above background, the problem can be formulated namely whether the Leader Member Exchange and Work Motivation have an effect on employee loyalty at PT. Ladang Hijau . The purpose of this study is to find out how much influence Leader Member Exchanges and Work Motivation have on Employee Loyalty at PT. Ladang hijau .

1.1. Literatur Review

a. Leader Member Exchange

Leader member exchange (LMX) which proposes the opinion of Morrow, et al (2005, p. 682) that "exchange leader member is an increase in the quality of the relationship between supervision and the company will be able to improve cooperation. But in reality, the relationship between employees and supervision can be grouped into two relationships, namely good relationships and bad relationships. A good relationship will create trust. Leader Member Exchanges according to Organ in Nusantara (2015: 17) that "employee behavior towards the company has an important role to the success of an organization. Good treatment of employees will be able to create voluntary feelings for employees to be able to sacrifice for the company. In addition, through positive special treatment will be able to increase employee contributions to companies where employees work".

Leader Member Exchange Variable Indicator. According to Graen and Uhl-Bien in Nusantara (2015: 18) there are three indicators of the Leader Member Exchange, namely:

1) Respect, Relations between superiors and subordinates cannot be formed without respect for the abilities of others.

2) Trust (Belief), without mutual trust, the relationship between superiors and subordinates will be difficult to form.

3) Obligation, the effect of obligations will develop into a working relationship between superiors and subordinates.

b. Work Motivation

Gitosudarmo in Faridatul Umu Rosyidah (2017: 17). Motivation is a factor that encourages a person to do a certain activity, therefore motivation is often interpreted as a driving factor for a person's behavior. Every activity carried out by someone must have a factor that drives the activity. Therefore, the driving factor for someone to do a certain activity in general is the need and desire.

Motivation Indicator. According to George and Jones in Changgriawan (2017) that work motivation indicators are divided into three parts, namely:

1) Employee Behavior (Direction of behavior) The ability of employees to choose the work behavior they will choose. Good employee behavior at work shows that employees are motivated at work.

2) Level of effort Describes how hard someone works for their chosen behavior. Work motivation is done not only so that employees show behavior that is beneficial to the company but also so that employees work hard for the company.

3) Employee persistence refers to the behavior of someone who still wants to work despite obstacles, problems, and obstacles. High employee tenacity shows that employees have high motivation.

c. Loyalty

According to Istijanto in Nusantara (2015: 11). Employees who have high loyalty are willing to work beyond ordinary conditions, are proud to tell their company to others, are willing to accept various tasks, feel there is a similarity in value with the

company, feel inspired, and pay attention to the overall fate of the company. Conversely, employees who are not loyal to the company are characterized by negative feelings, such as wanting to leave the company, feel working in another company is more profitable, do not feel the benefits of the company, and regret their decision to join the company.

Loyalty Indicator. Loyalty according to Gouzali in Nusantara (2015: 12) has several elements, namely:

1) Obedience and compliance, namely the ability of an employee to obey all regulations in the official service, and obey official orders given by an authorized supervisor, and be able to not violate a prescribed prohibition.

2) Responsibility, namely, the ability of an employee to complete the work submitted to him properly, on time and dare to take risks for decisions made or actions taken.

3) Service, which is a sincere contribution of thought and energy to the company.

4) Honesty, harmony between the spoken or act with reality.

2. RESEARCH METHODS

The type of research used in this study is descriptive quantitative. This study uses questionnaire data. The sample used is a saturated sampling technique. This study uses an analytical tool that is by Validity Test, Reliability Test, Multiple Linear Regression Test, Classical Assumption Test, Correlation Test, Determination Coefficient Test, T Test and F Test.

3. DISCUSSION

The results of data analysis are obtained as follows:

1. Test Validity According to Sugiyono (2014: 267) Test validity is used to measure the validity or validity of a questionnaire.

Table 1. Validity Test Results

Variables	Premis	r_{count}	r_{table}	Information
Leader Member Exchange X_1	X1.1	0.822	0.254	Valid
	X1.2	0.790	0.254	Valid
	X1.3	0.690	0.254	Valid
Motivasi Kerja X_2	X2.1	0.774	0.254	Valid
	X2.2	0.769	0.254	Valid
	X2.3	0.808	0.254	Valid
Loyalitas Karyawan Y	Y1	0.822	0.254	Valid
	Y2	0.816	0.254	Valid
	Y3	0.816	0.254	Valid
	Y4	0.762	0.254	Valid

Source: Primary Data Results Processed by Researchers

The results of the validity test can be seen that the ratio between r count and r table for each question in each independent and bound variable, i.e. rcount is greater than rtable, it can be concluded that the instrument used in this study is valid.

2. Reliability Test shows an understanding that an instrument is sufficiently reliable or used as a

data collection tool because these instruments are good (Arikunto, 2010: 223).

Table 2. Reliability Test Results

No	variables	value of Cronbach alpha	Information
1	*Leader Member Exchange* (X_1)	0.654	Reliabel
2	Motivasi Kerja (X_2)	0.682	Reliabel
3	Loyalitas Karyawan (Y)	0.818	Reliabel

Source: Results of primary data are processed by researchers

It is known that the value of Cronbach alpha for all variables is greater than 0.60. From the provisions mentioned earlier, all variables used for research are reliable.

3. Analysis of Multiple Linear Regression According to Sugiyono (2014: 245) Multiple linear regression analysis is used for research, if the researcher intends to predict the state of the dependent variable.

Table 3. Results of Multiple Linear Regression Analysis
Coefficients[a]

Models	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.661	1.724		.384	.703
1 TOTAL_X1	.552	.134	.401	4.107	.000
TOTAL_X2	.706	.142	.485	4.961	.000

a. Dependent Variable: TOTAL_Y
Source: Data processed by SPSS

Regression equation obtained is equal to $Y = 0.661 + 0.552\,X_1 + 0.706\,X_2$. From the above equation can be interpreted as follows that = constants; X_1 = Leader Member Exchange, X_2 = Work Motivation. From the above analysis it can be concluded that, the variable that has a more dominant influence on employee loyalty is the Work Motivation variable because it has a greater value of 0.706.

a) Classical Assumption Test can be seen as follows

b) Test for normality obtained sig. equal to 0.960 or greater than 0.05, then the provision H_0 is accepted, namely that the assumption of normality is fulfilled.

c) Multicollinearity test, namely the Tolerance value of all independent variables of (X_1 = 0.755 X_2 = 0.755) greater than 0.1. and VIF values for independent variables (X_1 = 1.324, X_2 = 1,324) and smaller than 10. Then it is said that multicollinearity does not occur.

d) Heterocedasticity test results that the scatterplot display diagram spreads and does not form a certain pattern, there is no heterocedasticity

4. Correlation Analysis According to Sugiyono (2013: 231) is a number that shows the direction and strength of the relationship between two variables

together. The results of the r coefficient value are r = 0.767. This correlation value shows that the relationship between independent variables and dependent variables is included in the strong category. And the result of partial r coefficient of X_1 to Y is 0, 641. While the efficiency of the X_2 variable against Y is 0.684. This correlation value indicates that it has a strong relationship.

5. The coefficient of multiple determination aims to see the small size of the effect of the independent variable on the non-free variable (Sugiyono, 2011: 286).

Table 4. Results of the Determination Coefficient (R2)Summaryb model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.767[a]	.589	.574	1.791	1.808

Source: Data processed by SPSS

Showing that the contribution of the independent variable of Leader Member Exchange (X_1) and Work Motivation (X_2) to the dependent variable (variation) is Employee Loyalty (Y) with a $r - \text{square}$ value of 58.9% while the remaining 41.1% Employee Loyalty variables will influenced by other variables not discussed in this study.

6. The t test is used to determine the significant partial influence between each independent variable on the dependent variable, or to find out the most dominant influence between the two variables X on Y (Sugiyono, 2013: 194).

Table 5. Test Results t

Variabel Terikat	Variabel Bebas	t hitung	t tabel	Sig	Keterangan
Loyalitas Karyawan	*Leader Member Exchange*	4,107	2,002	0,000	Signifikan
	Motivasi Kerja	4,961	2,002	0,000	Signifikan

Source: Results processed by researchers

The t-test results show X1 t count> t table which is 4.107> 2.002 This means that H0 is rejected and H1 is accepted. It can be concluded that the Leader Member Exchange (X1) has a partial and significant influence on Employee Loyalty (Y), while for X2 t count> t table is 4,961> 2,002 This means that H0 is rejected and H1 is accepted so it can be concluded that Work Motivation (X2) has a partial and significant influence on Employee Loyalty (Y).

7. Test F According to Sugiyono (2014: 257) Test F is used to determine the effect of all independent variables contained in the model together (simultaneous) on the dependent variable.

Table 6. F test Result

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	261.820	2	130.910	40.828	.000[b]
Residual	182.763	57	3.206		
Total	444.583	59			

Source: Processed results from SPSS

Because $F\ count > F\ table$ is $40.828 > 3.16$ or sig value $F\ (0{,}000) < a = 0.05$, the regression analysis model is significant. This means that H0 is rejected and H1 is accepted so that it can be concluded that the independent variable Leader Member Exchange (X_1), Work Motivation (X_2) can be influenced simultaneously and significantly by the dependent variable (Employee Loyalty).

4. CONCLUSION

Based on the results of this study, it can be concluded that Leader Member Exchanges and Work Motivation have a partial influence on Employee Loyalty with the value of t count from the Leader Member Exchange of $4{,}107 > 2{,}002\ t\ table$ and the calculated t value from Work Motivation $4{,}961 > 2{,}002\ t\ table$. And from both the Leader Member Exchange and Work Motivation variables also have a simultaneous influence on Employee Loyalty. And the dominance of the two variables can be seen from the value of multiple linear regression, namely $Y = 0.661 + 0.552\ X_1 + 0.706\ X_2$. It can be seen that Work Motivation (X_2) has a dominant influence on Employee Loyalty.

REFERENCS

Almansour, Y. M. 2012. The mediating role of organizational justice components in the relationship between leadership styles and job satisfaction. Global *Journal of Managemnet and Business research*, 12 (20).

Arikunto, Suharsimi. 2010. *Research Procedure: A Practical Approach.* 2010 Revised Edition. Jakarta: Rineka Cipta.

Changgriawan, Surya, Gary, 2017. The Effect of Job Satisfaction and Work Motivation on Employee Performance in One Way Production*. Agora Journal, Vol 5, (3).*

Cropanzano, R., Bowen, D.E., & Gilliand, S. W. 2017. *The management of Organitational justice. The Academy of Management Perspectives*, 34-48.

Nusantara, Billy Kharisma, 2015. *The Effect of Leader Member Exchange and Organizational Culture on the Employee Loyalty of PT Square Group.* Essay. Yogyakarta State University.

Rini, U.S. 2018. *Indonesia's fertilizer continues to spur exports, Here's the data*. Bisnis.com. https://ekonomi.bisnis.com/read/20181127/257/863875/pupuk-indonesia-terus-pacu-ekspor-begini-datanya. Bought on July 1, 2019: 09.42.

Robbins, S.P, & Judge, T. 2008. Organizational Behavior Jakarta: PT Gramedia Group Index.

Sugiyono (2013*). Research Methods: Approach, Quantitative, Qualitative and R&D*. Bandung: Alfabeta.

Sugiyono (2014). *Quantitative, Qualitative, and Combined Research Methods.* Bandung: Alfabeta.

Sugiyono (2015). *Research methods*. 22nd print. Bandung: Allfabeta.

Torang, S. (2013). *Organization and Management*. BANDUNG. ALFABETA ...

Yukl, G. 2015. *Leadership in Organizations: Seventh edition.* Jakarta: Index.

DESIGNING A RISK BASED BUSINESS CONTINUITY PLAN AT PT. SWADAYA GRAHA, DIVISI BUSINESS MODEL, SYSTEM AND IT

Widya Sayekti[1]

[1]Universitas Internasional Semen Indonesia
Jln Veteran Gresik Jawa Timur 61122

ABSTRACT

PT. Swadaya Graha in the field of business models, systems and IT has risk management that has been applied to the company, but despite having risk management that can help companies reduce or minimize the risk of occurring before a disaster occurs, the company does not have a business continuity plan (BCP) PT. Swadaya Graha in the field of business models, systems and IT requires BCP with the aim of dealing with the risks that arise after a disaster which has a primary focus on how to ensure continuity of business when losing access to people, facilities, information systems, services and resources. The research aims to design a BCP that fits the needs of PT. Swadaya Graha, the field of business models, systems and IT using the ISO 22301: 2012 framework. The method used to obtain data on research is the method of literature study or documents, interviews and observations using ISO 22301: 2012 in BCP. The results of the study will produce a draft BCP document that has been verified and validated by PT. Swadaya Graha in the field of business models, systems and IT.

KEYWORDS: BCP, ISO 22301:2012, Business Continuity Planning, Risk.

1. INTRODUCTION

In the present, there are many organizations or companies that have used Information Technology (IT) as a means for the continuity of their business processes. When an organization starts implementing IT, then at that time an organization will also have a variety of risks arising from many threats and disturbances both in terms of nature or humans. One company that has utilized IT for the continuity of its business processes is PT. Swadaya Graha, namely the Field of Business, Systems and IT Models.

The Business, System and IT Model Field is one of the fields in PT. Swadaya Graha which already has risk management to overcome before threats and disruptions occur in the company's IT. However, the Business, System and IT Model Field does not have further business continuity planning to protect IT after a disaster occurs, even though after a disaster occurs it will be more detrimental to the company in terms of cost and time and even paralyze the company's business processes. Therefore, companies must manage IT security well and structured.

BCP can be a guarantee for companies to be able to deal with the risks that arise after a disaster occurs. BCP has a main focus on how to ensure continuity of business when losing access to people, facilities, information systems, services and resources (Fajriansah, 2017).

This research will aim to produce BCP design documents that are in accordance with the needs of PT. Swadaya Graha, Business, System and IT Model Field in accordance with ISO 22301: 2012 and produce business calculation simulations for BCP document validation.

The limitation of the problem in this study is that research risk is only carried out in one field at PT. Swadaya Graha, namely the Field of Business, Systems and IT Models, the method used to obtain data in research is the method of interviewing, observation, literature or documents and BCP's work focuses on high value and very high critical business processes and IT risks in the Business Model Field , Systems and IT.

There are several previous researchers who can become BCP references, first, risk-based BCP

design carried out by (Fajriansah, 2017) with the results of the risk-based BCP design with two standard framework references namely ISO 22301: 2012 and Griffith University, also using the research method Failure Mode and Effect Analysis (FMEA), both researchers (Zahra, Pribadi, & Tyas, 2016) with the results of the preparation of information technology business continuity planning with risk based on ISO 22301 and Operational Critical Threat, Assets and Vulnerability Evaluation (OCTAVE) methods by showing that there are 6 IT assets that are used as the top priority in business continuity, namely SCADA, PLN e-mail , server, internet network, speed card, and company data. And third (Rifai & Faqih, 2017) with the results of BCP formulation being the standard procedure for handling information system risk services at STMIK AMIKOM Purwokerto.

2. BASIC THEORY AND METHODOLOGY

2.1. RISK MANAGEMENT

Risk management must be a non-stop and repetitive process that consists of several phases, when properly implemented, allowing continuous improvement in decision making and performance improvement (Ramadhani, Hartanto, & Nugroho, 2018). Threats to risk can be caused by various elements such as technology, human error, environment, politics or from the organization (Riyalni, Firdaus, & Jatmiko, 2015).

2.2. IT RISK

IT risk is part of operational risk because of its nature associated with the use of IT assets to support operational business processes within the company. IT risk includes internal risks such as system failure, network failure, hardware damage, software damage, data loss, viruses, and other external risks such as natural disasters (Megawati, Astuti, & Herdiani, 2014).

2.3. VALUE OF IMPACT

The value of impact is an assessment of the negative influence on what is felt as a result of a potential failure. On the value of the measured impact is the severity of the risk that occurs.

2.4 POSSIBILITY VALUE

Probable value is a measurement of the level of possible frequency or frequent occurrence of problems or disturbances that can result in failure (Fajriansah, 2017).

2.5 RISK PRIORITY NUMBER

Risk Priority Number (R) is a systematic multiplication of the Impact Value (C) and Possible Value (L).

2.6 ISO/IEC 22301:2012 FRAMEWORK

ISO / IEC 22301: 2012 This international standard establishes the requirements for preparing and managing an effective business continuity management system. ISO 22301-compliant BCMS will include a recovery plan that focuses on restoring certain operations, functions, sites, services or applications. International standards apply the cycle of the PDCA model (Plan-Do-Check-Act) with the aim of performing stages in the BCMS framework (Fajriansah, 2017).

2.7 METHODOLOGY

The first method used during the research took place, as well as the stages in the preparation of the Business Continuity Plan (BCP) framework, namely the study of literature where reference would be made to good theories, books, articles, papers or documents that are in accordance with the current research. discussed.

The second method is the identification of problems carried out with the aim that the reader understands the scope of the research problem and so that the readers' understanding does not extend to other topics. The analysis is carried out from the

initial conditions to find out the real conditions to find out the development of the Business, System and IT Model Field.

The third method is collecting data and information that is using the method of interviewing staff and heads of the Business, System and IT Model, observation and analysis of documents in the Field of Business, Systems and IT Models.

The fourth method is to design BCP documents using the PDCA process according to ISO 22301. The process starts from determining the objectives, scope and human resources in the company.

The fifth method is verification and validation of the BCP design with the approval of the company, that this BCP research document is in accordance with the objectives of the Business, System and IT Model Field. If appropriate, it can complete the risk-based BCP document in the Field of Business, System and IT Models.

3. RESULT AND DISCUSSION

3.1. BCP Framework in the Field of Business, Systems and IT Models

The first phase is a plan (planning) to ensure that the existing HR can run optimally, so there needs to be a committee or committee. Following is the composition of the BCP committee in the Business, System and IT Model in Figure 1.

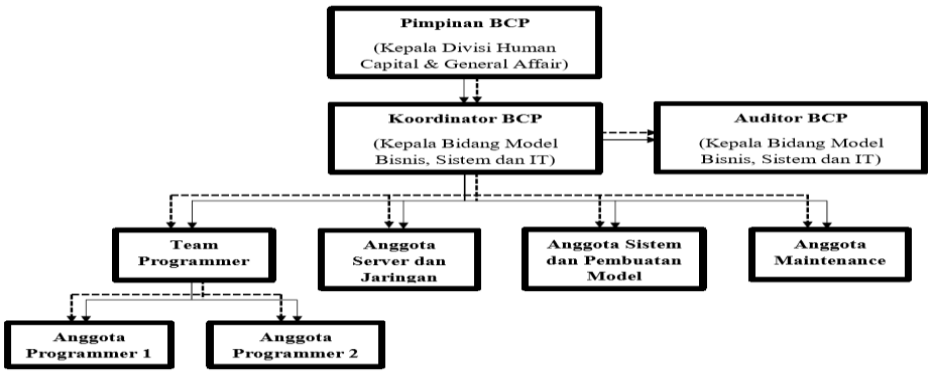


Figure 1. BCP Committee in the Field of Business, System and IT Models

The second phase is do (workmanship). In Table 1 is the risk matrix resulting from the multiplication of the value of the impact and the probability value. Until there is a risk that has the highest value or level of risk, namely, 1 a. Fire risk, 1 b. Building risk collapses due to external factors, 2 e. Risk of device theft.

Table 1. Risk Matrix

			IMPACT (C)				
			Losses <Rp. 10 million	Loss of Rp. 1 ≤ 10 million	Loss of Rp. 10 <50 million	Loss of Rp. 50 <100 million	Loss> Rp. 100 million
			1	2	3	4	5
POSSIBILITY (L)	Must be happen	5					
	Very possible	4					2 e
	Might happen	3			1 c	3 d	1 a,1 b
	less likely to occur	2		2 d		2 a,3 a	
	Almost impossible	1		2 b,3 b,3 c	2 c		

In Table 2 is the result of risk analysis at PT. Swadaya Graha, Business Model, System and IT Field consisting of numbers, categories, descriptions, levels and potential losses.

Table 2. Summary and Level of Risk of Losses

No.	Category	Description	Level	Potential Losses
1 a	Environment	Fire	M	> Rp. 100 million
1 b		The building collapsed due to external factors	M	> Rp. 100 million
1 c		Roof Leaks due to rain	L	Rp. 10 ≤ 50 million
2 a	Humans and animals	Data is hacked by irresponsible people	H	Rp. 50 < 100 million
2 b		• Server or network cables stumble when crossing • Server cable or tissue eaten by mice	L	Rp. 1 ≤ 10 million
2 c		File is corrupt	M	Rp. 10 ≤ 50 million
2 d		Data change	L	Rp. 1 ≤ 10 million
2 e		Device theft	H	> Rp. 100 million
3 a	System and Infrastructure	Server down	H	Rp. 50 < 100 million
3 b		Troubled hardware / error	L	Rp. 1 ≤ 10 million
3 c		Slow network	L	Rp. 1 ≤ 10 million
3 d		Backup failure	M	Rp. 50 < 100 million

After knowing the three risks that have the highest risk, then the strategy stage that describes the detailed actions of the BCP strategy. Table of BCP strategies can be seen in Table 3.

Table 3. Strategy BCP

No.	**Risk**	**Strategy**	**Action**
1 a	Fire	Preventive	1. Use a neatly arranged plug 2. Use standard installations or cables
		During a disorder	1. Use of a Light Fire Extinguisher (APAR) 2. Open the evacuation route
		Corrective	The hot cable to let out smoke also smells bad
1 b	Building Collapsed due to External Factors	Preventive	1. Regular monitoring of building conditions 2. Ensure the layout of the company 3. Data backup process
		During a disorder	Securing company IT assets
		Corrective	Feel the vibration on the office floor
2 e	Device theft	Preventive	1. Prepare an anonym complaint box 2. Appoint supervisor
		During a disorder	1. Provision of sanctions in accordance with the mistakes made 2. Identify the causes of device theft
		Corrective	Suspicious people go in and out of the company without clarity of identity and the opening of important rooms

Furthermore, the BCP training and testing phase is carried out to provide knowledge as well as an understanding of business continuity planning strategies and business continuity procedures that apply to staff in the Business, System and IT Model Field. Training and practice tables can be seen in Tables 4 and 5.

Table 4. BCP Training Scenario

No.	Module Name	Module Type	Target
1.	Use of APAR	Material and experimental practice	All IT staff
	General Material: 1. A description of the importance of using APAR 2. Procedures for using APAR 3. Things to know about using APAR tubes		
2.	Securing company IT assets		
	General Material: 1. Knowledge of the importance of securing IT assets 2. Priority of IT assets during an incident 3. Distribution of security responsibilities when an incident occurs 4. Steps to secure IT assets		
3.	Restore data		
	General Material: 1. Explanation of the importance of data restore 2. Priority of data in making backups 3. Procedures for restoring data 4. Scheduling the data backup and restore process		
4.	Socialization of IT device security		
	General Material: 1. General knowledge and explanation of the importance of paying attention to the security of IT devices 2. The impact of not being taken into account the security of IT devices 3. Security management and access management procedures in and out of employees 4. Security on hardware 5. Procedures for carrying out security of IT devices		

Table 5. BCP Training Scenario

1.	Name of Training	Training on the use of APAR
	Perpetrator	1. Staff in Division Business Model, System and IT 1 2. Staff in Division Business Model, System and IT 2 3. Staff in Division Business Model, System and IT 3 4. Head of Division Business Model, System and IT
	The division of roles	1. Staff in Division Business Model, System and IT 1 as Responsible for short electric current 2. Staff in Division Business Model, System and IT 2 as APAR users 3. Staff in Division Business Model, System and IT 3 as a documentator 4. Head of Division Business Model, System and IT as supervisor of the testing process
	Scenario	1. Staff in Division Business Model, System and IT 1 make artificial fires from electrical wires, by peeling the electrical wires until a fire sparks on low heat 2. Staff in Division Business Model, System and IT 2 taking APAR then spraying the end of the hose at the fire source slowly until the fire goes out (according to the training time, which is the procedure for using the APAR that is good and correct) 3. Staff in Division Business Model, System and IT 3 document the results of testing using APAR 4. Head of Division Business Model, System and IT conduct testing supervision
2.	Name of Training	Data Restore Training
	Perpetrator	1. Staff in Division Business Model, System and IT 1 2. Staff in Division Business Model, System and IT 2 3. Staff in Division Business Model, System and IT 3 4. Head of Division Business Model, System and IT
	The division of	1. Staff in Division Business Model, System and IT 1 as the actor to

	roles	restore data 2. Staff in Division Business Model, System and IT 2 as the perpetrator of deleting data on the system 3. Staff in Division Business Model, System and IT 3 as a documentator 4. Head of Division Business Model, System and IT as supervisor of the testing process
	Scenario	1. Staff in Division Business Model, System and IT 1 backup important company data from the system 2. Staff in Division Business Model, System and IT 2 delete data on a system that was previously backed up 3. Staff in Division Business Model, System and IT 1 restore data from previously deleted data then see the compatibility of the data from the restore with the data backup that was previously done 4. Head of Division Business Model, System and IT conduct testing supervision 5. Staff in Division Business Model, System and IT 3 document the results of testing data restore.

The third phase is a check that is carried out to check all the processes in the BCP. The inspection phase will contain BCP internal audit as an internal control and aims to see any incompatibility with the current condition of the company. The following are internal audits in Table 6 with five criteria, namely:

Table 6. Criteria for Internal Audit

No.	Criteria
1.	The Need for Corporate Business Sustainability
2.	BCP Objectives at the Company
3.	BCP Strategy Management
4.	BCP Training and Testing at the Company
5.	Continuous Maintenance and Improvement of BCP

The fourth phase is the act (action) where there will be continuous improvement in each phase in accordance with technological developments.

3.2. Verification and Validation

BCP verification is carried out by looking at the BCP that has been made and observing the suitability of the BCP design with the standards and best practices that will be used. Can be seen in Table 7

.

Table 7. Mapping BCP Framework Compliance with ISO 22301

Phase	Company Needs	BCP Framework	Compliance with ISO 22301	Status
Plan	The BCP must be in accordance with the company's goals	Company needs and desires	Understand organizational needs.	✓
		BCP Objectives	Establish policies and objectives for business continuity management.	✓
		Scope	Establish relevant targets and controls to improve business continuity.	✓
	BCP made must be able to be in accordance with the information technology that has been implemented	Resource	Determine and provide the resources needed for implementation of maintenance and continuous improvement from BCMS.	✓
		Roles and	People with specified responsibilities	✓

Phase	Company Needs	BCP Framework	Compliance with ISO 22301	Status
		responsibilities		
Do	The BCP created can handle the risks that arise.	Business risks and impacts Fields of Business, Systems and IT Models	Organizations plan, implement and control the processes needed to meet requirements, and to implement actions	✓
		BCP Strategy		✓
	BCP is made simple, easy to use and understood by HR	BCP training and testing		✓
Check	BCP made can be used in the long term.	Internal Audit	Monitor and review performance against business continuity policy objectives, report the results to management for review, and determine and certify actions for remediation and improvement	✓
	BCP made can be updated from time to time			✓
Act	The BCP must be dynamic and be able to keep up with the development of the information technology world.	Continuous improvement	Importance of BCMS: Continuous improvement based on objective measurements. Organizations can use BCMS processes such as leadership, planning and performance evaluation, to achieve improvement.	✓

BCP validation is the most important thing, where a simulation of calculating one of the critical risks will be carried out for BCP document validation and ensuring that BCP is in accordance with the needs and acceptable to the company. There are two BCP validations submitted. Can be seen in Tables 8 and 9.

Table 8. BCP Validation

1.	Validation name
	Validation of the suitability of the calculation of one of the high-value or the most critical IT risks namely building risk collapsed due to external factors by analyzing the calculation of risk calculation based on observations and interviews with the Head of Business, System and IT Model at PT. Self-help. Total loss of Rp. 534,950,000. Details of calculation analysis can be seen in Table 9.
2.	Validation name
	Validation of the suitability of the BCP design with the needs of the company which aims to ensure the suitability of the BCP design results with the needs of the company based on the data extraction that has been carried out.

Table 9. Calculation of Building Risk Validation Collapses Due to External Factors

No.	Damage	Recovery Strategy	piece	Unity	Total
1.	Office building for Business, System and IT Model Fields	Repair	-	Rp. 200.000.000	Rp. 200.000.000
2.	Computer hardware	Replacement	8	Rp. 8.000.000	Rp. 64.000.000
3.	DELL laptop office	Replacement	1	Rp. 9.000.000	Rp. 9.000.000
4.	DELL server	Replacement	2	Rp. 100.000.000	Rp. 200.000.000
5.	WiFi device	Replacement	1	Rp. 4.000.000	Rp. 4.000.000
6.	Table chairs	Replacement	1	Rp. 15.000.000	Rp. 15.000.000
7.	Epson printer	Replacement	1	Rp. 5.500.000	Rp. 5.500.000

No.	Damage	Recovery Strategy	piece	Unity	Total
8.	Photocopy machine	Replacement	1	Rp. 10.500.000	Rp. 10.500.000
9.	LCD Projector	Replacement	1	Rp. 4.000.000	Rp. 4.000.000
10.	Filling cabinet	Replacement	8	Rp. 2.000.000	Rp. 16.000.000
11.	Attendance machine	Replacement	1	Rp. 1.300.000	Rp. 1.300.000
12.	Document archive shelf	Replacement	1	Rp. 2.000.000	Rp. 2.000.000
13.	Office phone	Replacement	1	Rp. 150.000	Rp. 150.000
14.	Office stationery	Replacement	5	Rp. 500.000	Rp. 2.500.000
15.	Handy Talky (HT)	Replacement	1	Rp. 1.000.000	Rp. 1.000.000
TOTAL					Rp. 534.950.000

4. CONCLUSIONS

The following are the conclusions from the research, along with suggestions that can be useful for improvement in future studies.

Conclusion

a. There are three risks with the highest value or level of risk (hight), namely the risk of fire, the risk of buildings collapsing due to external factors and the risk of theft of the device.

b. Research has produced one of the risk calculations as one form of validation, namely the risk of buildings collapsing due to external factors.

c. This research has produced a risk-based BCP design formulated with company needs and a framework standard reference, namely ISO 22301 and PDCA phase.

Suggestions

a. For the continuation of further research, it is expected to make continuous improvements in the future, because BCP documents are a growing document, the strategies made in this document may change in the years ahead because the BCP framework is prepared from the needs of PT Swadaya Graha , Field of Business, Systems and IT Models.

b. It is expected that the BCP document in this study can be implemented in other companies or educational organizations in accordance with the steps described.

REFERENCES

Fajriansah, C. (2017) 'Risk-Based Business Continuity Plan Design in the Information Systems Development Sub-Directorate, Directorate of Technology and Information Systems Development. ', Pp. 1–194.

Megawati, T. A., Astuti, H. M., & Herdiani, A. (2014). IT ASSET RISK MANAGEMENT IN PT XYZ PROPERTY COMPANY, TANGERANG BASED ON COBIT FRAMEWORK 4.1, 449-454.

Ramadhani, S. T. A., Hartanto, R., & Nugroho, E. (2018). Using the Octave Allegro Method and Iso 27001 Control at Public Service Providers, 619–627.

Rifai, Z., & Faqih, H. (2017). Designing Business Continuty Plan (BCP) Information System Services at STMIK AMIKOM Purwokerto, 10 (2), 48-57.

Riyalni, A. N., Firdaus, Y., & Jatmiko, D. D. (2015). Risk Management Information Technology Based Risk Management Using ISO Information Technology Risk Analysis Based On Risk Management Using ISO 31000 (Case Study: i-Gracias Telkom University), 2 (2), 6201–6208.

Zahra, A. A., Pribadi, A., & Tyas, E. W. (2016). Preparation of PT PLN (Persero) APD Central Java and DIY Business Continuity Planning with ISO 22301 and OCTAVE Method, 5 (2), 37–43.

DEVELOPMENT STRATEGY OF LEADERSHIP PATTERN IN INDONESIA NAVY CIVIL SERVANT USING SWOT ANALYSIS AND BORDA METHOD

Acep Maksum, Muchlis R. Luddin, Fahmi Idris

Human Resources Management Program Study of Jakarta State University

Doctoral program Lecturer of Jakarta State University
Rawamangun Muka, Pulo Gadung, East Jakarta, Jakarta, Indonesia 13220

ABSTRACT

Legalization of the Act Number 5 Year about the State Civil Apparatus (ASN/PNS), like being a new chapter and hope for State Apparatus towards professional bureaucratic leadership. The leadership in the Navy is the dominant thing owned by military personnel, not enough chance for civil servants to be able to develop their leadership, even if they are in class III and IV levels or strata, whereas in the strata function staff or administration, it can be said to be equivalent to the strata of the First Officer and Middle Officers. The aim of this study is to formulate a development strategy for transforming the leadership patterns of Civil Servants in the Navy. There are several methods used in supporting research, including the SWOT analysis method and Borda analysis method. The SWOT analysis method is used to formulate a strategy for developing the transformation of Civil Servants leadership patterns. While the Borda method is used to determine the priorities of the sub-strategies that have been formulated. Some strategies that need to be established in order to improve the quality of PNS leadership include: 1) Compilation of clear regulations or provisions regarding career development and nurturing of the Navy's PNS leadership with a weight of 0.229; 2) Establish recruitment standards based on the Navy's HR needs with a weight of 0.214; 3) Providing opportunities for civil servants to become leaders in the scope of the organization of staff functions at the level of Section Heads and Sub-Section Heads weighing 0.196; 4) Providing opportunities for civil servants to participate in leadership education and training (Diklatpim) and other gap education with a weight of 0.125; 5) Involving civil servants in unit activities by assigning duties and authority as chairman with a weight of 0.118; 6) Increasing the ability and professional expertise in civil servants with a weight of 0.064; 7) Establish communication between superiors from the military and civil servants and vice versa with a weight of 0.054; 8) Improve the quality and character of the firm and responsible in the civil servants themselves with a weight of 0.05. This research is expected to provide benefits in the implementation of PNS leadership in the Navy and the development of PNS leadership patterns within the Navy.

Keywords: *Leadership Pattern, Indonesia Navy Civil Servant (PNS TNI AL), SWOT analysis, Borda Method.*

1. INTRODUCTION

Legalization of the Act Number 5 Year about the State Civil Apparatus (ASN/PNS), like being a new chapter and hope for State Apparatus towards professional bureaucratic leadership in response to challenges and opportunities for Civil Servant (PNS) who worked for the Navy's organization (Mulawarman, Dyas Nurfitri and Wira Yudha Kusuma, 2015). The leadership in the Navy is the dominant thing owned by military personnel, not enough chance for civil servants to be able to develop their leadership (Inderjit, 2013), even if they are in class III and IV levels or strata, whereas in the strata function staff or administration, it can be said to be equivalent to the strata of the First Officer and Middle Officers.

This condition resulted in the opportunity and ability of civil servants from the Navy not to be optimal in developing leadership, so that the promotion and position of the pattern of career development are not directly proportional to the increase in leadership abilities. Based on the problem above, the aim of this study is to formulate a development strategy for transforming the leadership patterns of Civil Servants in the Navy. This research is expected to provide benefits in the

implementation of PNS leadership in the Navy and the development of PNS leadership patterns within the Navy.

There are several methods used in supporting research, including the SWOT analysis method and Borda analysis method. The SWOT analysis method is used to formulate a strategy for developing the transformation of Civil Servants leadership patterns. While the Borda method is used to determine the priorities of the sub- strategies that have been formulated.

This study has some literature, likely servant leadership in creating an environment that is in accordance with the wishes of the leader (Jones, 2018). Servant leadership as a model of effective leadership criteria (Gandolfi and Stone, 2018). Strategic servant leadership and operational servant leadership and supported by leadership and competency characteristics (Coetzer, Bussin and Geldenhuys, 2017). Analysis of servant leadership in the context of social enterprises (cooperatives) (Latiff, Majid and Mohamad, 2017). Model of servant leadership in the civil work environment and military work environment (Mulawarman, Dyas Nurfitri and Wira Yudha Kusuma, 2015).

Literature about analysis SWOT and Borda, such as SWOT analysis as a method for transforming the State Islamic University of North Sumatra (Nasution and Nasution, 2018). SWOT analysis is used to formulate innovative strategies in the manufacturing industry (Mardiana and Sutarman, 2018). SWOT as a development strategy in order to improve tourism competitiveness in the Borobudur area (Sasana, DA and Muid, 2017). Borda method to help and support decision makers in modeling multi-criteria ranking problems by assigning weights to criteria in a systematic way (Costa, 2017). Borda method is used to evaluate the performance of a salesman in a company (Fang, Xiang and Zhen, 2017). Borda method is used to calculate the level of trust and interest of respondents about conservation buffers in watersheds (Zou and Qiu, 2017).

This research consists of several writing systematics. Section 2 describes the theoretical basis of leadership, research goals and flowcharts. Section 3 describes the results of the formulation of the strategy for developing the pattern of leadership of the Indonesian Navy. Section 4 describes the discussion and impact of developing the leadership pattern of the Indonesian Navy Civil Servants. Section 5 describes the conclusions of the study.

2. MATERIAL AND METHODS

2.1. Leadership.

Leadership is the application of social science, cause and effect, rules and formulas that can benefit human life and well-being (Epley, 2015). Some of the meanings and definitions put forward by experts according to their respective expertise and perspectives, show the existence of several similarities (Dierendonck et al., 2004). Leadership as the ability to influence a group towards achieving goals (Robbins, 2003). The sources of influence may be formal, such as those given to managerial positions in the organization. Leadership as a process by which one individual influences other group members towards achieving defined group or organizational goals (Baron and Greenberg, 2003).

Leadership is about influencing, motivating and allowing others to contribute towards the effectiveness and success of the organization where they belong (McShane and Von Glinow, 2008). Leadership as the use of power and influence to direct followers' activities towards achieving goals (Colquitt, Lepine and & Wesson, 2011). There are five types of leadership, namely: 1) Charismatic type; 2) Paternalistic type; 3) Authoritarian type; 4) Type of Democracy; 5) Militaristic Type.

2.2. Transformation Leadership.

Transformation in leadership gave birth to a school of transformational leadership. Transformational leadership is a form of leadership where the leadership has the ability to expand and improve the performance of staff. In addition, leaders with these characteristics must be able to control subordinates, and have the ability to explore the potential of subordinates for the progress of the organization (Bass, 1998). Bass defines transformational leadership as the ability of a leader to influence subordinates in leading an organization to achieve organizational goals by becoming role models so that they are respected.

Bass also stated that there are four dimensions of transformational leadership, namely (Bass, 1998) :

a. Idealized influence, namely exemplary behavior, so that leaders are admired, respected and trusted by their leadership.

b. Inspirational motivation, able to articulate the achievements of subordinates, arouse the spirit of subordinates by growing enthusiasm and optimism.

c. Intellectual stimulation, able to grow new ideas, provide creative solutions to various problems of subordinates, and provide motivation to find new approaches in carrying out organizational tasks.

d. Individualized considerations, want to listen to their subordinates, pay attention to their needs, and encourage the development of their careers.

2.3. Indonesian Navy Leadership.

Within the scope of the Indonesia Armed (TNI) and the Navy (TNI AL), typical leadership characteristics apply. The Indonesian National Army has a form of leadership that comes from the leadership of the TNI Commander in Chief, General Sudirman, with characteristics (Kemhan, 2015): 1) Leader as Father; 2) Leader as Coach; 3) Leader as Friend; 4) Leaders as Teachers; and 5) Leader as Commander. The five leadership characters are summarized in the TNI Leadership which consists of 11 principles, namely: 1) Taqwa; 2) Ing Ngarsa Sung Tulada; 3) Ing Madya Mangun Karsa; 4) Tut Wuri Handayani; 5) Waspada Purba Wisesa; 6) Ambeg Parama Arta; 7) Prasaja; 8) Satya; 9) Gemi Nastiti; 10) Belaka; 11) Legawa.

2.4. Theory of SWOT (strength, Weakness, Opportunity, Threat).

Theory of SWOT (Strengths; Weaknesses; Opportunities; Threats) is a step to be able to identify internal and external factors that influence the achievement of organizational goals (Bull et al., 2016). External factors contain opportunities and threats variables which are outside the organization and is not something that can be controlled by the leadership of the organization in the near term (Lumaksono, 2014). Internal factors consist of variables of strengths and weaknesses which is within the body of the organization itself and is usually not in the control of the leadership of the organization in the near future (Wang, Zhang and Yang, 2014).

The SWOT matrix (Strengths-Weaknesses-Opportunities-Threats) is a tool in helping managers to develop four strategies: SO strategies (strengths opportunities), WO strategies (weaknesses-opportunities), ST (strengths-threats) strategies, and strategies WT (weaknesses-threats) (Weihrich, 1982). David (2011) explains that matching internal and external factors is the most difficult thing in making a SWOT matrix because it requires good judgment.

The SO strategy uses internal strengths to take advantage of existing environmental opportunities (Arshad, Fauzan and Bint, 2017). The WO strategy aims to improve internal weaknesses by taking advantage of opportunities. ST Strategy uses the strength of the organization to reduce the impact of threats originating from outside the organization. The WT strategy is a defensive

strategy to reduce weaknesses and avoid threats from outside the organization's environment (Nega, 2019).

There are eight steps in preparing the SWOT matrix (David, David and David, 2016): 1) Identification of external opportunities for the organization; 2) Identification of external threats to the organization; 3) Identification of the internal strength of the organization; 4) Identification of organizational internal weaknesses; 5) Match internal strengths and external opportunities then record the results as an SO strategy in the appropriate column; 6) Match internal weaknesses and external opportunities then record the results as a WO strategy in the appropriate column; 7) Match internal strengths and external threats then record the results as ST strategies in the appropriate columns; 8) Match internal weaknesses and external threats then record the results as a WT strategy in the appropriate column.

Table 20. SWOT Matrix.

SWOT Analysis		**Internal Factors**	
		Strengths (S)	Weakness (W)
External Factors	Opportunity (O)	SO Strategy	WO Strategy
	Threat (T)	ST Strategy	WT Strategy

(David, David and David, 2016)

2.5. Borda Method.

Borda is a method used in group decision making for the selection of single winners or multiple winners, where voters make a ranking of candidates who are chosen accordingly. Borda determines the winner of an election by giving a certain number of points for each candidate according to the position arranged by each voter (Zou and Qiu, 2017).

The principle of the borda method is to rank the alternatives (Costa, 2017). Alternatives that have the highest ranking are given the highest score, and so on and onwards are given a lower value for ranking below to the lowest rating of 0 or 1. The idea of Borda's method is to require voters to rank each candidate, and provide scores for each rank, for example, the first rank is given a value of 2, the second rank is given a value of 1, and the third rank is given a value of 0 (Fang, Xiang and Zhen, 2017).

Example calculation of the Borda Method

a. It is known that there are 3 alternatives to be ranked (A, B and C). Questioner distribution was carried out to find out the basic data to be ranked.

b. From the results of the questionnaire, calculate the number of respondents who stated the ranking for each type. For example, there are 4 respondents who say type A is ranked 2 and 3 respondents say the type is ranked 3, then write number 4 in column type A rank 2 and number 3 in column type A rank 3. The same is done for the other types.

c. Multiply the number in the ranking column with the weight below it, then add the multiplication result to the same type, then fill in the results in the ranking column. For example for type A, (0 x 2) + (4 x 1) + (3 x 0) = 4.

d. Add the ranking results, which in this example means: 4 + 11 + 5 = 20.

e. To find the weight of each type, for the ranking with the number of ranks. Type A = 4/20 = 0.2, and so on. The highest weight type is selected.

2.6. Goal.

a. Formulate a strategy for developing the transformation of the leadership patterns of Civil Servants.

b. Determine the priorities of the sub-strategies that have been formulated.

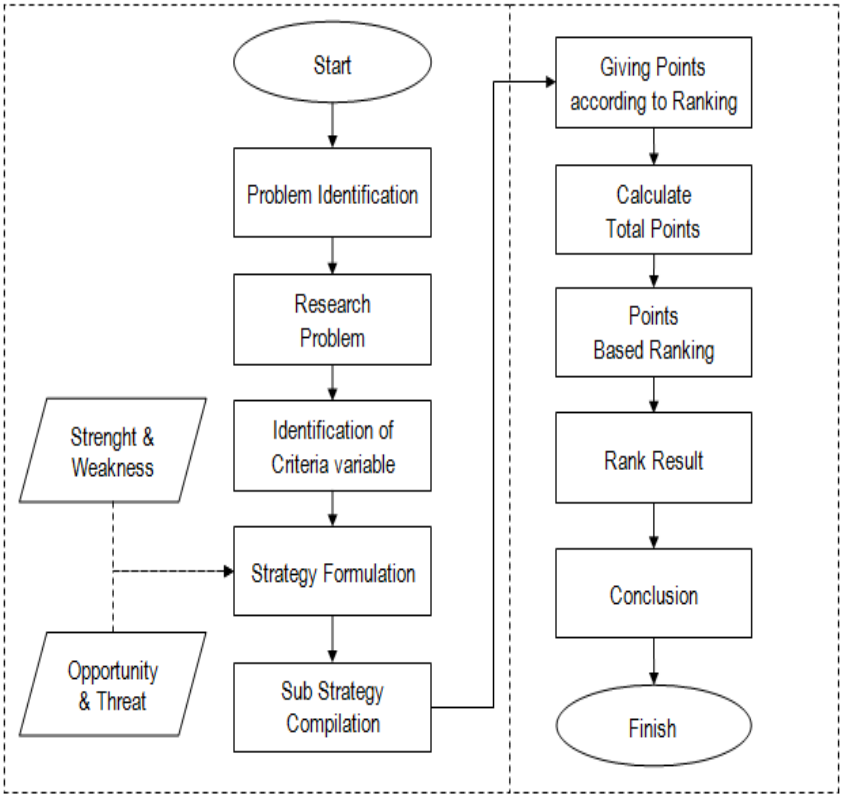


Figure 1. Flowchart Research.

3. RESULT AND DISCUSSION

With the results of research from a number of experts who have been determined, there are several analyzes of internal and external factors that influence the pattern of civil servant leadership in the current Navy. In the analysis of internal factors there is identification of strengths and weaknesses that exist in the current work environment of civil servants. Whereas on external factors there is identification of opportunities and constraints that exist today.

3.1. Strategy Formulation.

Based on the results of identification of internal factors that cover aspects of strengths and weaknesses, 3 (three) items of strength and 3 (three) points of weakness were obtained. This condition can be seen in Table 21.

Table 21. Identification of Internal Factors.

Internal Factors	Strength (S)	Weakness (W)
Ability	1. The ability of individual PNS when standardized recruitment. 2. There is leadership from civil servants when entering the Basic Training Leadership.	
Quantity		1. The number of civil servants who are still lacking in functional positions.
System	3. The system of rank and class of civil servants who have been structured in the Navy.	2. Recruitment of civil servants who are still not adjusted to the needs of the Indonesian Navy's Human Resources.
Rules		3. The absence of clear regulations regarding the formation of Civil Servant Career.

Based on the results of identification of external factors that include aspect opportunity and threat, 4 (four) points of strength and 2 (two) points of weakness were obtained. This condition can be seen in Table 22.

Table 22. Identification of External Factors.

External Factors	Opportunity (O)	Threat (T)
Education	1. Opportunities for college and course in the Indonesian Navy. 2. The existence of scholarships within the TNI for soldiers and civil servants.	1. Leadership abilities in civil servants who are partially confined in a comfort zone.
Work Unit	3. The number of functional activities within the Indonesian Navy.	
Social		2. A high sense of ego from a soldier if led by a civil servant in his unit staff.
Structural	4. The number of structural and functional positions within the Indonesian Navy can be held by civil servants.	

Based on the results of the SWOT matrix analysis, obtained several alternative strategies, namely SO strategy, WO strategy, ST strategy, and WT strategy. The overall strategy can be seen in the xx table. Furthermore, the strategy is compiled into one strategy to identify the priority strategies shown in

Table **23**.

Table 23. Result of SWOT Matrix.

Strategy SO	**Strategy ST**
(SO)1. Provide opportunities for civil servants to become leaders in the scope of the organization of staff functions at the level of Section Heads and Head of Sub-Section. (SO)2. Involve civil servants in unit activities by providing duties and authority as chairman. (SO)3. Providing opportunities for civil servants to participate in leadership education and training, and other leveling education.	(ST)1. Improve the quality and character that are firm and responsible in the civil servants themselves. (ST)2. Establish recruitment standardization based on the Indonesian Navy's Human Resources (HR) needs.
Strategy WO	**Strategy WT**
(WO)1. Arrange clear regulations or provisions regarding career formation and nurturing of the Navy's PNS leadership. (WO)2. Increased ability and professional expertise in civil servants.	(WT)1. Establish communication between superiors from the military and civil servants and vice versa.

Table 24. Result of Sub Strategy Compilation.

Code	Strategy Compilation
(SO)1.	Provide opportunities for civil servants to become leaders in the scope of the organization of staff functions at the level of Section Heads and Head of Sub-Section.
(SO)2.	Involve civil servants in unit activities by providing duties and authority as chairman.
(SO)3.	Providing opportunities for civil servants to participate in leadership education and training, and other leveling education.
(WO)1.	Arrange clear regulations or provisions regarding career formation and nurturing of the Navy's PNS leadership.

Code	Strategy Compilation
(WO)2.	Increased ability and professional expertise in civil servants.
(ST)1.	Improve the quality and character that are firm and responsible in the civil servants themselves.
(ST)2.	Establish recruitment standardization based on the Indonesian Navy's Human Resources (HR) needs.
(WT)1.	Establish communication between superiors from the military and civil servants and vice versa.

Based on the results of the strategy compilation in Table 24, 8 (eight) sub-strategies were obtained in the transformation of the leadership of the Indonesian Navy Civil Servants. This strategy is needed in supporting the development of leadership patterns as well as individuals for civil servants themselves. The TNI and Indonesian Navy have provided opportunities for self-development of civil servants through schools, courses and affirmation scholarships. Furthermore, the Navy itself has several functional positions that can be occupied by civil servants who are competent in their fields. However, this returns to the individual party from the PNS itself not to be trapped in the comfort zone. A good level of communication between civil servants and Indonesian Navy soldiers can be done to form a better synergy so that there is no social jealousy between civil servants and Navy soldiers.

3.2. Strategy Priority.

In determining the priority of compiled strategies, a step weighting questionnaire is carried out from the sub-strategy to 10 (ten) selected experts. The experts provide an evaluation based on priority from the steps of the strategy formulated in the previous stage. Based on the results of the Borda method analysis, the percent weight and priority of the sub-strategies are obtained as shown in Table 25.

Table 25. Result of Priority Strategy with Borda Count.

Code	Strategy	% Percent	Priority
(SO)1.	Provide opportunities for civil servants to become leaders in the scope of the organization of staff functions at the level of Section Heads and Head of Sub-Section.	18,611	3
(SO)2.	Involve civil servants in unit activities by providing duties and authority as chairman.	12,222	5
(SO)3.	Providing opportunities for civil servants to participate in leadership education and training, and other leveling education.	12,778	4
(WO)1.	Arrange clear regulations or provisions regarding career formation and nurturing of the Navy's PNS leadership.	20,556	1
(WO)2.	Increased ability and professional expertise in civil servants.	6,111	6
(ST)1.	Improve the quality and character that are firm and responsible in the civil servants themselves.	5,000	8
(ST)2.	Establish recruitment standardization based on the Indonesian Navy's Human Resources (HR) needs.	19,167	2
(WT)1.	Establish communication between superiors from the military and civil servants and vice versa.	5,556	7

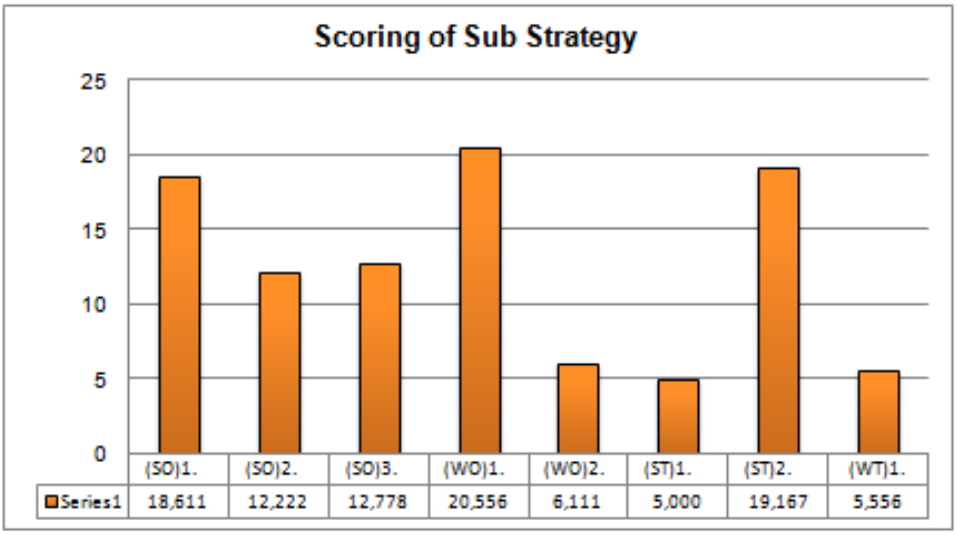


Figure 2. Graph of Sub Strategy Score.

Based on the results of the Borda method analysis according to Table 25 and Figure 2, weights and priorities can be obtained, among others: 1) Compilation of clear regulations or provisions regarding career guidance and nurturing of the Navy's PNS leadership with a weight of 0.229; 2) Establish recruitment standards based on the Navy's HR needs with a weight of 0.214; 3) Providing opportunities for civil servants to become leaders in the scope of the organization of staff functions at the level of Section Heads and Sub-Section Heads weighing 0.196; 4) Providing opportunities for civil servants to participate in leadership education and training (Diklatpim) and other gap education with a weight of 0.125; 5) Involving civil servants in unit activities by assigning duties and authority as chairman with a weight of 0.118; 6) Increasing the ability and professional expertise in civil servants with a weight of 0.064; 7) Establish communication between superiors from the military and civil servants and vice versa with a weight of 0.054; 8) Improve the quality and character of the firm and responsible in the civil servants themselves with a weight of 0.05.

3.3. DISCUSSION

To become a leader not only requires management and technical competence, but more than that also requires authority and charisma that is able to raise the name of the organization in the eyes of the community and even the wider public, so that the goals of the organization can be achieved.

Navy Civil Servants are required to improve and show their leadership abilities in accordance with the strata / group, so that the leadership of civil servants can be managed considering the general function of civil servants as government apparatus, so that adequate space and time are needed to continue to improve the ability of civil servants through gap education, leadership education and the most important thing is the opportunity to apply his leadership abilities in accordance with the duties and functions of his position in the unit / organization.

Civil servants must have expertise and expertise in leadership, the condition of a militaristic organization that is thick with command leadership, should be a strong spirit to create civil servants who have high discipline, loyalty, a spirit of service and reliable leadership.

4. CONCLUSION

The character building of the leadership from the Navy's Civil Servants, as the implementation of leadership typical of TNI organizations is still not optimal, where civil servants as a complement of TNI soldiers do not yet have leadership qualities

according to the strata of their groups and responsibilities. This happened, among others, due to the lack of optimal policies from the Navy's organizational leaders to provide opportunities and office space for civil servants to develop their careers so that they were expected to be in line with the improvement of their competence and leadership spirit..

Some strategies that need to be established in order to improve the quality of PNS leadership include: 1) Compilation of clear regulations or provisions regarding career development and nurturing of the Navy's PNS leadership with a weight of 0.229; 2) Establish recruitment standards based on the Navy's HR needs with a weight of 0.214; 3) Providing opportunities for civil servants to become leaders in the scope of the organization of staff functions at the level of Section Heads and Sub-Section Heads weighing 0.196; 4) Providing opportunities for civil servants to participate in leadership education and training (Diklatpim) and other gap education with a weight of 0.125; 5) Involving civil servants in unit activities by assigning duties and authority as chairman with a weight of 0.118; 6) Increasing the ability and professional expertise in civil servants with a weight of 0.064; 7) Establish communication between superiors from the military and civil servants and vice versa with a weight of 0.054; 8) Improve the quality and character of the firm and responsible in the civil servants themselves with a weight of 0.05.

5. ACKNOWLEDGEMENT

This research was supported by Jakarta State University. We thank our colleagues from Indonesia Navy who provided insight and expertise that greatly assisted the research, although they may not agree with all of the interpretations/conclusions of this paper. We thank Dr. Adi Bandono for assistance with intelligent discussion, and A. K. Susilo, M. Eng for comments that greatly improved the manuscript.

REFERENCES

Arshad, A., Fauzan, M. and Bint, R. (2017) 'A Synthesis on SWOT Analysis of Public Sector Healthcare Knowledge Management Information Systems in Pakistan', *International Journal of Advanced Computer Science and Applications*, vol. 8, no. 8, Sep, Available: 10.14569/ijacsa.2017.080817.

Baron, A.R. and Greenberg, J. (2003) *Organizational Behaviour in Organization. Understanding and managing the human side of work*, Canada: Prentice Hall.

Bass, B.M. (1998) *Transformational leadership: Industrial, military, and educational impact* , Mahwah: Erlbaum.

Bass, B.M. (1998) 'Two Decades of Research and Development in Transformational Leadership', *European Journal of Work and Organizational Psychology*, vol. 8, no. 1, pp. 9-32.

Bull, J.W., Jobstvogt, N., Böhnke-Henrichs, A., Mascarenhas, A., Sitas, N., Baulcomb, C., Lambini, C.K., Rawlins, M., Baral, H., Zähringer, J., Carter-Silk, E., Balzan, M.V., Kenter, J.O., Häyhä, T., Petz, K. and Koss, R. (2016) 'Strengths, Weaknesses, Opportunities and Threats: A SWOT analysis of the ecosystem services framework', *Ecosystem Services*, vol. 17, Feb, pp. 99-111, Available: 10.1016/j.ecoser.2015.11.012.

Coetzer, M., Bussin, M. and Geldenhuys, M. (2017) 'The Functions of a Servant Leader', *Administrative Sciences*, vol. 7, no. 1, Feb, p. 5, Available: 10.3390/admsci7010005.

Colquitt, J.A., Lepine, J.A. and & Wesson, M.J. (2011) *Organizational Behavio*, New York: McGraw-Hill.

Costa, H.G. (2017) 'AHP-De Borda: a hybrid multicriteria ranking method', *Brazilian Journal of Operations & Production Management*, vol. 14, no. 3, Sep, p. 281, Available: 10.14488/bjopm.2017.v14.n3.a1.

David, F.R. (2011) *Strategic management: Concepts and Cases*, 14th edition, Person Academic.

David, M.E., David, F.R. and David, F.R. (2016) 'The Quantitative Strategic Planning Matrix: A New Marketing Tool', *Journal of Strategic Marketing*, vol. 25, no. 4, pp. 1-11.

Dierendonck, D.v., Haynes, C., Borrill, C. and Stride, C. (2004) 'Leadership Behavior and

Subordinate Well-Being ', *Journal of Occupational Health Psychology* , vol. 9, no. 2, pp. 165-175.

Epley, J.L. (2015) 'Weber's Theory of Charismatic Leadership: The Case of Muslim Leaders in Contemporary Indonesian Politics', *International Journal of Humanities and Social Science* , vol. 5, no. 7, pp. 7-17.

Fang, J., Xiang, F. and Zhen, Z. (2017) 'Sales Performance Evaluation Based on Borda Method', *International Journal of Investment Management and Financial Innovations*, vol. 3, no. 6, pp. 67-70, Available: 2381-1196.

Gandolfi, F. and Stone, S. (2018) 'Leadership, Leadership Styles, and Servant Leadership', *Journal of Management Research*, vol. 18, no. 4, pp. 261-269.

Inderjit, S. (2013) 'The Pendulum of Leadership Change and Challenges of Civil Democracy and Military Rule in Pakistan', *International Journal of Education and Research* , vol. 1, no. 12, pp. 1-16.

Jones, P.R. (2018) 'Critical Analysis of Robert K. Greenleaf's Servant Leadership: A Journey into the Nature of Legitimate Power and Greatness', *International Journal of Language and Literature*, vol. 6, no. 1, Aug, pp. 10-15, Available: 10.15640/ijll.v6n1a2.

Latiff, A., Majid, I.A. and Mohamad, M. (2017) 'Exploring Servant Leadership Instrument for Social Enterprise (Cooperative)', *European Journal of Multidisciplinary Studies*, vol. 4, no. 3, Jul, p. 7, Available: 10.26417/ejms.v4i3.p7-23.

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, no. 5, pp. 56-67.

Mardiana, H. and Sutarman (2018) 'Swot Analysis In Manufacturing Company Organization', *International Refereed Journal of Engineering and Science*, vol. 7, no. 1, pp. 40-46.

McShane, S.L. and Von Glinow, M.A. (2008) *Organizational Behavior*, Fourth Edition edition, McGraw-Hill International.

Mulawarman, Dyas Nurfitri, A. and Wira Yudha Kusuma, D. (2015) 'Servant Leadership between Civil and Military Leader', *Research on Humanities and Social Sciences*, vol. 5, pp. 114-118.

Nasution, I. and Nasution, M.L.I. (2018) ' Swot Analysis On Transformation Of State Islamic University Of North Sumatra Medan', *International Journal on Language, Research and Education Studies*, vol. 2, no. 3, Feb, pp. 381-390, Available: 10.30575/2017/ijlres-2018091207.

Nega, D. (2019) 'An Investigating the SWOT Analysis of Cultural Tourism Heritage for Sustainable Tourism Development: The Case of LALIBELA Rock Hewn Churches, World Heritage Site, Ethiopia', *Journal of Tourism & Hospitality*, vol. 07, no. 06, Feb, Available: 10.4172/2167-0269.1000395.

Robbins, S.P. (2003) *Organisational Behaviour* , 10th edition, San Diego: Prentice Hall.

Sasana, H., DA, H. and Muid, D. (2017) 'The Strategy Development of the Region in Support Borobudur Tourism Cluster Competitiveness Regions in Indonesia', *Journal of Environmental Management and Tourism*, vol. VIII, no. 24, pp. 1517-1529, Available: 10.14505/jemt.

Wang, X.P., Zhang, J. and Yang, T. (2014) 'Hybrid SWOT Approach for Strategic Planning and Formulation in China Worldwide Express Mail Service', *Journal of Applied Research and Technology*, vol. 12, pp. 230-238.

Weihrich, H. (1982) 'The TOWS matrix—A tool for situational analysis.', *Long range planning*, vol. 19, pp. 54-66.

Zou, J. and Qiu, Z. (2017) 'An Improved Fuzzy Borda Count and its Application to Watershed Management'

STRATEGY ANALYSIS OF COMMAND X TRAINING LOCATION DEVELOPMENT WITH SWOT AND ANP METHODS

Giani Ferianto, Bambang Suharjo, Ayip Rivai Prabowo

Indonesian Naval Technology College, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia
E-mail: gianiferianto@gmail.com

ABSTRACT

Security Command is a security service business entity that has an official permit regarding security services. Seeing opportunities in the security industry in Indonesia that continues to grow, PT. X to develop its business, one of the strategies that will be taken by the company is to make branch offices to other regions or develop locations. The method used in conducting research is a combination of SWOT and ANP, and the Internal-External Matrix (IE) to determine the appropriate strategy, while to determine the location development of PT. X uses ANP with four criteria proposed by the company. Based on calculation of the analysis analysis strategy command security training location is as follows: Rating 1: Matrix value 0.53 location Pasuruan, Rating 2: Matrix value 0.30 location Tuban, Rating 3: Matrix value 0.16 Lamongan. Pasuruan area, is the main location obtained according to company criteria.

Keywords: *SWOT, AHP, ANP, Internal, Exsternal*

1. INTRODUCTION

Security Command is a security service business entity that has an official permit regarding security services. Education and training to get good and reliable HR security commanders conduct skill courses tailored to the needs of assignments or requests from clients, trainers and instructors use personnel who have tested their abilities and experience education and training. Broadly speaking education and training material includes: Attitude and behavior aspects, physical aspects, aspects of knowledge and skills, aspects of specialization and skills.

Along with the level of awareness and need for security in human beings and their ownership rights, competition in the world of security business is currently increasing steadily, level of vulnerability that is caused in these areas (Hutabarat, 2017; Hutabarat, 2017).

A company's assessment of its products and its own systems and the products and systems of its competitors makes the company know what it must do to face its competitors. Strategies built by companies, especially by management has a significant impact on the success or failure of a company as well as on bankruptcy or survival of the company on the market (Till, 2015; Nowakowska-Grunt, 2009).

Strategy is a framework for everything that matters, such as entrepreneurship, competition and functionality that will be applied to realize the company's goals and the position of the company to achieve sustainable success (Nedelea, 2009). Strategy can be interpreted as a direction or goal from long run that creates benefits for the organization through the management of resources (Yasar, 2010).

The ultimate goal of the company's strategy is to maintain its competitive position, even if it is possible to increase the mastery of products on the market (Gasparotti, 2009).

This paper used some literature to support the research, for example paper with title Coping with Imprecision in Strategic Planning: A Case Study Using Fuzzy SWOT (Hasan Hosseini-Nasab, 2011). Strategic Planning & SWOT Analysis (Kotnal,

2017). SWOT Balanced Scorecard (Rangkuti., 2012). . Business Development Strategy Analysis PT. X Using the SWOT Method (Arica dwi susanto, 2019). Study strategi management SWOT technique (Leila Asayesh, 2013). Performance Assessment of . Implementation of SWOT-ANP Women Navy Resources in Indonesia War Ship (Anggraini, Suparno, Bandono, Putra, & Susanto, 2018). A Logistics Strategy Taxonomy (Autry, 2008)

Seeing opportunities in the security industry in Indonesia that continues to grow, PT. X to develop its business, one of the strategies that will be taken by the company is to make branch offices to other regions or develop locations.

But there are several factors that must be considered before opening a new branch, such as: Financial factors (company finances, company capital in opening new branches, building rental / purchase prices, maintenance costs), Operational factors (access to producers and customers, teacher availability, security), Location Factors (close to industrial areas, available transportation access, easy access to offices), Employee Factors (Amount and quality of Human Resources (HR), UMR employees in the destination area, and employee insurance).

Based on these problems, in this study an analysis will be management strategy of developing a location that is in accordance with the criteria of the company in developing the security business. This method was chosen because SWOT is a powerful instrument in conducting strategy analysis. The efficacy lies in the ability of the company's strategy makers to maximize the role of the power factor and the use of opportunities so that it also serves as a tool to minimize weaknesses of the organization and reduce the impact of threats that arise and must be faced (Ommani, 2011). In the strategy preparation phase there are several matrices that can assist in determining new strategies such as, External Factor Evaluation Matrix, Internal External Matrix and SWOT matrix (Nejad, 2011). The matrix will be obtained criteria that can later be weighted to find the relevance of these criteria using ANP.

The use of expected to be able to find linkages to each other's criteria. The use of SWOT and ANP methods aims to harmonize the criteria that have been ranked and given this weight with the company's vision and mission in order to create ideal solutions that are in accordance with the wishes of the company.

This Paper is organized as follows. Section 2 is review about the basic ship theory. Section 3 would be about the result of the research and section 4 discussion of research. Finally, while in section 5 we would present the conclusions of this paper.

2. RESEARCH METHODOLOGY

The method used in conducting research is a combination of SWOT Analysis with AHP, aInternal-External Matrix (IE) to determine the appropriate strategy, while to determine the location development of PT. X uses ANP with four criteria proposed by the company.

2.1. SWOT Analysis

SWOT analysis is a strategic used to evaluate strengths, weaknesses, opportunities, a business speculation (Hajikhani & Jafari, 2013). These four factors form the acronym Strengths, Weaknesses, Opportunities, and Threats. This process involves determining the specific objectives of business or project speculation and identifying factors that support these goals. SWOT analysis can be applied and sorting things that affect all four factors, then applying it in the SWOT matrix image, where the application is how strengths are able to take advantage of opportunities, how to overcome weaknesses which prevents advantages from

opportunities that exist,The hierarchi of Figure 1(Chermack & Kasshanna, 2007).

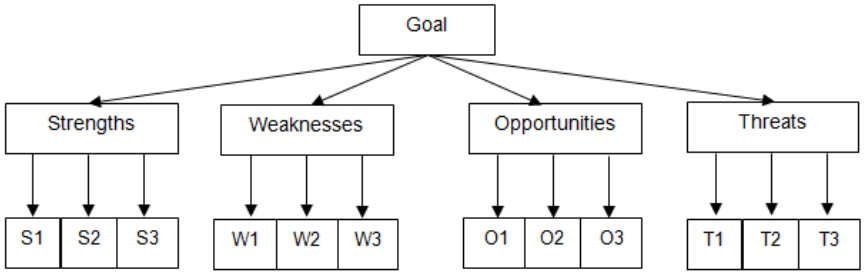


Fig. 1 Hierarchical structure of the SWOT matrix

Steps of the SWOT analysis:

a. Preparation and determination of External and Internal strategic factors

b. Preparation and calculation of weight values, ratings and scores for tables of external and internal factors using the following scale:

1) Where is the weight value,
   1.00 = very important
   0.75 = important
   0.50 = standard
   0.25 = not important
   0.10 = very insignificant
2) Rating value
   5 = very good
   4 = good
   3 = neutral (standard)
   2 = not good
   1 = not very good

2.2. AHP (Analytical Hierarchy Process) analysis

One method used by decision makers is to be able to understand the condition of a system and carry out the decision making process is the Analytical Hierarchy Process. AHP method is intended to model unstructured problems and is usually applied to solve measurable problems and problems that require opinions both in the fields of economics, social and management science (Saaty, 1980).

AHP includes of the human mind. The qualitative aspect defines the problem and its hierarchy and quantitative aspects express judgment and preference in a concise and concise manner. The process it self is these two traits. This process clearly shows that for healthy decision making, to set priorities make judgments (Saaty, 1980). AHP allows users to provide relative weight values of a plurality of criteria or multiple alternatives to a criterion intuitively, that is by doing a paired comparison (pairwise comparison).

2.3. Analytical Network Process (ANP)

Is a method that produces a framework to overcome decision-making problems without involving assumptions related to independence between higher level elements with weak and independent elements in one level (Babak Daneshvar Rouyendegh, 2010).

Like the AHP, ANP involves hierarchical relationships. Hierarchical control, however,a standard structure such as the AHP so that it can handle complex relationships between decision levels with attributes. This ANP models the system with feedback and system where one level may dominate or be dominated, both other levels. In ANP, a pairwise comparison method is used as in the AHP (Răzvan Cătalin Dobrea, 2015). This pairwise comparison process uses numbers/scales that reflect the level of importance/preference of a decision element with other decision elements in the

same hierarchy level. This helps decision makers to compare each element of the decision, because in each paired comparison, they only concentrate on two of them.

Table. 1 Pairwaise Comparison Scale

Improtance Level	Definition
1	Both elements are equally important
3	One element other elements.
5	One element is actually more important than the other elements.
7	One element is clearly than the other elements.
9	One element absolutely other elements.
2,4,6,8	Middle values between 2 adjoining assessments.

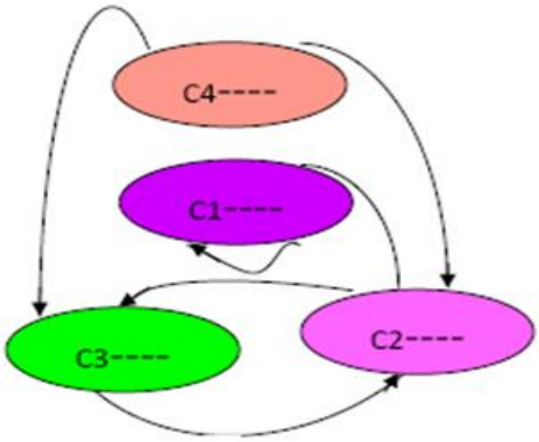


Fig. 2 network Structure

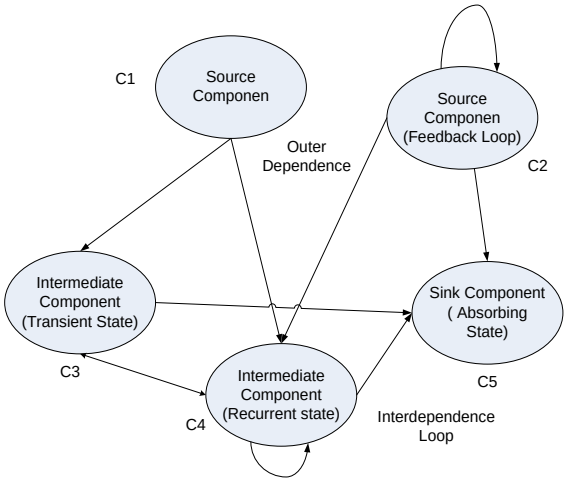


Fig. 3 Feedback network Structure

2.4. Expert Choice

Expert Choice is one application or software used for decision making based on multi-criteria decision making. In its use, offers several facilities ranging from input criteria data, and several alternative choices, to goal setting. In the SWOT Analysis method, Expert Choice software is on each in choosing the most suitable alternative strategy, taking into account the overall SWOT factor. The version used is Expert Choice 11.

2.5. Super Decision

Super Decision software implements ANP for decision making with dependency and feedback (Saaty, 1980)

3. RESULT AND DISCUSSION

3.1. RESULT

3.1.1. IFE and EFE Matrix Analysis

SWOT analysis was chosen to identify contained in each parameter. By using this SWOT analysis, it is expected to be able to produce what is in accordance with the wishes of the company which will be more attractive and competitive. to rank locations. In the ANP method, the level of influence on each criterion and subcriteria will be assessed. Assessment of the level of importance of criteria/sub-criteria with one another is done by making a comparison matrix between criteria and subcriteria. The aim is to find out the priority criteria in this method. The next step is to find the value of CR. The CR value is said to be consistent if the value is ≤ 0.1. If the value of CR ≥ 0.1, it is said to be invalid because it has not been consistent. If the CR value is not consistent, it must be reassessed. After the CR value is obtained, the supermatrix is made. There are three stages in supermatrix, namely: and supermatrix limit. In the supermatrix limit the final results are in the form of the most attractive location priorities and the most influential priority criteria in making a new location.

Fig. 4 Internal-External Matrix (IE)

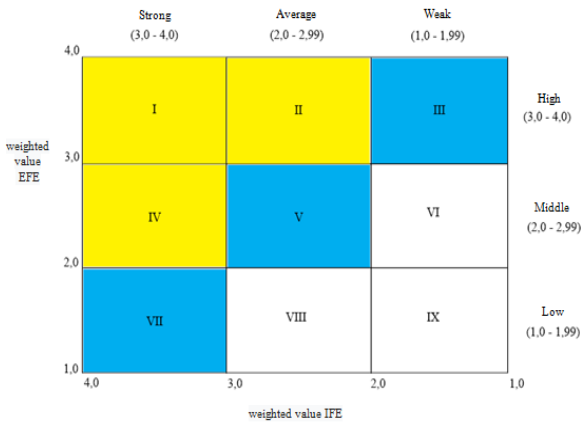


Table. 2 Location SWOT Score

S	Pasuruan	Lamongan	Tuban
1	5.00	3.00	3.00
2	5.00	1.50	1.50
3	5.00	3.00	3.00
4	1.50	1.50	3.00
5	1.50	2.00	5.00
	18.00	11.00	15.50

W	Pasuruan	Lamongan	Tuban
1	0.75	0.50	0.50
2	0.75	0.50	0.50
3	1.50	0.50	0.50
4	0.50	0.50	0.50
5	0.25	0.50	0.50
	3.75	2.50	2.50
O	Pasurua n	Lamongan	Tuban
1	5.00	3.00	3.00
2	5.00	3.00	1.50
3	5.00	5.00	3.00
4	5.00	3.00	3.00
5	5.00	3.00	5.00
	25.00	17.00	15.50
T	Pasurua n	Lamongan	Tuban
1	3.00	5.00	5.00
2	5.00	5.00	5.00
3	5.00	3.00	5.00
4	5.00	5.00	5.00
5	3.00	5.00	5.00
	21.00	23.00	25.00

Table. 3 Best Location

No	Location Name	S	W	O	T	(S-W)+(O-T)
1	Pasuruan	18	3.75	25	21	18.25
2	Lamongan	11	2.50	17	23	2.5
3	Tuban	15.5	2.50	21	25	9.00

Table. 4 Comparison Matrix Between Criteria

Criteria	Building Area	Price	Transportation	Reach
Building Area	1	2.00	4.00	3.00
Price	0.50	1	3.00	2.00
Transportation	0.25	0.33	1	0.50
Reach	0.33	0.50	2.00	1
Total	2.08	3.83	10.00	6.50

Table. 5 Normalization Matrix

Criteria	Building Area	Price	Transportation	Reach	Eigen vector
Building Area	0.47	0.56	4.00	0.48	1.91
Price	0.23	0.28	3.00	0.32	1.14
Transportation	0.12	0.09	1	0.08	0.39
Reach	0.16	0.14	2.00	0.16	0.66
Total	1	1	1	1	

Table. 6 Calculation of Consistency Ratio

Criteria	Building Area	Price	Transportation	Reach	Results	λmax	CI	CR
Building Area	0.47	0.56	4.00	0.48	1.91	1.02	0.01	0.01
Price	0.23	0.28	3.00	0.32	1.14	1.02		
Transportation	0.12	0.09	1	0.08	0.39	1.02		
Reach	0.16	0.14	2.00	0.16	0.66	1.03		
Total						4.04		

3.1.2. Making of Supermatrix

In making a supermatrix there are three types of supermeters that must be performed, namely unweighted supermatrix, weighted supermatrix, and supermatrix limit.

a. Unweighted Supermatrix, formed from pairwise comparisons. The method of writing is done by putting the results of the calculation of pairwise comparisons in a horizontal order from left to right by adjusting the code of the elements.

b. Weighted Supermatrix, an unweighted supermatrix that has been normalized. The matrix results in a matrix whose column values are equal to one.

c. The Supermatrix Limit, obtained by raising the value of a supermatrix weighted with a large power. The result is a value between columns with one with the other columns having the same value. This supermatrix limit will be used in the process of weighting subcriteria/elements.

Table. 7 Unweighted Supermatrix

Criteria	Building Area	Price	Transportation	Reach
Building Area	1	0.54	0.16	0.30
Price	0.50	1	0.12	0.20
Transportation	0.25	0.33	1	0.16
Reach	0.33	0.50	2.00	1

Table. 8 Weighted Supermatrix

Criteria	Building Area	Price	Transportation	Reach	Results	Total
Building Area	0.47	0.15	0.02	0.05	0.69	0.30
Price	0.32	0.28	0.01	0.05	0.64	0.28
Transportation	0.25	0.08	0.10	0.03	0.46	0.20
Reach	0.29	0.07	0.01	0.16	0.53	0.23
Total					2.32	1.01

Table. 9 Limit Supermatrix

Criteria	Building Area	Price	Transportation	Reach	Total	Priority
Building Area	0.08	0.08	0.06	0.07	0.30	1
Price	0.09	0.08	0.06	0.06	0.28	2
Transportation	0.06	0.06	0.04	0.05	0.21	3
Reach	0.07	0.06	0.05	0.05	0.23	4
Total	0.30	0.28	0.21	0.23	1.02	

3.2. DISCUSSION

The way to calculate alternative values is almost the same as calculating the supermatrix criteria by going through three supermatrix stages. What is different only at the beginning of the calculation is the calculation of unweighted supermatrix formation which is done by taking the geometry averages that exist in each alternative. From the results of the ANP calculation using Super Decision, there are 3 Supermarkets, which in each matrix get the highest value for each cluster that is interconnected, for the highest criteria cluster as a very important criterion to be considered in choosing alternatives, there are prices, then building area, transportation and finally reach. For alternative results which are the main objectives of using ANP with Super Decision, based on the limit matrix the following priorities are obtained:

Table. 10 Results from the alternative Unweigthed Supermatrix

Criteria	Building Area	Price	Transportation	Reach
Pasuruan	0.60	0.54	0.50	0.30
Lamongan	0.20	0.30	0.25	0.16
Tuban	0.20	0.16	0.25	0.24

The next process is supermatrix process by multiplying the unweigthed supermatrix matrix with eigen weighting vector criteria. Note that the column values are 1. Whereas the supermatrix limit is calculated by multiplying the supermatrix weighted by itself with the result in the form of a row value equal to the column value. From the supermatrix limit, alternative priorities can be identified as a result. The results of the alternatives in this study are in the form of the priority of the most influential criteria.

After going through the SWOT analysis and calculation of dependency criteria in using ANP, the results obtained in the form of tour packages based on their respective ranks. In this study, Pasuruan was ranked first with a value of 0.53. Then Tuban was ranked second and Lamongan was ranked third. The weakness of this system is that the SWOT analysis framework used in the study does not yet have a definite framework in determining the criteria for each S-W-O-T indicator. These criteria are used not only for SWOT analysis but for calculations on ANP. If the criteria used still do not have a definite framework or rule, this results in a weak level of accuracy being produced.

4. CONCLUSION

By using SWOT analysis combined withAHP then an alternative strategy is obtained that best fits the overall internal and external factors of the company, namely determining the location development in 3 (three) locations. This is based on the calculation of factor weights using ANP method, getting the 3 best alternative branch locations and in accordance with the criteria desired by the Company, namely:

Table. 11 Calculation results and location location

Rating	Location
1	Pasuruan
2	Tuban
3	Lamongan

Based on calculation of the analysis analysis strategy command security training location is as follows: Rating 1: Matrix value 0.53 location Pasuruan, Rating 2: Matrix value 0.30 location Tuban, Rating 3: Matrix value 0.16 Lamongan. Pasuruan area, is the main location obtained according to company criteria. This is obtained based on the consideration of 3 (three) locations that are used as alternatives. analysis in combination with AHP method, is considered more effective in

determining the strategies that will be taken by the company by paying attention to external and internal factors of the company, this is because in the strategy selection phase, AHP gives weight that is considered influential with a hierarchical structure. Determining the location using the Analytical Network Process (ANP) method can help companies choose locations that are in accordance with the criteria desired by the company.

REFERENCES

Anggraini, D. C., Suparno, Bandono, A., Putra, I. N., & Susanto, A. D. (2018). Implementation of SWOT-ANP Method to Determine the Best Strategy on Development Women Navy Resources in Indonesia War Ship. *International Journal of Academic Multidisciplinary Research (IJAMR)*, 11-20.

Arica dwi susanto, N. S. (2019). Business Development Strategy Analysis PT. X Using the SWOT Method. *International Journal of Academic and Applied Research (IJAAR)*, 4-9.

Autry, C. Z. (2008). A Logistics Strategy Taxonomy. *Journal of Business Logistics*, 27-51.

Babak Daneshvar Rouyendegh, S. E. (2010). The DEA – FUZZY ANP Department Ranking Model Applied in Iran Amirkabir University. *Acta Polytechnica Hungarica, 7*(4), 103-114.

Chermack, T. J., & Kasshanna, B. K. (2007). The use and misuse of SWOT analysis and implications for HRD professionals. *Human Resource Development International*, 383-399.

Gasparotti, C. (2009). The Internal and External Environment Analysis of Romanian Naval Industri with SWOT Model. *Management & Marketing Journal*, 97-110.

Hajikhani, A., & Jafari, H. R. (2013). Developing a Mix Method of a SWOT, BSC and QFD toward strategic Planning. *Interdisciplinary Journal of Contemporary Research in Business*, 476-489.

Hasan Hosseini-Nasab, A. H.-N. (2011). Coping with Imprecision in Strategic Planning: A Case Study Using Fuzzy SWOT Analysis. *iBusiness, 3*, 23-29.

Hutabarat, L. F. (2017). Indonesian Female Peacekeepers in the United Nations Peacekeeping Mission. *Jurnal Pertahanan*, 185-206.

Kotnal, J. R. (2017). Strategic Planning & SAnalysis. *International Journal of Advanced Research and Development, 2*(6), 60-62.

Leila Asayesh, H. K. (2013). Studying strategies of sport management using SWOT technique. *European Journal of Experimental Biology, 3*(6), 54-60.

Nedelea, S. P. (2009). The Importance of Strategic Management Process in the Knowledge-Based Economy. *Review of Internasional Comparative Management*, 95-105.

Nejad, M. B. (2011). Applying Topsis and QSPM Methods in Framework SWOT Model : Case Study of the Iran's Stock Market. *Australian Journal of Business and Management Research*, 93-103.

Nowakowska-Grunt, J. (2009). Strategy of Distribution on Food Industri Companies. *Annales Universitatis Apulensis Series Oeconomica*, 875-880.

Ommani, A. R. (2011). Strenght, Weakness, Opportunities, and Threats (SWOT) Analysis for Farming System Business Management: Case of Wheat Farmers of Shadervan District, Shoushtar Township, Iran. *African Journal of Business Management*, 9448-9454.

Rangkuti., F. (2012). *SWOT Balanced Scorecard.* Jakarta: PT Gramedia.

Răzvan Cătalin Dobrea, G. M. (2015). Food Sustainable Model Development: An ANP Approach to Prioritize Sustainable Factors in the Romanian Natural Soft Drinks Industry Context. *Sustainability*, 10007-10020.

Saaty, T. (1980). *The Analytical Hierarchy Process.* New York: McGraw-Hill.

Till, G. (2015). Indonesia as a growing maritime power: possible implications for Australia. *Soundings Sea Power Centre*, 1-13.

Yasar, F. (2010). Competitive Strategies and Firm Performance : Case Study on Gaziantep Carpeting Sector. *Mustafa Kemal University Journal of Sosial Sciences Institute*, 310-311.

ANALYSIS OF RELOCATION FEASIBILITY STRATEGY OF MAIN CADET IN SUPPORTING AAL CADET EXERCISE

Edy Susanto, **Ahmadi**, **Fa'iq Mumtaz M**
Indonesian Naval Technology College, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia

ABSTRACT

The Naval Academy's educational institutions still need a lot of space in accordance with various educational operations in the Navy Academy. The arrangement of the Naval Academy building has been structured as the integrity of ideal educational needs. The AAL Kal Cadet Pier is one of the docks which functions to anchor Kal Cadet and cadets training. The current condition of the Kal Kadet dock cannot be used anymore because it has been damaged and the environment around the pier is shallow. For this reason, it is necessary to relocate or construct a new dock. This study intends to study the feasibility strategy for the planned relocation of the Kal Cadet pier to a new place. This study uses a combination of SWOT methods and Analytical methods to obtain integrated decision results by carrying out assessments of existing indicators. So that it will produce a comparison of feasibility strategies and produce a feasibility strategy for relocation by determining the right strategy

Keywords*: SWOT, Analytical Hierarchy Process (AHP), Kal Cadet.*

1. INTRODUCTION

Human Resources (HR) is a factor that determines the success of an organization in achieving its main tasks. Achieving assignments at the Naval Academy (AAL) in order to support the operations of the Indonesian Navy depends on the quality of human resources. The ability of the Indonesian Navy is not only measured by the sophistication of the cysts possessed by the Indonesian Navy. The Indonesian Navy must have a reliable and quality defense equipment so that it can carry out its duties professionally. AAL is the first Academy level administrators under Kasal. AAL has the main task of educating the Cadets to become candidates for officers who have the spirit of Pancasila and Saptamarga fighters. Cadets are required to have the knowledge and professional skills of the sea in the spectrum of initial assignments in KRI / troops and have managerial abilities and leadership as candidates for the TNI / Navy leadership. The main thing is to answer the challenges of the Indonesian Navy's task in the future and to realize a respected Indonesian Navy in the regional countries. Development of development in the AAL environment is very fast. The Indonesian Navy's defense equipment from abroad is very diverse, so AAL built several facilities to meet the needs of Taruna and Taruni in carrying out education. This development is to support learning in carrying out future tasks.

The condition of AAL's dock is currently damaged. The environment around the pier is shallow due to the sedimentation. AAL Pier cannot be used for KAL berth. this condition can only be used to support cadets or rubber boats. so that it cannot be used for KAL / KRI support in cadets release activities when they are going to carry out cruise training. At present KAL Kadet lean on the Armatim dock.

Based on the above, it is necessary for a feasibility study to analyze the strategic and risk of the dock relocation plan. This study to ensure whether or not the dock relocation project works well and successfully, is mainly used by the interests of AAL and the Navy. whereas from local governments, or non-profit institutions, the presence of docks can provide benefits to the community such as social benefits

Therefore, it is necessary to analyze the location as well as the things that become the inhibiting factors and the influencing factors so that they get the solution according to the characteristics of the pier. There are several factors and many variables that influence in determining the criteria in accordance with the standard of the dock. So far the results and methods that are often used in determining the location of the dock are only based on the results of team decisions which are qualitative results and subjective elements of the decision maker.

At this writing will use a combination method between SWOT analysis and analytical hierarchy process (AHP), for the dock relocation strategy approach, an analysis of strengths, weaknesses, opportunities and threats (SWOT) is needed for the pier location of KAL Kadet to be planned so that the formulation of strategies will be taken sharper (effective). SWOT Analysis (Strengths, Weaknesses, Opportunities, and Threats) is an important strategy formulation technique that can be integrated into three-stage decision making, namely input stage, matching stage and decision stage (Fred R. David, 2012), according to Freddy Rangkuti (2015) Analysis SWOT is the identification of various factors systematically to formulate a corporate strategy that is based on the logic of maximizing strengths and opportunities, but simultaneously can minimize weaknesses (Weaknesses) and Threats (Threats), so that they are obtained from the identification of conditions, potentials and problems with related aspects so as to produce decisions on matters that are influenced by factors and variables that exist. from the results of the SWOT approach, a decision that shows the strengths and weaknesses of the results so that the determination of the ranking results is used AHP method that will determine the ranking for the right strategies and risks to be faced in the Analysis of Strategies Feasibility for Relocation of Kal Kadet Pier in Supporting Training Kadet AAL.

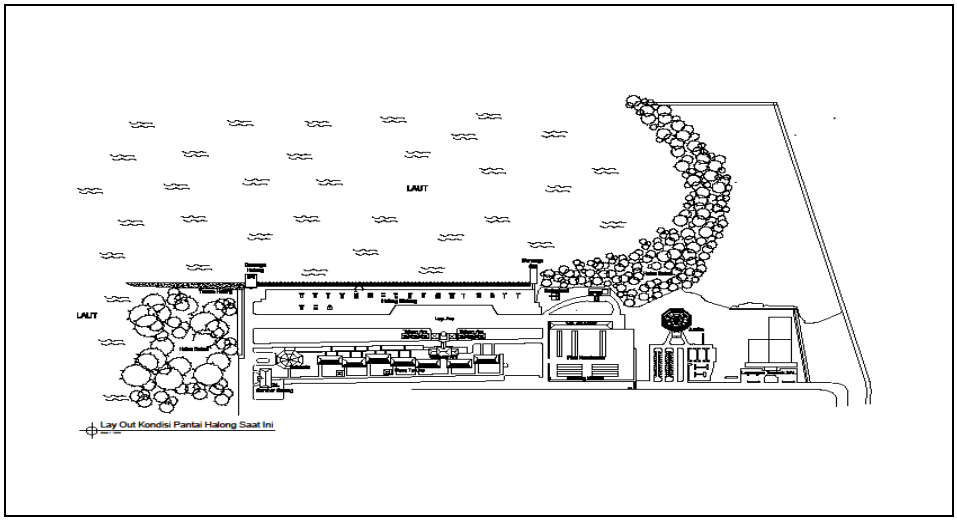


Figure 1. Location of Kal Kadet pier

2. METHODOLOGY

2.1 Strategy Theory

Etymologically is a derivative of the Greek word, strategos. Strategos can be translated as "military commander" at the time of Athens' democracy. At first the term strategy was used in the military world which was interpreted as a way of using all military power to win a war. While in terms

of terminology many experts have proposed a 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. among experts who formulate the definition of strategy is one of the processes by which to achieve a goal and be oriented towards the future to interact in a competition to achieve the goal. In a strategy, victory is everything. The main objective of the strategy is to guide decisions in order to shape and maintain excellence so that it can achieve success. The strategy is also a means for communication and coordination within the organization.

According to Fred R. David (2010) management strategy can be defined as art and science to formulate, implement and evaluate cross-functional decisions that enable organizations to achieve their goals. Historically, the main benefits of strategic management have helped organizations formulate better strategies using a more systematic, logical and rational approach to strategy choices.

2.2 Determination of Benefits (Impact Analysis)

According to Ivan Wirata (2008) The benefits of a project can be classified into two, namely direct benefits and indirect benefits. Direct benefits are benefits that can be directly obtained from a project. Indirect benefits are benefits that cannot be measured by the value of money, but can make a region grow and can spur regional economic growth: Tangible benefits, namely benefits that can be measured in the form of a value of money. Intangible benefits, for example the feeling of being safe from flooding after a flood control project Indirect benefits are a controversial phenomenon, because these benefits are very difficult to determine so that in the calculation changes will appear.

2.3 SWOT Analysis

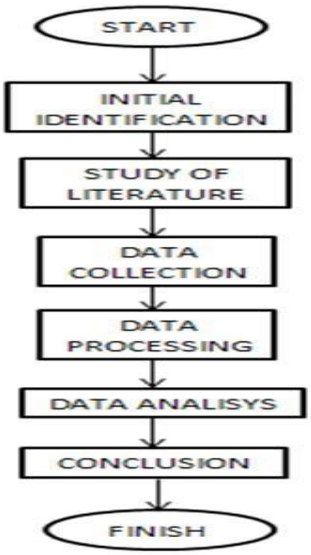
SWOT analysis is a strategic planning method used to evaluate strengths, weaknesses, opportunities, and threats in a project or business speculation. The four factors that form the SWOT acronym (strengths, weaknesses, opportunities, and threats). This process involves determining specific goals of business or project speculation and identifying internal and external factors that support and those that are not in achieving that goal. SWOT analysis can be applied by analyzing and sorting out various things that affect the four factors, then applying them in the SWOT matrix image, where the application is how strengths are able to take advantage of existing opportunities, how to overcome weaknesses (weaknesses) which prevents the existing opportunities, then how strengths are able to deal with existing threats, and finally how to overcome weaknesses that are able to make threats become real or create a new threat.

Table 2. SWOT Matrix

SWOT Matrix	Strenght (S)	Weakness (W)
Opportunity (O)	Positive internal aspects that can be controlled and can be strengthened in planning. **Strategy SO**	Negative internal aspects that can be controlled and can be corrected in planning. **Strategy WO**
Positive external conditions that cannot be controlled and can be taken advantage of.	Utilizing Internal power to profit from external opportunities.	Utilizing Internal power to profit from external opportunities

Threat (T)	Strategy ST	Strategy WT
Negative external conditions that cannot be controlled and may be minimized.	Use strength to avoid or reduce the impact of external threats	Defensive tactics directed at reducing internal weaknesses and avoiding external threats

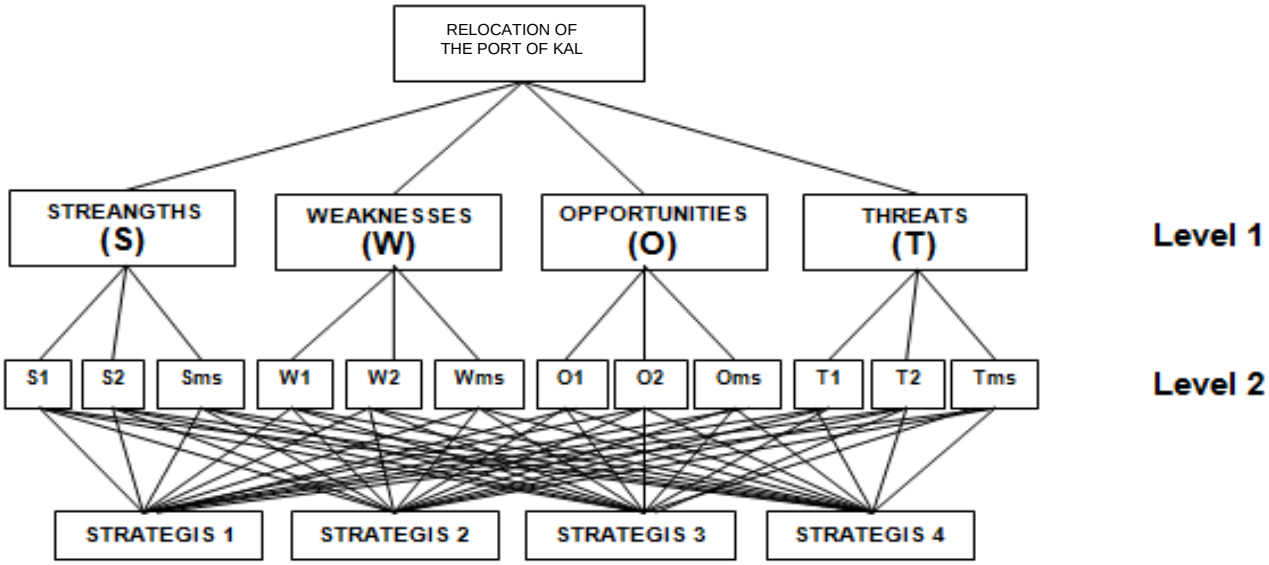
2.4. Research Metodhology



Gambar 2: Research Metodhology

3. RESULT AND DISCUSSION

At this stage of the analysis the problem hierarchy process is carried out first, then carry out the SWOT Global Ranking process.



3.1. Matrix Analysis (Internal Factor Evaluation)

This analysis is a strategy formulation tool that summarizes and evaluates key strengths and weaknesses, and becomes the basis for identifying and evaluating the relationships of strengths and weaknesses.

In the calculation of the EFI relocation matrix analysis Kal Kalet is produced as follows:

Table 3. EFI Matrix (Internal Factor Evaluation)

SWOT Criteria Level 1	Evaluation Factors Internal	**Weight**	**Rating**	**Score**
				(2)x(3)
	(1)	(2)	(3)	(4)
Strengths (S)	1 Policy	0.239	4.19	1.00
	2 Basic Principal Duty	0.157	2.54	0.40
	3 Physical Requirements	0.147	2.33	0.34
	4 Logistics Availability	0.123	1.95	0.24
	5 Topography	0.109	1.73	0.19
	6 Physical Classification	0.087	1.38	0.12
	7 Physical Function	0.081	1.28	0.10
	8 Personnel Readiness	0.058	0.92	0.05
		1.00		2.45
Weaknesses (*W*)	9 Public Port Area	0.244	3.17	0.77
	10 Supporting facilities	0.202	2.56	0.52
	11 Layout Design	0.182	2.31	0.42
	12 Geology	0.140	1.73	0.24
	13 Availability of Shipyards	0.122	1.44	0.18
	14 Availability of facade	0.111	1.31	0.15
		1.00		2.27

Source: Excel Data Processing

From the results of the above analysis as a whole produces a score of 4.72 which on a scale of 1 to 4, ranging from scale 4 indicates that these factors are very strong in influencing the internal factors of relocation of the Kal Kalet dock.

3.2. EFE Matrix Analysis (External Factor Evaluation)

In this analysis it is possible for the strategists to summarize and evaluate external factors. In the calculation of the EFE matrix relocation analysis the Kal Kadet Pier is produced as follows:

Tabel 4. Matrik EFE (Evaluasi Faktor Eksternal)

SWOT Criteria Level 1	Evaluation Factors External	Weight	Rating	Score **(2)x(3)**
	(1)	(2)	(3)	(4)
Opportunities (O)	15 Regional Spatial Planning	0.228	2.44	0.56
	16 Land Availability	0.214	2.24	0.48
	17 Oceanography	0.142	1.49	0.21
	18 Sedimentation	0.126	1.32	0.17
	19 Geostrategic & Geoeconomics	0.123	1.29	0.16
	20 Side Unit Support	0.085	0.85	0.07
	21 Availability of Public Pier	0.083	0.81	0.07
		1.00		1.71
Threats (T)	22 Community support around	0.291	1.61	0.47
	23 Shipping Volume	0.246	1.36	0.33
	24 Road Access	0.206	1.14	0.23
	25 Supporting facilities	0.152	0.80	0.12
	26 Level of vulnerability	0.104	0.43	0.04
		1.00		1.20

From the results of the above analysis as a whole produces a score of 2.92 which on a scale of 1 to 4, ranging from scale 3 indicates that the factor is the response above the average in influencing the external factors of relocation of the Kal Kadet Pier.

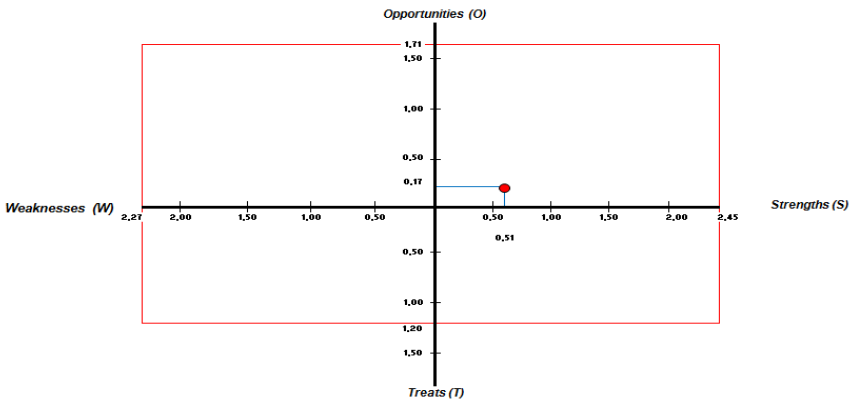
3.3. Strategy Formulation

From the EFI matrix (Internal Factor Evaluation) and EFE matrix (External Factor Evaluation) above, the intersection of the four lines of Strength, Weakness, Opportunity and Threat factors, then the following coordinates are obtained:

Strength Score - Weakness Score = 2.45 - 2.27 = 0.17

Opportunity Score - Threat Score = 1.71 - 1.20 = 0.51

In the graph above which is generated through the EFI Matrix and EFE Matrix the comparison of strength lies in Quadrant I, which supports the Aggressive Strategy, in the graph below:



Graph 1. SWOT Analysis

a. SWOT Matrix Analysis

INTERNAL FACTOR EKSTERNAL FACTOR	STRENGTHS (S) 1. Policy 2. Basic Principal Duty 3. Physical Requirements 4. Logistics Availability 5. Topography 6. Physical Classification 7. Physical Function 8. Personnel Readiness	WEAKNESSES (W) 1. Public Port Area 2. Supporting facilities 3. Layout Design 4. Geology 5. Availability of Shipyards 6. Availability of facade
OPPORTUNITIES (O) 1. Regional Spatial Planning 2. Land Availability 3. Oceanography 4. Sedimentation 5. Geostrategic / g.eko 6. Sat sat beside 7. General Pier	STRATEGY SO 1) Preparation of administration of land transfer provisions prior to the implementation of relocation in accordance with the policy, to the TNI AL SIMAK-BMN Cq. Slogal, Disfaslanal. 2) The maturity of the pier planning design is in accordance with the topography of the area supported by oceanography & sedimentation conditions with the design of infrastructure facilities, limiting taps cq.l Disfaslanal and Dishidros. (S1)(S2)(S5)(O2)(O3)(O4)	STRATEGY WO 1. Collaboration & providing views on the City Government of Surabaya with the Indonesian Navy cq. AAL about regional development 2. Establishment of a marine economy center in the AAL area with central marine facilities, the Indonesian Navy cq. Dispotmar & AAL .(W2)(W3)(O1) (O2)(O5)
THREATS (T) 1. Level of vulnerability 2. Supporting Facilities 3. Access Road 4. Shipping Volume 5. Duk Fishing communities .	STRATEGY ST 1. AAL as a marine education institution can empower maritime potential by implementing cooperation with the Surabaya City Government & the Navy's Dispotmar to build facilities and infrastructure, maintain clean and safe beaches. 2. With the relocation plan will have an impact on the development of a spatial area that requires the construction of surrounding facilities, the Surabaya City Government, Dispotmar TNI AL.(S2)(S7)(O1)(O2)	STRATEGY WT 1. Collaboration with local companies that have harbor facilities, Dismatal. 2. Utilizing existing space contours for dock facilities, Disfaslanal. 3. Implementation of routine screen exercises around the harbor waters in coordination with side units. (W2)(W3)(W6)(T1)(T2)

b. Internal - External Matrix Analysis (IE)

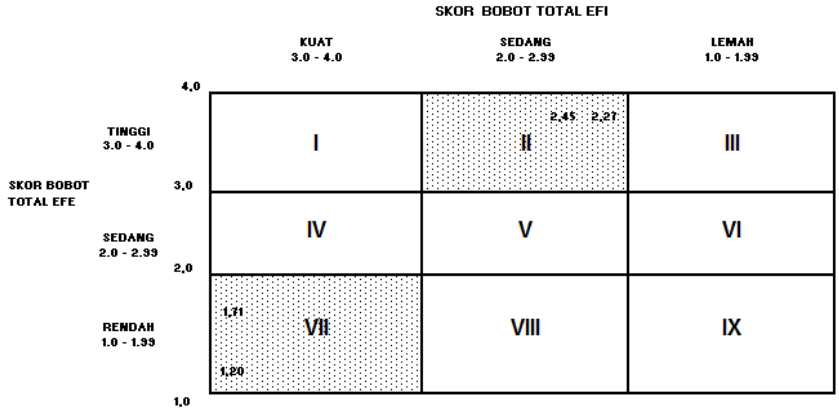


Figure 4. Internal - External (IE) Matrix

he results of the IE matrix show that EFI and EFE scores are located in Quadrant II and Quadrant VII means:

1) Implementation of Backward Integration, Future Integration, or Horizontal Integration, Growth Strategy quadrant which means that the power possessed in the relocation plan is supported by opportunities that will increase the strength of the owned and profitable to overcome weaknesses and threats faced, such as policy support and implementation of basic tasks.

2) Implementation of the strategy through concentration and diversification, namely concentration on existing opportunities so that strong opportunities will increase strength while relatively small opportunities for diversification will be a beneficial force, such as the utilization of land readiness that is related to regional spatial development and support for preparedness factors topography and oceanography.

c. Alternative Strategy

1) Strategy S-O :

- Preparation of administration of land transfer provisions between the Government and the Indonesian Navy cq. Dispfaslanal and AAL before the implementation of relocation in accordance with the policies of the Navy's leadership.
- The maturation of the dock planning design is according to the topography of the area which is supported by oceanographic conditions & sedimentation of the survey results by Dishidros.

2) Strategy W-O :

- Collaboration and giving a view to the Surabaya City Government regarding the development of facilities to support local economic development as well as regional development.
- Establishment of a maritime economic center in the area. Plan for relocation with the construction of a pier and other marine business centers and even marine tourism centers

3) Strategy W-T :

- Collaboration and utilization of ship maintenance facilities at local companies.
- Utilization of existing land and space contours for dock facilities with land maturation, talud.
- Implementation of exercises around the harbor waters in coordination with other relevant parties.

4) Strategy S-T :

- AAL as a marine education institution can empower maritime potential by collaborating with the Surabaya City Government and the Navy's dispotmar to build facilities and infrastructure, maintain the cleanliness and safety of coastal waters.
- Relocation will have an impact on the development of spatial areas that require the construction of surrounding facilities which will certainly improve the economy of the surrounding area.

4. CONCLUSIONS AND RECOMMENDATION.

4.1. Conclusions

From the results of the analysis and discussion that has been done, the conclusions that can be drawn from this study are:

a. The application of analysis to the SWOT-AHP method can be used in determining the feasibility of alternative strategies on the relocation of the Kal Kadet Pier in addition to taking into account the technical factors that influence the decision.

b. Strength and Opportunities Strategy is a priority strategy generated from the SWOT-AHP analysis where this strategy has a focus on the power possessed to seize the opportunities available, the priority is the existence of a policy of relocation implementation that is proportional to the available land and supported by technical readiness geology of the relocation and oceanographic area of the coastal path, sedimentation, the width of the beach to navigate the ship around the relocation area.

4.2 Recommendation

Recommendation that can be given are as follows:

a. It is expected that this research can help leaders understand the strategic value of the Kal cadet dock for the use of education in AAL and cultural values in the Surabaya area.

b. In the implementation of relocation and preparation of the existing location, proper planning must be carried out considering the existing land conditions need to be done ripening, dredging, landfilling as well as the manufacture of soil retaining taluds

c. Further research and writing is needed regarding this research

REFERENCES

Ali Gorener, Kerem Toker, Korkmaz Ulucay (2012). Application Of Combined SWOT and AHP : A Case Study For a Manufacturing Firm, SciVerse ScienceDirect Journal 58 (2012) 1525 – 1534.

Edgar Elias Osuna (2007). Combining SWOT and AHP Techniques For Strategic Planning. Jurnal ISAHP 2007, Vina Del Mar, Chile, August 2-6, 2007.

Fred, R. David (2012). Strategic Management. Salemba Empat, Jakarta

Freddy Rangkuti (2015). SWOT analysis. Gramedia Main Library, Jakarta

George O. Wesolowsky, William G. Truscott (1975). The Multiperiod Location-Allocation Problem With Relocation Of Facilities. Journal Institute For Operation Research an The Management Sciences (INFORM) U.S.A. Vol.22, No.1, September 1975.

Ivan Wirata (2008). Port Extension Prospect Study in Jambi. Thesis of Master of Civil Engineering, Post-Graduate Program of Diponegoro University. Semarang.

J. David Hunger and Thomas L. Wheelen (2001). Strategic Management and Business Policy, Twelfth Edition Iowa State University.

Jonathan Sarwono (2006). Quantitative and Qualitative Research Methods. Graha Sciences.

Mabes TNI (2004). Law No. 34 concerning the Indonesian National Army. Jakarta

Mikko Kurttila, Mauno Pesonen, Jyrki Kangas, Miika Kajanus (2000). Utilizing The Analytic Hierarchy Process (AHP) in SWOT Analysis – a Hybrid Method and its Application to a

Forest-Certification Case. Forest Policy an Economics I (2000) 41-52.

Niken Hermayanti (2012). Feasibility Study and Development Strategy of PPI Muara Air Palik, North Bengkulu Regency. Naturalis-Journal of Research on Natural Resource and Environmental Management. Faculty of Agriculture, University of Bengkulu. Vol. 1, No.3, December 2012.

SWOT ANALYSIS TO DETERMINE COMPETITIVE STRATEGIES IN XYZ HOSPITAL

Yunus Endang Patabang, Adi Bandono, Endin Tri Hartanto

Indonesian Naval Technology College, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia

ABSTRACT

The XYZ Hospital is a public hospital that gives a medical service, holds quality education and research. In carrying out its duties XYZ Hospital will immediately participate in competition with other hospitals. Therefore XYZ Hospital is required to be able to compete more competitively in determining strategies. Competitive strategy is one way to know competitiveness in every strength. Effective use of SWOT analysis can play an important role in determining competitive strategies, so that strengths, weaknesses, and challenges can be identified by XYZ Hospital in maintaining its existence and continuity. The problem that the answer to this research is looking for is whether the SWOT analysis is the right strategy to increase production at the XYZ Hospital and how is the competitive strategy applied in overcoming competition? In connection with this problem the hypothesis is proposed as follows: it is suspected that using a SWOT analysis can improve competitiveness so that XYZ Hospital has the advantage of being superior to other hospitals. This study uses primary data by providing questionnaires and secondary data to obtain archives or documents. In line with the problem and the research hypothesis, this research was carried out using the IFAS analysis method to analyze internal factors, EFAS analysis for external factors, then included in the quantitative model, namely the SWOT matrix. The results of the analysis show that, using IFAS and EFAS analysis and using the SWOT analysis show the position of the XYZ Hospital in cell 1, the strategy chosen to support the achievement of goals is the SO strategy.

Keywords: *Swot Analysis, competitive strategy.*

1. INTRODUCTION

The hospital is a professional health care institution whose services is provided by doctors, nurses, and other health professionals. These hospitals have sprung up hospitals or other health care institutions such as clinics and medical centers. This makes the existing hospital compete to provide the best service to attract as many patients as possible, so that along with the hall will provide benefits for the hospital. If previously the business orientation developed was a hospital that could freely impose its will on patients with the facilities and services they have, which sometimes are not in accordance with the wishes of patients, then what happens now is the opposite. The orientation shift is that patients will look for the best facilities and services provided by a hospital. So that a hospital is fully aware that in the current world of health services, patients are the holders of control over the services they will obtain. Patients in this case are very free to determine what type and form of service they can get and get from the hospital, thus the hospital seems "forced" to follow and provide services that are in accordance with the patient's values and desires if they still want to survive.

XYZ Hospital must also be able to provide better facilities and services from other hospitals. The average daily XYZ Hospital serves 425 patients with a total of 629 beds. This number is relatively less compared to the other surrounding hospital, which serves 800, 900 to 3000 patients per day. From this data it can be seen that hospitals also have increasingly fierce competition in attracting as many patients as possible. To address this, various efforts are needed. The best step to maintain and increase the number of patients is by following the trend of the development of services and facilities

provided by the hospital in accordance with the demands of the current era.

So, the function of the SWOT analysis and competitive strategy is to analyze the strengths, weaknesses and competitive advantages that the hospital has through analysis of the internal conditions of the hospital, as well as an analysis of the opportunities and threats faced by hospitals through analysis of external conditions the hospital.

One of the efforts made by XYZ Hospital is improving the services and health facilities it has. This is done in order to be able to stay in the hospital business competition or even increase its profitability. Improved services and facilities owned are expected to increase profit margins significantly. Factors of strengths, weaknesses, opportunities and threats are dynamic factors in SWOT (Strength, Weakness, Opportunity, and Threat) that can describe the ability of the hospital to optimize and allocate using its resources and the situation faced in an effort to achieve a goal.

2. METHODOLOGY

In this study using a type of qualitative research with a descriptive approach that is a study that aims to make a systematic, factual, and accurate depiction of the facts and characteristics of research objects (Sumadi Suryabrata, 2003) Prof. Dr. Saginaw (2013: 29). Descriptive Statistics is statistically that function to describe or give an overview of the object under study through sample data or population as it is, without analyzing and making conclusions that apply to the public. The research sample is part of the medium's power of the XYZ Hospital is a number of medical staff, 10 employees who have the potential to provide accurate data or information. Research on current conditions, by making an assessment of handling conventions as follows:

a. Very good with scores: 4
b. Good with a score: 3
c. Enough with a score: 2
d. Less with a score: 1
e. Number 1: not agreeing
f. Number 2: lack of green
g. Number 3: ugren
h. Number 4: very ugly.

To obtain accurate data that can be trusted with the truth and relevant problems examined, the data collection is carried out by several methods: Interview, Observation, Questionnaire, Literature Study.

Operational variables are everything in the form of what is determined by the researcher to be studied so that information about it is obtained, then conclusions are drawn (Prof. Dr. Sugiono: 2013). The variables in this study are independent variables (free) and dependent variables (bound). The independent variable (independent variable) or variable X Sugiono (2013: 04) is often also called the stimulus variable, predictor, antecedent. The independent variable is a variable that affects or which is the cause of the change or the emergence of the dependent variable. In this study independent variables are the four constituent elements of SWOT, which include:

a. Strengths as X1
b. Weaknesses, as X2
c. Opportunities as X3
d. Threats as X4.

The dependent variable (dependent variable) or variable Y Sugiono (2013: 04) is often also called the output variable, criteria, consequently. The dependent variable is a variable that is influenced or that becomes a result, because of the existence of independent variables. Which is the dependent variable (independent variable) in this research is a competitive strategy.

The analysis in this study is to use SWOT analysis, where this method shows hospital performance by determining a combination of internal and external factors. SWOT analysis compares internal factors, namely strength (weakness), and weakness (weakness). With external factors, namely opportunities and threats. Internal factors are included in the matrix called IFAS factor matrix (Internal Strategic Factor Analysis Summary). External factors are included in the matrix called the external factor matrix or EFAS (External Strategic Factor Analysis Summary). After the internal and external strategy factor matrix was completed, the results were included in the qualitative model, namely the SWOT matrix to formulate the competitive strategy of the hospital.

2.1 Research Place and Time

The time used to conduct this research is in January to June 2018. The location of this study is located at XYZ Hospital, Surabaya City.

2.2 Data

The type of data used is the primary data by conducting interviews and direct observation.

2.3 Data Collection Techniques

The technique of data collection is done by conducting observations and interviews directly coming to the Decoration X business place.

2.4 Data Analysis Techniques

According to Rangkuty (2006), the data analysis used to solve the problem is as follows:

On cell Opportunities (O), several opportunities are formulated by the hospital. This must consider industrial deregulation as one of the strategic factors.

a. On cells Threats (T), determine some of the threats facing the hospital.

b. On cell Strengths (S), determine several threats facing the hospital.

c. On cell Weaknesses (W), determine a number of weaknesses that still entwine the hospital.

d. Formulate several possible alternative strategies for the hospital based on consideration of the combination of four opportunities for the strategic factor, which consist of:

1) SO Strategy, This strategy is based on a way of thinking, namely how hospital uses all the power to take advantage of opportunities.

2) ST Strategy, this strategy is to use the strengths that the hospital has by avoiding threats.

3) WO Strategy, this Strategy is implemented by utilizing existing opportunities and overcoming weaknesses possessed.

4) WT Strategy, this Strategy is based on activities that are defensive and aimed at minimizing existing weaknesses and avoiding threats.

Furthermore, by using strategic factors, both internally and externally as explained in the EFAS and IFAS tables, then continue the stages one through six above. Transfer opportunities and threats (stages one and two) of the EFAS table and add strengths and weaknesses (from the third and fourth stages). Based on this approach, various possible alternative strategies can be made (SO, ST, WO, WT).

3. RESULTS AND DISCUSSION

3.1 Analysis of Internal Factors and SWOT External Factors

The results of the analysis of internal factors of this hospital are as follows:

Table 1. SWOT internal factors

Internal Strategy Factors		**Priori scale (PS)**	**Constants (C)**	**PS*C**	**Score (S)**
Strength:					
1	XYZHospital is well known to the public	1	4	4	0,077
2	There are health facilities that are not owned by other hospitals	3	4	12	0,231
3	Employees who have high discipline	5	4	20	0,385
4	The number of patients tends to be stable	4	4	16	0,308
Total				**52**	**1,00**
Weakness:					
1	Publication is still lacking	4	4	16	0,444
2	Limited availability of experts	3	4	12	0,333
3	The bureaucracy is still long	2	4	8	0,222
Total				**36**	**1,000**

Table 2. SWOT external factors

External Strategy Factors		**Priori scale (PS)**	**Constants (C)**	**PS*C**	**Score (S)**
Opportunity:					
1	Open good opportunities for patients	2	4	8	0,667
2	There are still opportunities for patients with certain diseases	1	4	4	0,333
Total				12	1,000
Threats:					
1	The location is located adjacent to another hospital	3	4	12	0,429
2	Patient dissatisfaction with service	4	4	16	0,571
Total				**28**	**1,000**

3.2 IFAS and EFAS on XYZHospital

Below is the IFAS (Internal) table

Strategic Factors Analyst Summary).

Table 3. Table IFAS SWOT

Internal Strategy Factors		**Score (S)**	**Rating (R)**	**S x R**
Strength:				
1	XYZHospital is well known to the public	0,077	3	0,23
2	There are health facilities that are not owned by other hospitals	0,231	3	0,69
3	Employees who have high discipline	0,385	4	1,54
4	The number of patients tends to be stable	0,308	4	1,23
Total		**1**		**3,69**
Weakness:				
1	Publication is still lacking	0,444	2	0,89
2	Limited availability of experts	0,333	4	1,33
3	The bureaucracy is still long	0,222	3	0,67
Total		**1**		**2,89**

Table 4. Table EFAS SWOT

External Strategy Factors		**Score (S)**	**Rating (R)**	**S x R**
Opportunity:				
1	Open good opportunities for patients	0,667	3	2,000
2	There are still opportunities for patients with certain diseases	0,333	4	1,333
Total		1		3,333
Threats:				
1	The location is located adjacent to another hospital	0,429	2	0,86
2	Patient dissatisfaction with service	0,571	3	1,71
Total		**1**		**2,57**

After we get the score or the value of strengths, weaknesses, opportunities and threats, then the next step is to determine the type of strategy in the way below: Strategy Determination

= {(Strength score - weakness score) /2}; {(opportunity score- Threat score) /2}

= {(3.69-2.89)/2} ; {(3.33-2.57)/2}

= 0.42 ; 0.38

Then the type of strategy chosen is strategically at the coordinate point (0.42; 0.38), can be described as follows:

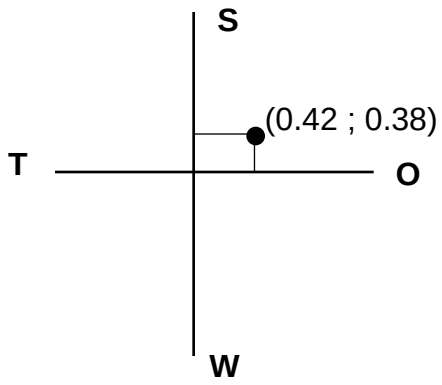


Figure 1. Coordinate strategy

Figure 1 shows that strategy generated is the SO strategy, namely the organization have the strength and opportunity in the organization in prime and steady state. Organization enabled to continue to expand, increase growth and achieve progress maximally.

3.7 SWOT Matrix on XYZ Hospital

Table 5. Swat matrix table

IFAS **EFAS**	**Strength:** ✓ XYZHospital is well known to the public ✓ There are health facilities that are not owned by other hospitals ✓ Employees who have high discipline ✓ The number of patients tends to be stable	**Weakness:** ✓ Publication is still lacking ✓ Limited availability of experts ✓ The bureaucracy is still long
Opportunity:	**SO strategy:**	**WO strategy:**
✓ Open good opportunities for patients	✓ Provide opportunities for general patients to get certain services and facilities that other hospitals do not have.	✓ Add to hospital socialization and promotion
✓ There are still opportunities for patients with certain diseases	✓ More improving services and adding facilities to increase the number of patients.	✓ Providing education for existing staff to become specialists
Threats:	**ST strategy:**	**WT strategy:**

IFAS	Strength:	Weakness:
✓ The location is located adjacent to another hospital	✓ Add hospital facilities that are not owned by the surrounding hospitals	✓ Carry out publications with methods and methods that are different from the surrounding hospitals
✓ Patient dissatisfaction with service	✓ Improve service by minimizing patient complaints.	✓ Repair bureaucracy to avoid patient complaints.

4. CONCLUSION

From the description and previous discussion, some conclusions can be drawn as follows:

The most influential internal factors on the strength by XYZ Hospital is an employee who has a high discipline (1.54) and for weaknesses is still a lack of experts (1.33).

The external factors of the hospital that most influence in terms of opportunities, namely still open opportunities for more patients (2.00) and

For threats are patient dissatisfaction with the service (1.71)

The results of the SWOT analysis in this study are SO strategies, first is provide opportunities for general patients to get certain services and facilities that other hospitals do not have and the second is more improving services and adding facilities to increase the number of patients.

REFERENCE

Afrillita, N. (2013). Swot Analysis In Determining Motorcycle Marketing Strategies. E-Journal Business Administration.

Prawitasari, S. Y. (2010). Swot Analysis as the Basics of Formulating Competitive Marketing Strategies (Study on Honda Dealer Tunggul Sakti in Semarang). Faculty of Economics, Diponegoro University, Semarang.

Kotler, P. Gary, A. 2008. Principles of Marketing. Erlangga. Jakarta.

Suhartini. (2012). Swot Analysis in Determining a Marketing Strategy for the Company. Industrial Engineering, University of Muhammdiyah Gresik, Volume: XII.

Winarni, Wisnubroto, P., & Suyatno. (2010). Planning For Marketing Strategy Through Swot And Bcg Methods. Industrial Engineering Department, Industrial Technology Faculty AKPRIND Yogyakarta Institute of Science & Technology.

Freddy Rangkuti, 2004, SWOT Analysis Technique for Dissecting Business Cases, PT. Gramedia, Jakarta

Richard L. Daft, 2010, New Era of Management, Edward Tanujaya, Issue 9, Bandung

Ismail Sholihin, 2006, Sugiyono's Strategic Management (2013), Statistics for Research. ALFABETA. Bandung

Riduwan, Drs. M.BA (2013), Statistics Basics, ALFABETA. Bandung

DEVELOPMENT STRATEGY OF CADETS INDONESIAN NAVAL ACADEMY HR IN FACING GMTT 2030

Risa Apriyani[1], Ahmadi [2], Umar Winarno[3]

[1,2] Indonesian Naval Technology College, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia
[3] Indonesian Naval Academy. Surabaya, Indonesia.

ABSTRACT

The implementation of the national defense strategy carried out at sea relies on infrastructure and refers to the Global Marine Trend Technology (GMTT) 2030 aspects of Naval Technology, specifically on the Integrated Fleet Weapon System (SSAT). In the military strategy the superiority of weapons and information systems supported by reliable technology is a strategic asset to win a battle. The Indonesian Navy's educational institution has a strategic role as a producer of the Indonesian Navy's human resources who are skilled in guarding increasingly modern defense equipment. The purpose of this study is to obtain alternative strategies for developing AAL HR. The approach method used is descriptive qualitative using SWOT analysis. The results showed that the development of AAL cadets' human resources can be done through human resource development through increasing practice practice in the field of IT and foreign languages, optimizing network usage, literature, supporting facilities and infrastructure, recruiting lecturers and providing opportunities for lecturers to study S2 and S3 according to qualifications and working with government institutions in an effort to strengthen the field of research and community service.

Keyword: *SWOT Analysis, Cadets AAL, HR Development, GMTT 2030*

1. Background

National Resilience is essentially the level of civilization of a nation that can not only be measured on the basis of parameters of defense and security capabilities. There are many other parameters that affect the national resilience of a nation, including citizens' understanding of the Pancasila ideology, political stability, economic growth, the level of education including comparative and competitive advantages in scientific and technological mastery. (Fanani & Bandono, 2018)

The TNI is an instrument of the state's interest to anticipate quickly and precisely in its role of maintaining the stability of national security and global development. At present the Indonesian Navy has all-powerful of the main weapon system tool which is operated and controlled digitally with military power to be an important element because technological developments have changed the entire military strategy order (Apriyani, 2019).

The implementation of the national defense strategy carried out at sea relies on infrastructure and refers to the Global Marine Trend Technology (GMTT) 2030 aspects of Naval Technology, specifically on the Integrated Fleet Weapon System consisting of: KRI, KAL, Aircraft, Combat Materials Marines and Base, where in the military strategy the superiority of weapons and information systems supported by reliable technology is a strategic asset to win a battle. Thus, the role of marine power technology influences the implementation of national defense strategies including the national defense strategy at sea.

To answer the challenges above, in an effort to optimize the implementation of the Navy's main tasks, Kasal has formulated its vision and mission that was delivered before the President and the TNI Commander within a 100-day Kasal work program. One of Kasal's priority programs in 2018 is the Naval Technology Mastership which is in line with the government's policy commitments and the

importance of synchronizing the development of the TNI's power title with national development. (Kasal, 2018).

The Indonesian Navy's educational institution has a strategic role as a producer of the Indonesian Navy's human resources who are skilled in guarding increasingly modern defense equipment. This means that the human resources within the TNI organization must be proportionately given the best education and training, even as perfect as possible. In this context, the man behind the gun is the most basic element in creating a professional army (Octavian, 2014).

The Indonesian Navy has four educational institutions and coaching institutions, one of which is the Indonesian Naval Academy (AAL). AAL is one of the Indonesian Navy's educational institutions within the Indonesian Navy's organizational structure under the guidance of a Governor of AAL. The main task of the AAL is to educate cadets for four years to be appointed as Navy officers with the rank of Second Lieutenant and entitled to hold the title of Applied Defense Bachelor (S.ST.Han).

At present AAL educates cadets consisting of level one to level four, with a total of 429 people with five Diploma IV study programs, namely: Marine Defense Management (Sailor Corps), Warship Mechanical Engineering (Engineering Corps), Warship Electronic Engineering (Electronic Corps), Logistics and Financial Management of the Marine (Supply Corps), and Land Aspect Marine Corps (Marine Corps) Management.

The current condition, Cadets SAAL is considered not able to answer the challenges of GMTT 2030 in terms of the main weapon system tool mastery capabilities so that it takes strategic decision-making and steps to be able to accompany the development of science and technology while carrying out the mission of AAL to organize educational processes consisting of effective teaching, training and care and efficient to produce graduates of the Navy who are fighting, professional, disciplined, proud, hard work and smart work and have a high physical fitness, through efforts to implement management and educational technology appropriately.

There is information that the current condition of the implementation of AAL learning is good, but there are several problems, among others, the lack of lecturers in accordance with qualifications, lack of research conducted by Cadets AAL, the teaching and learning process has not varied faced with cadets who have special characteristics in the learning process. subject matter that does not adjust to the development of science and technology.

The real step in addressing this issue is implementing the preparation of the Cadets AAL HR development strategy in response to the challenges of GMTT 2030 and the qualifications of graduates in accordance with the needs of the community (societal need) as well as the needs of graduate users (stakeholder need). Efforts to develop these strategies must be able to produce formulations and implement them so that the organization can achieve its objectives and the institution is required to better understand the needs and expectations of students as consumers. (Wiyono, Welsa, & Prayekti, 2019).

2. Methodology

2.1 Development Strategy

According to (Afridhal, 2017) the development strategy is an action that demands top management decisions in developing a business to make it happen. Development strategies also affect the life of the organization in the long run because the nature of the development strategy is oriented towards the future.

The development strategy has a formulation function and in considering internal and external

factors faced by the company. Strategy formulation includes activities to develop the vision and mission of a business, identify external opportunities and threats of the organization, determine internal organizational strengths and weaknesses, set long-term goals of the organization, make a number of alternative strategies for the organization, and choose certain strategies to use. (Wheelen & Hunger, 2010)

2.2. Human Resources (HR)

HR is part of an advance in science, development and technology. HR can be said to be of quality when it has the ability to carry out the authority and responsibility given to it. This ability can only be achieved when they have sufficient education, training and experience to carry out the tasks and responsibilities given (Merisa Fajar Aisyah, 2017).

HR management is one of the most important factors of an organization, both institutions and companies because it can determine the development of the company and improve the quality of better performance

(Blaga and Jozsef, 2014) (Vardarlıer, 2016) (Javed, Anas, Abbas, & Khan, 2017). The HR management process includes four things, namely attracting, developing, creating a point of view and maintaining (Alami and Sohaei, 2015). In essence, human resources in the form of humans are employed in an organization as a driver, thinker and planner to achieve the goals of the organization, therefore the progress or failure of a country depends on the ability of its human resources (Prihantoro, 2012).

2.3 GMTT 2030

Global Marine Trends 2030 (GMT2030) demonstrates that the shape

of the marine world in 2030 will depend on the interactions between people, economies and natural resources. Using publicly available and proprietary information, and a scenario development methodology, GMT2030 envisions three possible scenarios, namely Status Quo, Global Commons, and Competing Nations.

These three scenarios were shown to have different impacts on individual marine sectors. The commercial sector is influenced by economy, people and natural resources, while the energy sector is influenced by economy and natural resources. In the naval sector, we find that the primary driver is economic power. In all cases, the marine industry will see growth, and will play expanding and positive roles in international seaborne trade and the global economy. We have decided to focus on three scenarios separated by degrees of global political cooperation. At global and local levels, the interaction between people is at the heart of business and the economy.

2.4 AAL's vision and mission

a. Vision

The realization of the Naval Academy which is capable of producing Navy officers who are intelligently smart, physically skillfull and mentally strong.

b. Mission

1). Organizing an educational process consisting of effective and efficient teaching, training and nurturing to produce graduates of the Indonesian Navy who are fighting, professional, disciplined, proud, hard work and smart work and have high physical fitness, through the application of management and appropriate education technology.

2). Carrying out ongoing education evaluations in order to improve the quality of education towards better, innovative and useful development.

3). Develop character education based on moral values and academic ethics to build a civilized and cultured life in the military environment among the academic community.

2.5 SWOT analysis

The SWOT analysis is a relevant strategic planning method used to determine the alternative strategy for the development of the AAL cadets HR. The initial process of a SWOT analysis by evaluating strengths, weaknesses, opportunities, and threats in a project or business speculation (Rangkuti., 2012) (Cui, Allan, & Lin, 2019).

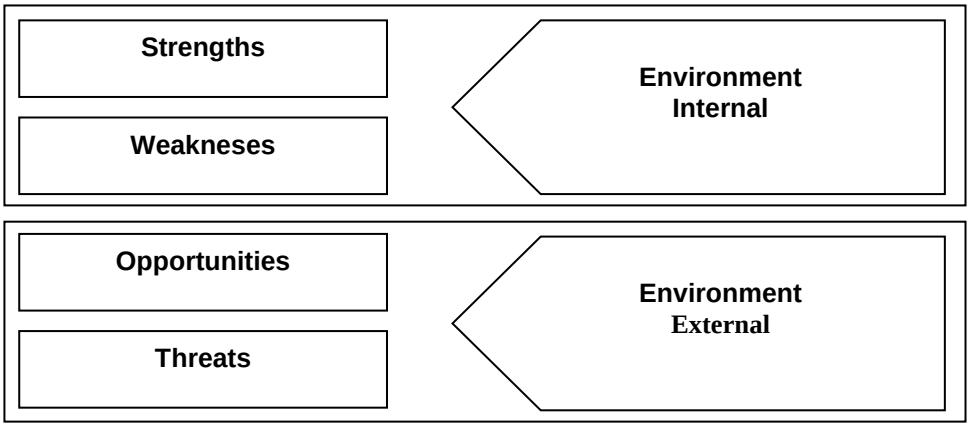


Figure 1. SWOT Concept Scheme Source: (Anggraini, 2018)

SWOT analysis can be applied by analyzing various things that affect the four factors, then applying them in the SWOT matrix. In determining the strategy, the technique used is to look for cross strategies from the four SWOT factors, namely:

a. S-O Strategy: A strategy to utilize all strengths and optimize opportunities.

b. S-T Strategy: A strategy to utilize all strengths in overcoming existing threats.

c. W-O Strategy: Strategies to utilize opportunities optimally to overcome weaknesses.

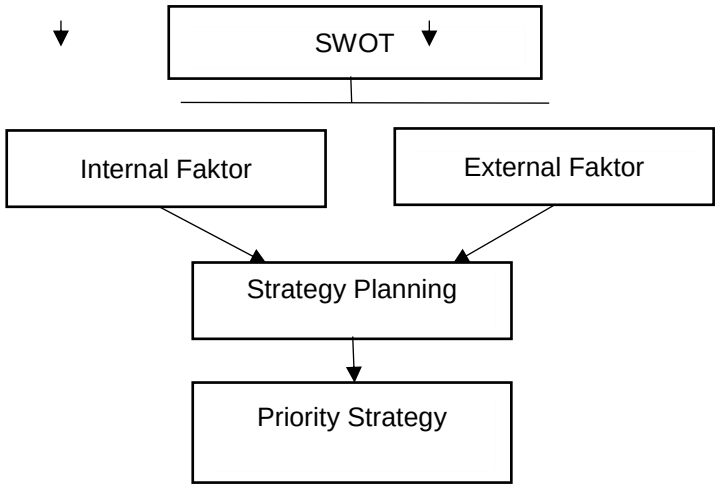
d. W-T Strategy: Strategy to overcome weaknesses and eliminate threats that arise.

	Strengths	**Weakneses**
Opportunities	strategy to utilize all strengths and optimize opportunities. **(S-O Strategy)**	Strategies to utilize opportunities optimally to overcome weaknesses **(W-O Strategy)**
Threats	strategy to utilize all strengths in overcoming existing threats **(S-T Strategy)**	Strategy to overcome weaknesses and eliminate threats that arise. **(W-T Strategy)**

Table 1. SWOT Matrix Sumber: (Anggraini, 2018)

2.6 Research Metodhology

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:



Picture 3. Research Metodhology

3. Result and Research Analysis

The development of the quality of the AAL cadets' human resources is currently aimed at obtaining the same perception in the mindset, attitude patterns and action patterns in the implementation of the Navy's education in accordance with AAL's vision and mission. The target of developing AAL Human Resources is mastering the technology of seas and maritime technology in the face of the challenges of GMTT 2030 and in accordance with the qualifications of graduates to become Sapta Marga combatant officers who have the basic technical skills in the military and the defense science potential to develop their careers during their service.

The following will describe the existing conditions and potential (strengths, weaknesses, opportunities and threats) of the quality of AAL cadets' human resources is:

Internal factor analysis	
Strengh	***Weakness***
1. Have high loyalty and multitasking skills 2. Have an appropriate education curriculum. 3. Has a structured teaching, training and parenting schedule. 4. Have a supported budget and good infrastructure.	1. Less use of the network, available learning facilities and infrastructure. 2. The number of protocol activities outside of school hours. 3. Don't have a structured HR development system. 4. Lack of carrying out scientific research, innovation, community service and international journal publications.

Table 2. Internal Factor Analysis

External factor analysis	
Opportynities	***Threat***
1. Improving the quality of human resources that follows the development of science and technology. 2. The recruitment of Cadetshas a higher standardization. 3. There is a great opportunity to carry out a comparative study. 4. The success of graduates in careers.	1. Low legal awareness. 2. High stress levels due to environmental influences and many activities. 3. Technological developments that are faster if not anticipated will lag behind. 4. Assessment of accreditation falls if graduates of AAL cadets do not meet the qualifications.

Table 3. External Factor Analysis

Based on the analysis above, the main strategies that must be implemented to develop the quality of the AAL cadets human resources are as follows:

IFAS **EFAS**	**STRENGHT (S)**	**WEAKNESS (W)**
	1. Have high loyalty and multitasking skills 2. Have an appropriate education curriculum. 3. Has a structured teaching, training and parenting schedule. 4. Have a supported budget and good infrastructure.	1. Less use of literature, networks, available learning facilities and infrastructure. 2. The number of protocol activities outside of school hours. 3. Lack of lecturers that are in accordance with the qualifications. 4. Lack of carrying out scientific research, innovation, community service and international journal publications.
OPORTUNITY (O)	**STRATEGI (SO)**	**STRATEGI WO**
1. Improving the quality of human resources that follows the development of science and technology. 2. The recruitment of Cadetshas a higher standardization. 3. There is a great opportunity to carry out a comparative study. 4. The success of graduates in careers.	1. Carry out self-development through education in accordance with the corps and their expertise. (S-1, S-2, O-1, O-4) 2. Improving the system of supervision and control of controlled education. (S-3, S-5, O-1, O-2) 3. Improve the system of care and learning in a more structured class. (S-3, O-3, O-4) 4. Carry out comparative studies at other universities both domestically and abroad (S-4, O-1)	1. Optimizing literature, use of networks, supporting facilities and infrastructure. (W-1, O-1) 2. Recruit lecturers and provide opportunities for lecturers to study S2 and S3 according to qualifications. (W-3, O-1) 3. Increase scientific research, innovation, community service and international journal publications while promoting AAL in the international world. (W-2, W-4, O-1, O-2, O-4) 4. Develop cooperation / MOU with parties outside the IT field (W-5, O-1, O-3, O-4, O-5)

THREAT (T)	STRATEGI ST	STRATEGI WT
1. Low legal awareness. 2. High stress levels due to environmental influences and many activities. 3. Technological developments that are faster if not anticipated will lag behind. 4. Assessment of accreditation falls if graduates of AAL cadets do not meet the qualifications.	1. Increasing counseling activities to cadets about law and disciplinary violations. (S-1, S-3, T-1, T-2) 2. Optimizing urikes, physical fitness test, public lectures, counseling, recreation and sports together so as to reduce stress levels in the face of lectures. (S-2, S-3, S-4, T-2) 3. Improving practice in the field of foreign and IT fields (S-4, T-4)	1. Having a breakthrough for designing community service programs that are right on target. (W-1, W-2, W-3, W-4, T-3, T-4) 2. Improving the welfare of lecturers, especially lecturers, in their teaching motivation. (W-1, W-2, T-4) 3. Working closely with government institutions in an effort to strengthen the research field. (W-4, T-4) 4. Knowing the interests of talent and skills of cadets so that the placement of graduates according to their expertise. (W-3, T-4)

Table 4. Cadets AAL Human Resources Development SWOT Matrix

With the results above, four strategies were obtained, namely SO, WO, ST and WT. The following are alternative strategic priorities that can be used to answer the challenges of GMTT 2030 where AAL must be prepared to educate cadets who master the technology of ocean and maritime departure:

a. Improve the practice of IT and foreign language practice.

b. Optimizing literature, use of networks, supporting facilities and infrastructure.

c. Recruit lecturers and provide opportunities for lecturers to study S2 and S3 according to qualifications.

d. Working closely with government institutions in an effort to strengthen the field of research and community service.

4. Conclusion

Based on the SWOT analysis for the development of AAL cadets that have been carried out, it can be concluded that AAL's strategic objectives as a reference indicator of achieving strategic plans are prepared based on Vision, Mission, AAL Objectives and the challenges of GMTT 2030 by considering the condition of resources, facilities and infrastructure and existing infrastructure at AAL. The goal of the AAL strategy is to be a tool used to develop strategic factors that are based on strengths, weaknesses, opportunities and threats.

For further research, it is expected that weighting on each factor, adding respondents to be more varied and further developed to determine the priority weighting interval model of the criteria derived and increased so as to cause changes in the order of priority strategies

REFERENCES

Afridhal, M. (2017). Tanjong Bread Development Strategy in Samalanga District, Bireuen District. *Jurnal S. Pertanian 1 (3)*, 223–233.

Alami, R., & Sohaei, R. (2015). The Effectiveness of Human Resource Management on Improving the Performance of Education Staff. *International Journal of Business and Social Science, Vol 6 No 5*, 251-254.

Anggraini, D. C. (2018). *Development of Woman Navy Guidance Instrument to Improve Performance in Supporting the Main Task of the Navy.* Surabaya: STTAL.

Apriyani, R. (2019). Innovation In The Development Of STTAL Human Resources To Face The

4.0 Industrial Revolution. *International Journal Of Asro - STTAL [S.l.], v. 10, n. 1*, 45-53.

Blaga, P., & Jozsef, B. (2014). Human Resources, Quality Circles and Innovation. *Procedia Economics and Finance 15* , 1458 – 1462.

Cui, J., Allan, A., & Lin, D. (2019). SWOT Analysis and Development Strategies for Underground Pedestrian Systems. *Tunnelling and Underground Space Technology 87*, 127-133.

Fanani, Z., & Bandono, A. (2018). *National Defence, Regional and Global.* Malang: Muhammadiyah University Malang.

Javed, A., Anas, M., Abbas, M., & Khan, A. I. (2017). Flexible Human Resource Management And Firm Innovativeness: The Mediating Role Of Innovative Work Behavior. *Journal of Human Resource Management, vol. XX , no . 1*, 31-41.

Kasal. (2018). *Plan of Activities 100 Days Work Program for Navy Chief of Staff Field Priority Program 12.* Jakarta: Mabesal.

Merisa Fajar Aisyah, W. U. (2017). Quality of Human Resources, Work Professionalism, and Commitment as Supporting Factors for Increasing Employee Performance of PDAM Jember Districk. *e-Journal of Business Economics and Accounting, Volume IV (1)*, 131-135.

Octavian, A. (2014). Globalization and Transformation of Military Education Institutions in the Indonesian Navy Staff and Command School (SESKOAL). *Community Social Journal Vol. 19, No. 2*, 167-194.

Prihantoro, A. (2012). Improving the Performance of Human Resources through Motivation, Discipline, Work Environment and Commitment. *Value Added, Vol. 8, No. 2, Maret 2012–Agustus 2012*, 78-98.

Rangkuti., F. (2012). *SWOT Balanced Scorecard.* Jakarta: PT Gramedia.

Vardarlıer, P. (2016). Strategic approach To Human Resources Management During Crisis. *Procedia - Social and Behavioral Sciences 235* , 463 – 472.

Wheelen, T. L., & Hunger, J. D. (2010). *Essentials Of Strategic Management 5th Edition.* United States Of America: Prentice Hall.

Wiyono, G., Welsa, H., & Prayekti. (2019). Swot and Analytic Hierarchy Process as a Reference Strategy for Student Body Optimization. *Jurnal Riset Bisnis dan Manajemen Vol. 12, No. 1*, 1-8.

.

STRATEGY FOR DEVELOPMENT OF CIVIL SERVANTS COMPETENCIES NAVAL ACADEMY FOR REACHING *SMART ASN* 2024

Sri Nurhayati, Bambang Ispri B, Ahmadi

Indonesian Naval Technology College, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia

ABSTRACT

Development of human resources is the basic capital that must be developed and directed in order to achieve the expected goals. The development of competencies of Civil Servants is expected to achieve Smart ASN 2024. In this study the development strategy of the competence of Civil Servants uses SWOT analysis, which analyzes the conditions of strengths, weaknesses, opportunities, and threats. Based on the results of the study based on the SWOT analysis, several strategies were found that could help stakeholders in making decisions for strategic planning. Strategies obtained for the development of competencies of Civil Servants can be carried out several strategies, namely Attend education / courses that support career development, provide socialization and training / courses on IT and foreign languages in order to broaden the knowledge of civil servants in supporting career advancement. Recruit Civil Servants and placement of personnel according to organizational needs and educational qualifications, Carry out job analysis.

Keyword: *Civil Servants, SWOT, Competence*

1. Introduction

In national development, human resources are the basic capital that must be developed and directed so that they can achieve the expected goals, namely a clean and authoritative system of government and creating good, efficient, and effective public services. For this reason, we need Human Resources (HR) apparatus, especially Civil Servants who are professional, responsible, fair, honest and competent in their fields.

In the era of the Industrial Revolution 4.0 Civil Servants are expected to be able to compete with other countries. The government has designed the *Smart ASN* program map which is targeted to be realized in 2024. One of them is the *Smart ASN* program which is to increase professionalism with increasing competence, qualifications and performance. The competencies that must be possessed by *Civil Servants* in the *Smart ASN* program include mastering IT, foreign languages, Hospitality, Networking, and entrepreneurship. Civil Servants are not required to stutter technology and information that is able to operate and utilize IT product applications including being able to wisely use the internet that is used in increasing effectiveness and efficiency to improve performance in order to improve the quality of tasks and functions in service and community service. Furthermore, civil servants are required to master foreign languages such as English, Mandarin and so on. The nature of hospitality or hospitality must be possessed by civil servants in carrying out their duties. Networking ability is to build relationships with other people or organizations that have a positive effect on professional success. Civil servants are required to have entrepreneurial abilities, namely entrepreneurial spirit which is characterized by having courage, creativity, innovation, never giving up, and being smart in capturing and creating opportunities and being responsible. Entrepreneurship ability will be able to improve performance in every time.

On the Regulation of the Commander of the Indonesian Armed Forces Number Perpang / 161 / XII / 2011 (Panglima, 2011) the scope of guidance for Civil Servants Personnel includes provisions on

procurement, education and training, use, care and separation of Civil Servants. In HR apparatus management Civil Servants are required to have professionalism and global insight and have high competence. Based on the data we obtained from Personnel of the Naval Academy can be seen in the table below:

Table 1. Recapitulation of the number of navy civil servants

No.	Rank	Amount
1.	Group IV	15
2.	Group III	70
3.	Group II	134
4.	Group I	3

Current conditions Civil servants of the Naval Academy have a diverse educational background. Based on data Personnel of the Naval Academy educated Master as much as 6 people, Bachelor as much as 42 people, Diploma as much as 6 people, Senior High School as much as 128, Junior High School as much as 34 people and Primary School as much as 6 people. The motivation of civil servants to participate in training/courses is still low, causing competence that has low civil servants. By enhancing the competency ability of Civil servants of the Naval Academy strongly supports the main task of Indonesian Navy and reach *Smart ASN* 2024.

2. METODHOLOGY

2.1 Civil Servants

In Law No. 5 of 2014 concerning civil apparatus of the state. The civil servant is a qualified citizen of the Republic of Indonesia who has been qualified, appointed by an authorized officer and assigned a duty in a state office, or in the other country's duties and paid in accordance Applicable legislation. Civil Servant of the Naval Academy is a civil servant of the Ministry of Defense which is assigned to the unit of naval academy organization is a partner (complement) that is parallel to the other navy.

2.2 Competence

In-weld competencies are the underlying characteristics of behavior that depict motifs, personal characteristics (characteristic), self-concept, values, knowledge or expertise that a person brings superior performers. According to the opinion (Suprapto, 2002). The competence of civil servants is the ability and characteristics owned by a civil servant in the form of knowledge, skills and attitudes that are necessary in the execution of his duties In a number of competency literature is often distinguished into two, namely soft competency and hard competency. The first soft competency is a type of competence that is closely related to the ability to manage job processes, relationships between people and build interactions with others. Examples of soft competency are leadership, communication, interpersonal relation, etc. This type of competency is both hard competency which is a type of competence related to the functional or technical ability of a job. Examples of hard competency are electrical engineering, marketing research, financial analysis, manpower planning, and so on. Competencies relating to capacity or potential about performance in certain situations. (Rachael Vernona, 2019). Validation and standardization of competence must be an ongoing commitment. (Tom O'Connor, 2017). Research on (Øyvind Lund Martinsen, 2019) shows if competence increases then performance increases. (Kathleen Markeya, 2019) undergraduate nurse education needs to seize the opportunity to implement value-based learning in curriculum design and utilize innovative learning and teaching approaches that ensure cultural competence is developed more Explicit.

2.3 SWOT Analysis

SWOT analysis, a tool commonly used for strategic planning, is traditionally a form of brainstorming (Boonyarat Phadermroda, 2019). SWOT is a strategic planning method used to evaluate the strengths, weaknesses (weaknesses), opportunities (opportunities), and threats (threats) in a project or a business speculation. These four factors form the acronym SWOT (Strengths, weaknesses, opportunities, and threats). (Friesner, 2010). In (Miguel Romero-Gutierrez, 2016) uses a SWOT to analyze students ' perception of environmental education combined. A master program to determine if it runs according to its original plan. (Maratovnam, 2014) determines what external and internal factors affect the implementation of the policy of using SWOT. The SWOT matrix (Freddy Rangkuti, 2006) can describe clearly how the opportunities and external threats The company faces can be adapted to the strengths and weaknesses it possesses.

Table 2. SWOT matrix

IFAS **EFAS**	**STRENGTH**	**WEAKNESS**
OPPORTUNITY	Create strategies that use to build opportunities	Strategies that minimize weaknesses to capitalize on opportunities
THREATS	Create strategies that use the power to overcome threats	To create strategies that minimize weaknesses and avoid threats

2.4 *Smart ASN*

The Government through bureaucratic reform Kemenpan formulates about the Civil Servants criteria that *SMART ASN* with the qualification as the first Civil Servants mastered IT (Information Technology) i.e. Civil Servants are not stuttering technology and information. Civil Servants can operate and utilize the applications of IT products including can wisely utilize the Internet used in improving the effectiveness and efficiency to improve performance in order to improve the quality of tasks and Service and devotion to the community. Both Civil Servants possesses a foreign language. The third Civil Servants has the nature and attitude of Hospitality (hospitality) is to have a kind and attractive nature, sweet speech and demeanor in every run of task and work execution activities. The four Civil Servants has Networking capabilities, i.e. Establishing relationships with other people or organizations that have a positive influence on professional success. And the fifth Civil Servants is required to have the ability of entrepreneurship that is entrepreneurial spirit characterized by its own courage, creativity, innovative, unyielding, and intelligent in capturing and creating opportunities and responsibilities. If Civil Servants has an enterpeneurship capability, it will be able to improve performance in every time.

2.5 Research Metodhology

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:

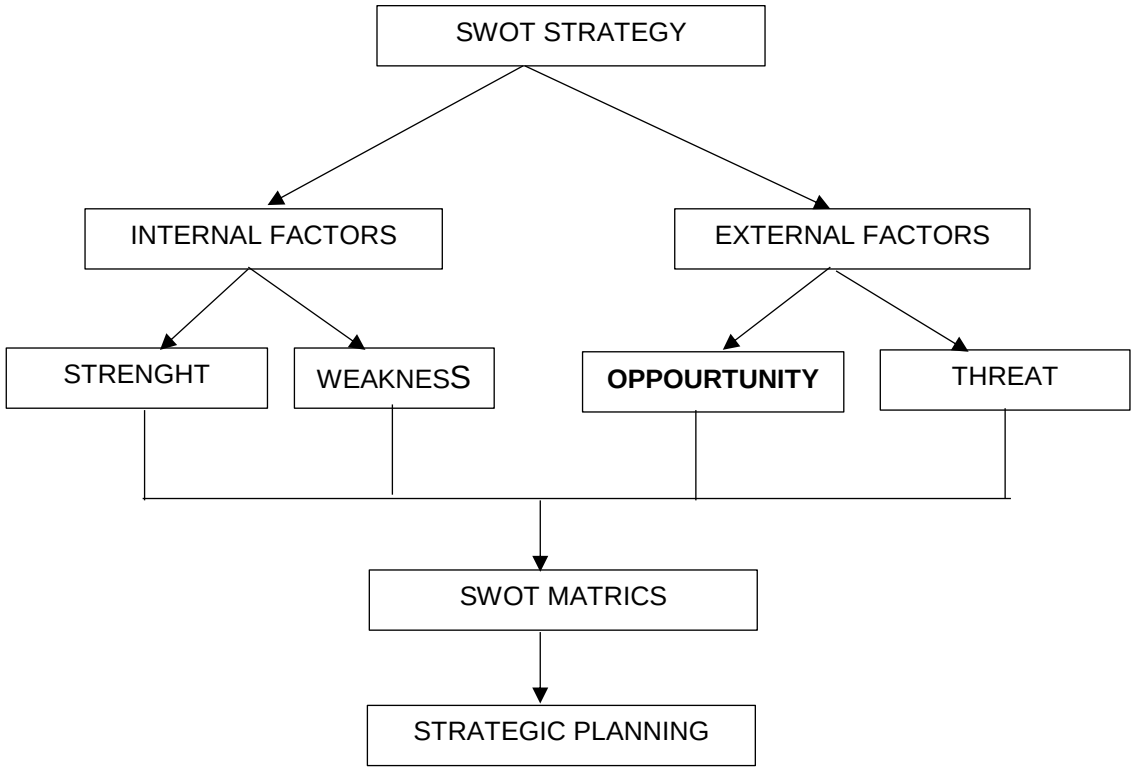


Figure 1: Research Metodhology

3. RESULT AND RESEARCH ANALYSIS

Based on the above analysis, it can be obtained strategy that must be done to develop the competence of civil servants as follows:

Table 3. strategy for development of civil servants competencies
SWOT Matrix

IFAS	***STRENGHT (S)***	***WEAKNESS (W)***
EFAS	1. Loyalty and potential/skills (mul king skill) 2. Availability of a clear task description of each function;	1. Lack of interest to participate in training/courses. 2. Number of personnel less than DSP arrangement. 3. Not mastered IT and foreign languages,
Opportunity (O)	**STRATEGI (SO)**	**STRATEGI WO**
1. Improved career of PNS 2. There are many training courses in the TNI and Kemhan. 3. High competence CPNS recruitment. 4. Personnel policy that requires training as part of the staff's coaching system;	1. Attend education / courses that support career development. 2. Preparation of position competency standards and implementation of competency tests in order to improve employee structuring. 3. Increasing the performance and performance of civil servants.	1. Provide socialization and training / courses on IT and foreign languages in order to broaden the knowledge of civil servants in supporting career advancement. 2. Recruit Civil Servants and placement of personnel according to organizational needs and educational qualifications.

Threat (T)	**STRATEGI ST**	**STRATEGI WT**
1. Violations of discipline. 2. Career development is not optimal.	1. Conduct personnel training to reduce discipline violations. 2. Dissemination of legislation in the field of staffing;	1. Carry out job analysis 2. Dissemination of legislation in the field of staffing;

Based on data on the strengths, weaknesses, opportunities and threats that have been gained after developing a strategic approach as the following power-opportunities use existing strengths to create opportunities, threat-strength uses Existing strengths to avoid and eliminate existing threats, weaknesses-opportunities eliminate existing weaknesses to create opportunities, weaknesses-threats eliminate weaknesses to avoid threats. Strategic Approach as table 3.2 below

Table 3.2 Strategic Approach

	S	**W**
O	**Strategy S-O**	**Strategy W-O**
	1. Attend education / courses that support career development. 2. Preparation of position competency standards and implementation of competency tests in order to improve employee structuring. 3. Increasing the performance and performance of civil servants.	1. Provide socialization and training / courses on IT and foreign languages in order to broaden the knowledge of civil servants in supporting career advancement. 2. Recruit civil servants and placement of personnel according to organizational needs and educational qualifications.
T	**Strategy S-T**	**Strategy W-T**
	1. Conduct personnel training to reduce discipline violations.	1. Carry out job analysis 2. Dissemination of legislation in the field of staffing;

Approach SWOT strategy consists of 4 categories, consisting of a strategy I (Strength-Opportunity) has 2 strategies, strategy II (Weakness-Opportunity) has 2 strategies, III strategy (Strength-Threat) has 1 strategic, IV strategy (Weakness-Threat) has 2 strategies. The strategic approach corresponds to the 3.3 tables.

Table 4 symbols and strategies

No.	**Strategy**	**Symbol**
1.	Attend education / courses that support career development.	SO1
2.	Preparation of position competency standards and implementation of competency tests in order to improve employee structuring.	SO2
3.	Increasing the performance and performance of civil servants.	SO3
4.	Provide socialization and training / courses on IT and foreign languages in order to broaden the knowledge of civil servants in supporting career advancement.	WO1
5.	Recruit Civil Servants and placement of personnel according to organizational needs and educational qualifications.	WO2

No.	Strategy	Symbol
6.	Conduct personnel training to reduce discipline violations.	ST1
7.	Carry out job analysis	WT1
8.	Dissemination of legislation in the field of staffing;	WT2

Based on the SWOT analysis, the total strategy that has been formulated is eight sub-strategies that determine the potential development strategy to become a competent civil servant. Based on SWOT analysis, the priority strategy for developing civil servants are:

a. Attend education / courses that support career development.

b. Provide socialization and training / courses on IT and foreign languages in order to broaden the knowledge of civil servants in supporting career advancement.

c. . Recruit Civil Servants and placement of personnel according to organizational needs and educational qualifications

d. . Carry out job analysis

4. CONCLUSIONS

Based on the SWOT analysis for the development of Civil Servant of the Naval Academy competence that has been done, it can be concluded that the development of the competency of Civil Servant of the Naval Academy to achieve competency according to Smart ASN program can be done several strategies based on objectives Expected in accordance with the existing regulations. The competency development strategy of Civil Servant of the Naval Academy is obtained based on SWOT analysis based on strengths, weaknesses, opportunities and threats.

REFFERENCE

Boonyarat Phadermroda, R. M. (2019). Importance-Performance Analysis based SWOT analysis. *International Journal of Information Management*, 194-203.

Freddy Rangkuti. (2006). *SWOT Analysis Tenics Splitting business case.* Jakarta: PT. Gramedia Pustaka Utama.

Friesner, T. (2010, Januari 21). *https://id.wikipedia.org/wiki/Analisis_SWOT*. Diambil kembali dari https://id.wikipedia.org/wiki/Analisis_SWOT.

Kathleen Markeya, C. O. (2019). Nurturing cultural competence in nurse education through a values-based. *Nurse Education in Practice*, 153-156.

Maratovnam, A. D. (2014). Impact Factors Of Education Policy In Kazakhstan: SWOT-Analysis. *Procedia - Social and Behavioral Sciences* , 414 – 416.

Miguel Romero-Gutierrez, M. R.-L.-C. (2016). SWOT analysis to evaluate the programme of a joint online/onsite master's degree in environmental education through the students' perceptions. *Evaluation and Program Planning*, 41–49.

Øyvind Lund Martinsen, A. F. (2019). Cognitive style and competence motivation in creative problem solving. *Personality and Individual Differences*, 241–246.

Panglima. (2011). *Guidelines on organizing the state of national Development in Indonesian Army.* Jakarta: Mabes TNI.

Rachael Vernona, M. C. (2019). Assuring competence or ensuring performance. *Collegian*, 399-406.

Rangkuti., F. (2012). *SWOT Balanced Scorecard.* Jakarta: PT Gramedia.

Suprapto. (2002). *Standardization competency of civil servant to the Era of globalization.* Jakarta.: LAN,.

Tom O'Connor, U. A. (2017). The use of a Competence Fair to validate nursing competence. *Nurse Education Today* , 1-7.

FORMULATION OF THE DEVELOPMENT STRATEGY OF AN ORGANIZATION USING A SWOT ANALYSIS

Arys Susanto, I Nengah Putra A, Sutikno Wahyu Hidayat

Indonesian Naval Technology College, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia

ABSTRACT

Today global competition is increasing. This requires an organization to be able to compete by always paying attention to the user's condition. Development strategy is one way to find out competitiveness in each of its power lines. To deal with user competition, especially in the face of global users, an organization must be able to establish a method as the basic foundation for the formulation of development strategies by increasing the value of competitiveness for its output or services. This strategy needs to be involved using the SWOT method as the main method to increase output, internal and external factors become the initial steps to carry out strategies to optimize business to achieve success. The use of an effective SWOT analysis can play an important role in determining the development strategy, in order to know the strengths, weaknesses, opportunities and threats faced by the company in maintaining the survival and continuity of the organization. The problem that the answer in this research is looking for is 'whether the SWOT analysis is the right strategy to increase output in the organization and how the development strategy applied by the organization in overcoming global friendships'. In connection with these problems the following hypothesis is proposed: 'It is suspected that using a SWOT analysis can increase output so that the organization experiences a profit (surplus)'. This study uses primary data by providing questionnaires and secondary data to obtain archives or documents. In line with the problem and the research hypothesis, this study was conducted using the IFAS analysis method to analyze internal factors, EFAS analysis for external factors, then, included in the quantitative model, namely the SWOT matrix. The results of the analysis show that, using IFAS and EFAS analysis and using SWOT analysis shows the position of the organization in cell 2, the strategy chosen to support the achievement of the objectives of the organization is 'ST - strategy'.

Keywords: *SWOT analysis, development strategy*

1. INTRODUCTION

Today, countries in the world seem to be without any boundaries and time and space limits, which are predicted to change the user's orientation. If previously the developing user orientation is an organization that can freely impose its will on the user with output outputs, which sometimes are not in accordance with the wishes of the user, then what happens now is the opposite. The orientation shift is that entrepreneurs have fully realized that in today's global world, users are the holders of control over output and there are users, the user determines the type and form of output as what the diuser can or does, thus an organization as if " forced "to follow and produce output in accordance with the values and desires of the user if they still want to survive survive (Rangkuti, 2004). According to one source, it is estimated that the number of organizations reaches more than 12,000 organizations throughout the country. As a result, business competition is getting tougher. To address this, various efforts are needed.

The best step to maintain and or expand the user is to keep up with the latest technological developments. However, this step must be followed by educating users through offering comprehensive solutions.So, the function of the SWOT analysis and development strategy is to analyze the strengths, weaknesses and development advantages possessed by the organization / business carried out through an analysis of the internal conditions of the organization, as well as an analysis of the

opportunities and threats faced by the organization through analysis of the external conditions.

A developing organization is an organization that is demanded to be able to adjust user needs in a large scale. One of the efforts made by an organization is to increase efficiency and output in order to stay in competition with the user or even increase profitability. In situations of competition and challenges due to the constantly changing situation today, increasing efficiency and output is certainly desired by every organization. Increased efficiency and output are expected to increase profit margins significantly. Factors of strength, weakness, opportunity and threat are dynamic factors in SWOT (Strength, Weakness, Opportunity, and Threat) that can describe the ability of an organization to optimize and allocate using its resources and the situation faced in an effort to achieve a goal . Based on the above background, the authors are interested in taking the research title "Swot analysis to formulate a development strategy for an organization".

In the writing of this proceeding is also used a lot of literature as a reference to support the research conducted, such as including the following : Analisis SWOT Terhadap Penetapan Strategi Pemasaran Pada PT. Hadji Kalla (Toyota) Cabang Urip di Makasar (**Unsupported source type (Report) for source Erl13.**), Analisis Strategi Pemasaran Pada PT. Nusantara Jaya Makmur Makasar (**Unsupported source type (Report) for source Mai12.**), Strategi pemasaran dengan pendekatan analisis swot pada PT. Super sukses motor banjarmasin (Nuary, 2016), Implementasi Analisis Swot Dalam Strategi Pemasaran Produk Mandiri Tabungan Bisnis (Tamara, 2016), Analisis SWOT Teknik Membedah Kasus Bisnis (Rangkuti, 2008), Analisis SWOT Terhadap Strategi Pemasaran Layanan SAP Express pada PT. SAP (Reca Elyarni, 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.

2.1. SWOT analysis

SWOT analysis (SWOT analysis) which includes efforts to recognize strengths, weaknesses,

2. MATERIAL/METHODOLOGY.

Before it was stated about the determination of the development strategy, first an understanding of the strategy would be put forward. Strategy is a tool to achieve goals (Rangkuti, 2004). Whereas the other notions of strategy are incremental actions (always increasing) and continuously and carried out based on the point of view of what is expected by future customers (Rangkuti, 2009), strategy (strategy) explicitly, namely the action plan that explains about allocation of resources and various activities to deal with the environment, obtain competitive advantage, and achieve organizational goals (Daft, 2010) defines competitive advantage is the thing that distinguishes an organization from other companies and gives a characteristic to the organization to meet user needs the user. The core strategy formulation is determining how our organization will be different from other organizations.

The strategy of course changes over time according to environmental conditions, but in order to continue to develop (Daft, 2010), make a corporate strategy that focuses on:

a. Utilization of basic competencies,
b. Develop synergy
c. Creating Value for Customers

opportunities, and threats that determine organizational performance. External information about opportunities and threats can be obtained from many sources, including customers,

government documents, suppliers, banks, other organized partners. Many organizations use the services of an institution to obtain newspaper multiples, research on the internet, and analysis of relevant domestic and global trends (Daft, 2010). Furthermore (Rangkuti, 2009) explains that SWOT Analysis is a systematic identification of various factors to formulate organizational strategy. This analysis is based on logic that can maximize strengths and opportunities, but simultaneously can minimize weaknesses and threats. The strategy decision making process is always related to the development of the organization's mission, goals, strategies and policies. Thus, strategic planning must analyze the factors of the organization's strategy (strengths, weaknesses, opportunities and threats) in the current conditions.

SWOT analysis compares the factors of external opportunities (opportunities) and threats (threats) with internal factors strengths (strenght) and weaknesses (weakness). SWOT elements consist of: Strength (Strength), Weakness (weakness), Opportunity (Opportunity), Threats (Threats), External and internal factors (Anggrianto.M, 2013) to analyze more deeply about SWOT, it is necessary to look at the factors external and internal as an important part of the SWOT analysis, namely:

a. External factors

This external factor influences the formation of opportunities and threats (O and T). Where this factor concerns the conditions that occur outside the organization that influence organizational decision making. This factor covers the industrial and macro environment, economy, politics, law, technology, population, and socio-cultural environment.

b. Internal factors

This internal factor affects the formation of strenghts and weaknesses (S and W). Where this factor concerns the conditions that occur in the organization, which this also influences the formation of organizational decision making. These internal factors cover all kinds of functional management: marketing, finance, operations, human resources, research and development, management information systems and organizational culture.

2.2. SWOT Analysis Model SWOT analysis compares between external opportunities and threats with internal factors of strengths and weaknesses. Internal factors are included in the matrix called the internal strategy factor matrix or IFAS (Internal Strategic Factor Analysis Summary). External factors are included in the matrix called the EFAS external strategy factor matrix (External Strategic Factor Analysis Summary).

After the internal and external strategy factor matrix was completed, the results were included in the quantitative model, namely the SWOT matrix to formulate an organizational development strategy.

Tabel 1. External Strategy Factor Matrix (EFAS)

Eksternal strategy factor	Weight	Rating	Weight X rating	Information
Opportunity	X	X	X	
Total	X	X	X	
Threat	X	X	X	
Total	X	X	X	
Total	X	X	X	

Source : (Rangkuti, 2004)

Tabel 2. Internal Strategy Factor Matrix (IFAS)

Internal strategy factor	Weight	Rating	Weight X Rating	Information
Power	X	X	X	
Total	X	X	X	
Weakness	X	X	X	
Total	X	X	X	
Total	X	X	X	

Source : (Rangkuti, 2004)

SWOT Matrix

The tool used to compile the strategic factors of the organization is the SWOT matrix. This matrix can clearly describe how the external opportunities and threats faced by the organization can be adjusted to the strengths and weaknesses it has. This matrix can produce 4 sets of possible strategic alternatives (Nugrohojati, 2013).

Table 3. diagram Swot matric II. 4

IFAS EFAS	STRENGHT (S) Determine 5-10 factors of internal strength	WEAKNESS (W) Determine 5-10 internal weaknesses
OPPORTUNITIES (O) Determine 5-10 external threat factor	STRATEGY SO Create a strategy that use the power to take advantage of opportunities	STRATEGY WO Create strategies that minimize weaknesses to take advantage of opportunities
THREATS (T) Determine 5-10 external threat factors	STRATEGY ST Create a strategy who uses it the power to Overcome threats	STRATEGY WT Create strategies that minimize weaknesses and avoid threats

a. Strategies (Strength-Opportunities) This strategy is based on the mindset of the organization, namely by utilizing all the power to seize and take advantage of the greatest opportunities

b. ST Strategy (Strenghts-Threats) It is a strategy to use the strength of the organization to overcome threats.

c. WO (Weknesses-Opportunities) Strategy This strategy is implemented based on utilization opportunities that exist in a way minimize existing weaknesses.

d. WT Strategy (Weknesses-Threats) This strategy is based on defensive activities and seeks to minimize existing weaknesses and avoid threats.

2.3. Development Strategy

In his book (Rangkuti, 2009). The success of a predetermined strategy is largely determined by how much the level of suitability of the strategy is with changes in the environment, competitors, and organizational situation factors in formulating a strategy:

In Conditions of Strong Competition Position Strengthens the Power of Development.

a. Type of Development Strategy

To find out its competitiveness in every power, Porter advises organizations to use one of three strategies: differentiation, cost leadership, or focus. Organizational characteristics that can be associated with each strategy.

1) Differentiation Strategy

2) new competitors through customer loyalty that are difficult to overcome.

3) Focus Strategy Leadership Strategy

b. Formulating a Development Strategy

An effective way to formulate a strategy is the five strengths and development strategies (Widiastini, 2012) researching a number of organizations and stating that business-level strategies are the result of five developmental strengths within the organization.

Five Porter Development strengths. The development forces that exist within the organization

and show the influence of internet technology on each power.

These forces help determine the position of the organization versus its competitors in the industrial world.

1) New potential competitors.
2) Bargaining power of buyers
3) The bargaining power of suppliers
4) Threat of replacement output
5) Inter-competitor competitors

2.4. Research methods

In this study the authors used a type of qualitative research with a descriptive approach that is a study that aims to make a systematic, factual and accurate enunciation of the facts and characteristics of the object of research (Suhartini, 2012). Descriptive statistics are statistics that function to describe or give an overview of the object under study through sample data or population as it is, without doing analysis and making conclusions that apply to the public (Sugiyono, 2011). Bogdan and Biklen in (Supranto, 2011) propose five characteristics of a qualitative study, namely:

a. Qualitative research is carried out on a natural setting as a direct data source and research is a key instrument
b. It is descriptive in that it describes a particular situation or data collected in the form of words rather than numbers
c. Pay more attention to the process than the results or output alone
d. In analyzing data tends to be inductive
e. Meaning is essential for qualitative research

Sample research is part of kariyawan An organization of several existing employees, researchers took 10 employees who have the potential to provide accurate data or information. The reference for filling out this questionnaire is as follows:

Current conditions of research: assessment of handling urgency:

a. Very good with scores: 4
b. Good with a score: 3
c. Enough with a score: 2
d. Less with a score: 1
e. Number 1: not ugren
f. Number 2: lack of ugren
g. Number 3: ugren
h. Number 4: very ugly

To obtain accurate data that can be trusted by the truth and relevant problems examined, the data collection is done by several methods: Interview, Observation, Questionnaire (Questionnaire), Literature study. Operational variables are everything in the form of what is determined by the researcher to be studied so that information about it is obtained, then conclusions are drawn (Sugiyono, 2011). The variables in this study are independent variables (free) and dependent variables (bound).

Free variable (independent variable) or variable X (Sugiyono, 2011) is often also called a stimulus variable, predictor, antecedent. the independent variable is a variable that affects or which is the cause of the change or the emergence of the dependent variable. In this study independent variables are the four constituent elements of SWOT, which include:

a. Strengths as X1
b. Weaknesses, as X2
c. Opportunities as X3
d. Threaths as X4

Dependent variable (dependent variable) or variable Y) is often also called the output variable, criteria, consequently. Dependent variable is a variable that is influenced or that becomes a result, because of the existence of independent variables. Which is the dependent variable (independent variable) in this research is a development strategy.

2.5. Data analysis method

The analysis in this study is to use SWOT analysis, where this method shows the performance of the organization by determining a combination of internal and external factors'. SWOT analysis compares internal factors, namely strength (weakness), and weakness (weakness). With external factors, namely opportunities and threats. Internal factors are included in the matrix called IFAS factor matrix (Internal Strategic Factor Analysis Summary). External factors are included in the matrix called the external factor matrix or EFAS (External Strategic Factor Analysis Summary).

After the internal and external strategy factor matrix was completed, the results were entered into a qualitative model, namely the SWOT matrix to formulate an organizational development strategy. The internal strategy (IFAS) and external matrix (EFAS) matrix.

2.6. Research Methodology Flowchart.

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:

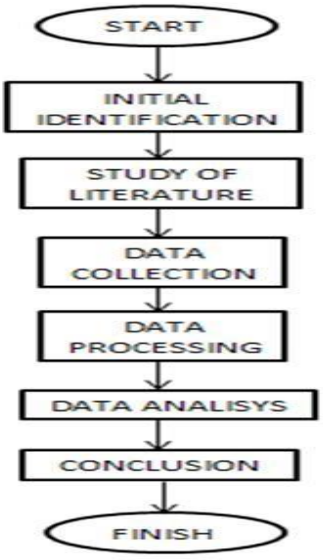


Fig. 2.1. Research Methodology Flowchart.

Target: the purpose of this study is to formulate an organizational development strategy in order to develop and compete in the midst of global flows so that users can obtain optimal results. The stages can be explained as follows:

a. Defining the problem

Before a decision support system is built, problems in research must be precisely defined so that the results obtained are in accordance with the problem at hand.

b. Data collection.

Data collection was obtained by conducting a literature study of the SWOT method used in research to determine the influence of internal and external influences obtained from several literatures such as journals, books and other scientific sources that are related and relevant to research.

c. Identification and processing of data at this stage of identification and processing of data that has been obtained will be carried out.

d. System Analysis and Design Perform analysis and system design in accordance with identified problems.

e. System Implementation.

At this stage, the system will be implemented in accordance with the concept prepared in the previous stage. The final step provides suggestions for improvement and conclusions.

3. RESULT AND DISCUSSION.

From the results of the SWOT analysis includes strengths, weaknesses, opportunities and threats to an organization, namely: Strength of an organization that is

a. Organizations that are well known to the public

b. Quality service.

c. Delivery of goods that are always on time.

d. Cheap but high-quality prices that make a difference from other organizations.

e. Relationship of leaders with good employees.

Weaknesses of an organization are:

a. Most activities are carried out manually
b. Not so much about promoting new customers
c. There is still a defective item of around 15%
d. Rarely do machine maintenance opportunities for an organization, namely:
e. Organizations that have regular customers
f. There are still many opportunities because of potential customers
g. The occurrence of internet development that aims to improve communication with clients and suppliers that will help increase output.
h. With the addition of employees who will help service and income of the organization.

The threat of an organization is:

a. Many competitors close to the organization
b. Competitors who have the capacity and wide range
c. Fluctuating prices of raw materials
d. Slow user growth
e. Customers who have sensitivity to the price of goods that can move to competitors that offer low prices.

3.1. Discussion of Research Results

After knowing the strengths, weaknesses, opportunities and threats to the next organization will be analyzed against these factors to get a further picture of the conditions at the organization's output to the community so that strategies and steps can be determined that can be applied in the future. The first step in the analysis phase of the factors of strength, weakness, opportunity and threat of the Organization is to do an analysis through the IFAS matrix (Internal Strategic Factor Analysis Summary) and EFAS (External Strategic Factor Analysis Summary)

Furthermore, from the results of the analysis using the IFAS and EFAS matrices, it will be analyzed using a SWOT diagram to get an overview of the end of the organization's output with similar outputs from other organizations.

Internal Strategy Factor Matrix (IFAS) and External Strategy Factor Matrix (EFAS)

After the internal and external strategy factors of an organization are identified, an IFAS and IFAS table is prepared to formulate these internal strategy factors in the framework of Strength and Weakness. Organizations from the results of observations and interviews on questionnaires on the respondents selected, then with calculations as in the following table to determine the weight value, rating and score. Alternative strategy formulation

Next to formulate alternative strategy formulations An organization uses the SWOT matrix. alternative strategies are prepared based on the interaction of internal and external factors of the organization to obtain a development strategy. Some alternative strategies that can be done by the organization, Development strategies for an organization Based on the results of analysis using the SWOT matrix of several internal factors, in the form of strengths and weaknesses, and external factors such as opportunities and threats to determine the development strategy for an organization is to diversify (output, user), namely : ST - strategy.

3.2. ST - Strategy

a. Organizations that are already known to the public will provide positive value for the organization so that users remain loyal to the Organization.
b. Improve quality, shuttle service and expand coverage to outside the city / Java with internet promotions and services.
c. Conduct paper stock strategies to anticipate the surge in prices of paper raw materials

d. improve promos with the principle of 'quality low price' to reach as many customers as possible and with training and mastery of technology which are the main causes. As well as resources

e. Guarantee the quality of paper and the perfect prints by checking manually at low prices so that users do not move to competition.

4. CONCLUSION

From the results of SWOT internal and external analysis An organization to obtain a development strategy can be concluded as follows:

a. SO Strategy

1) Improve quality and service so that users feel satisfied and comfortable and attract new users.

2) Increase organizational capacity by utilizing teamwork capabilities and organizational experience to reach potential users

b. ST Strategy

1) Organizations that are already known to the public will provide positive value to the organization so that users remain loyal to the Organization.

2) Quality, shuttle service and expanding coverage to outside the city / Java with internet promotions and services.

3) Conduct paper stock strategies to anticipate the surge in prices of paper raw materials

4) Ensure the quality of paper and the perfect printout by checking manually at low prices so that users do not move to competitors.

c. WO Strategy

1) Buy new machines and add employees to simplify and speed up the output process.

2) By further increasing promotion through the internet as well as agencies such as schools, shops or organizations will indirectly provide information to new users.

d. WT Strategy

1) Increase the number of marketing employees on duty to come directly to the user.

2) Suppress the existence of defective goods to produce quality and cheap output prices

3) Creating an organization website to introduce output output to the user

e. SWOT Analysis

After identifying what is in an organization, using SWOT analysis, namely IFAS, IFAS and SWOT matrix. So it was concluded that an organization has a very strategic position to support the development of obtaining a strategic advantage. An organization is located in squared I, meaning that at this position the output of an organization is very supportive for an aggressive growth strategy to gain organizational excellence to compete with other organizations .

One method of strategy that can be implemented is to create distinctions or distinctions from other organizations using the S-T strategy.

REFERENCE

Anggrianto.M, P.i.S. (2013) Application of the SWOT and BCG Methods to determine sales strategies', *Journal of Recavation,* pp. Vol. 1, No. 1: 2338-7750.

Daft, R.L. (2010) A New Era of Management, Jakarta: Salemba Empat.

Nuary, N.S. (2016) 'Marketing strategy with swot analysis approach at PT. Super successful banjarmasin 'motor, Scientific *Journal of Business Economics, Vol 2, No 1*, pp. 30 - 42.

Nugrohojati, A.S. (2013) *'Marketing Strategy Planning Through SWOT Method To Increase Sales Volume (Case Study: PT.CI Kemang No. 112 South Jakarta)'*, Faculty of Mathematical Engineering and Natural Sciences, Indraprasta University PGRI.

Rangkuti, F. (2004) *SWOT Analysis of the Technique for Dissecting User Cases,* Jakarta: PT. Gramedia.

Rangkuti, F. (2008) *SWOT Analysis of the Technique for Dissecting Business Cases,* Jakarta: Gramedia Pustaka Utama.

Rangkuti, F. (2009) *SWOT Anasisist Technique Dissecting Business Cases. Printing Sixteen,Jakarta: GramediaPustaka.*

Reca Elyarni, H. (2016) ' SWOT Analysis of the Marketing Strategy of SAP Express Services at PT. SAP *', Jurnal Metris, 17, pp. 81 – 88.*

Sugiyono (2011) Qualitative Quantitative Research Methods and R&D. Thirteen Prints*, Bandung. : Alfabeta.*

Suhartini (2012) ' SWOT analysis in determining marketing strategies on companies', *Jurnal Matriks, pp. 12 (2) : 1693-5128.*

Supranto, J. (2011) Consumer Behavior and Marketing Strategy (to win business competition). The second mold,*Jakarta: Mitra Wacana Media.*

Tamara, A. (2016) ' Implementation of SWOT Analysis in the Mandiri Tabungan Bisnis' Product Marketing Strategy, *Jurnal Riset Bisnis dan Manajemen Vol 4 ,No.3, pp. 395-406.*

Widiastini, N.M.A.d.D.A..N. (2012) 'Tourism marketing strategy in Buleleng regency of Bali', *Journal of social sciences and humanities, pp. Vol. 1, No. 1: 2303-2898.*

BRONDONG FISHERIES PORT DEVELOPMENT STRATEGY TO ACHIEVE ECONOMIC RESILIENCE

Ali Mashudi, Dwi Saptono, Okol Sri Suharyo

Indonesian Naval Technology College, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia

ABSTRAK

Indonesia has started to carry out maritime empowerment through the five pillars of the World Maritime Axis so that several fishing ports that will be appointed including Brondong Archipelago Fisheries Port must be able to improve services to optimize catch fish production. As a service center in Lamongan Regency, how can the Brondong Nusantara Fisheries Port prepare itself to develop both to achieve regional and national economic resilience. The purpose of this paper is to be able to determine the right strategy in the context of the development of Brondong Archipelago Fisheries Port to achieve regional economic resilience. The approach method used is descriptive qualitative analysis using SWOT. The results showed that the development of Brondong Archipelago Fisheries Port included two types of development, namely physical development and non-physical development. Furthermore, in the field of development, in addition to being supported by adequate facilities, business units and industrial forms are able to absorb labor so that it will strengthen resilience the economy of the Lamongan area.

Keyword: *Brondong Archipelago Fisheries Port, SWOT analysis, Port Development, economic resilience*

1. Introduction

Indonesia as one of the UN member states that agreed on the implementation of the Sustainable Development Goals (SDGs) has committed to the successful implementation of the SDGs through several activities and has taken strategic steps. There are several objective points from 17 Goals in the Sustainable Development Goals (SDGs) that are closely related to economic resilience. Ending all forms of poverty anywhere, this goal speaks of increasing the incomes of the poor, ensuring access to basic services and protecting all communities from all forms of disasters (Singh.Z, 2016). And this is one of the goals declared by the Indonesian government on the SDGs agenda in Indonesia, namely the government is committed to eradicating poverty in all forms for the next 15 years. Meanwhile, to make this successful, one of them is by developing the Archipelago Nusantara Fisheries Port to create strong economic resilience.

Brondong Archipelago Fishery Port is one of the very busy fishing ports located in Lamongan Regency. The activity of the Brondong Nusantara Fisheries Port is quite crowded based on the average fish production of 125 tons/ day, the average boat visit reaches 50 ships/ day and the number of fishing fleets reaching 1,495, the number of fishermen is 12,160 people and motorboats 1,385 pieces, the number 312 people and 40 fish processors (PPN-Brondong, 2016). The vision of the Brondong Archipelago Fisheries Port is the realization of the development of Sovereign, Independent, Competitive and Sustainable Capture Fisheries for Fishermen Welfare. While the mission of Nusantara Brondong Fisheries Port is: a). Participate in realizing sovereignty in the sea by developing activities that have strategic social, economic, cultural and defense and security values. b). Realizing independence in the management and utilization of fish resources. c). Increase capacity and competitiveness in managing and utilizing fish resources. d) Realizing sustainable fish resource management. e) Realizing an increase in the welfare of fishermen (PPN-Brondong, 2016).

Table 1. Performance data of Brondong Archipelago Fisheries Port

No	Activities	Vol	2015	2016	2017	2018
1	Fish Production	Ton	64.813	66.179	65.373	55.985
2	Ship Visits	Ship	10.839	10.912	11.751	10.744
3	Fish Production Values	Billion	858,38	1.001,57	1.106,89	919,47
4	Distribution of Supplies					
	Ice Distribution	Ton	34.597	44.746	46.167	31.240
	Water Distribution	m3	39.513	38.396	15.282	13.333
	Distribution of Fuel	Kl	6.576	7.640	7.894	7.831
5	PNBP	Billion	425.37	520,43	806,12	643
6	Number of Labour	Person	10.360	10.360	14.135	15.090
7	Number of Fishermen	Person	8.854	8.710	8.415	9.370
8	Number of fish Ships	Unit	972	956	1.008	971
9	Number of fishing gear	Unit	929	909	972	936
10	Money Circulating	Billion	912,30	1.190,09	1.315,89	1.131,82

With the advancement of the level of the Brondong Archipelago Fisheries Port facility which is very supportive of the economy in Lamongan, of course, there are some things that need to be considered so that fish production in Lamongan can achieve the desired both in terms of quantity and quality. The problem that exists at Brondong Archipelago Fisheries Port is:

a. Port facilities that are less adequate, this can be seen from the activities of the ship's entry and exit which are not too crowded due to lack of depth of the pool and lack of navigation equipment and fire fighting facilities that do not yet exist.

b. In terms of risk management, it also needs attention, this can be seen from the 54 number of ships left by the owner so that it disrupts incoming and outgoing ship traffic.

c. Relocation of Fish Auction Sites also reaps the problem that now people are reluctant to move to the location of new fish auction sites which is certainly more hygienic, this is due to the large production costs incurred by fish owners and workers.

Therefore, the development of Brondong Archipelago Fisheries Port is very important because it will have an impact on increasing economic resilience which is very beneficial for national security. By knowing a number of strengths and weaknesses as well as opportunities and threats in the Brondong Archipelago Fisheries Port area of Lamongan Regency, a strategy analysis can be carried out to improve economic business. This strategy can be carried out through training, education, coaching, and system changes (Augustin and Akossiwa, 2018). The use of the approach method in this study is the method of SWOT analysis. With SWOT analysis, internal and external factors will be known with a matrix that shows strengths and weaknesses as well as opportunities and threats.

2. Methodology

2.1 Fisheries Port

Port of fishery is a blend of land and sea areas with certain limits as a place of government activities and a fisheries business system that functions as a place for lean fishing vessels,

anchoring ships, loading and unloading fish, as well as market places equipped with shipping safety facilities and other fishery support activities (Bentaleb, Mabrouk and Semma, 2015). Based on the Minister of Maritime Affairs and Fisheries Regulation Number PER.08/MEN/2012 concerning Fisheries Ports, Fisheries ports are classified into 4 (four) classes, as follows: Ocean Fisheries Port (PPS/Type A), Archipelago Fisheries Port (PPN/Type B) , Coastal Fisheries Port (PPP/Type C), Fish Landing Base (PPI /Type D). Some of the criteria for supporting the development of fishing ports according to Lubis and Pane in Lubis are: (1) system and quality of data collection; (2) aspirations from the central and regional governments; (3) quality of human resources; (4) condition of road infrastructure to Fisheries Port or Fish Landing Base; (5) conditions of transportation facilities to and from Fisheries Ports or PPIs; (6) Fisheries Port facilities or Fish Landing Base (7) availability of land. With these seven criteria, it can be concluded whether the development of a fishing port can be recommended or not. Recommendations can be directed at 2 alternatives, namely "full development" or "limited development". Organizing and managing a fishery port is often associated with the economic conditions of a country especially in the public interest (Guo, 2014). According to Lubis, there are 4 types of port management, each type has a different pattern, namely: (1) management by the local government; (2) management by public companies (semi-public); (3) management by the central government; (4) management by the private sector.

2.2 Analysis SWOT

SWOT analysis is the identification of various factors to formulate a company's strategy (Ercui and Man, 2012). This analysis is based on the logic that can maximize the strengths and opportunities but simultaneously can minimize weaknesses and threats (Vladi, 2014). The company's strategic decisions need to consider internal factors that include strengths and weaknesses as well as external factors that include opportunities and threats (Amin, Yan and Morris, 2018). Therefore it is necessary to have important considerations for the SWOT analysis.

Table 2. Matrix SWOT

SWOT Matrix	**Strength (S)** Existing internal conditions and can be strengthened in planning.	**Weakness (W)** Internal conditions that can be improved in planning.
Opportunity (O) External conditions that can be taken advantage of.	**S-O Strategy** Utilizing Internal strength to take advantage of opportunities	**W-O Strategy** Fixed internal flaws by taking advantage of opportunities
Threat (T) External conditions that can not be controlled and have a negative impact.	**S-T Strategy** Use the power to avoid or reduce the impact of threats	**W-T Strategy** Defensive strategy to reduce internal weakness and avoid threats

2.3 Economic Resilience

Economic resilience is an absolute requirement for the prosperity of a region (Kakderi, 2017). Economic resilience can be achieved by increasing growth and development. In Indonesia, regions have their own economic potential that can be developed. Economic developments in each region have different bases. Economics is a very important factor because it is always related to human survival. In a sense, economics is the study of human behavior to fulfill their needs. In economics the main problem is how every human being takes the means of fulfilling unlimited life needs with the availability of resources, therefore economic resilience is needed.

Economic resilience is interpreted as a dynamic condition of the nation's economic life (region) which contains the tenacity and resilience of national (regional) forces in dealing with and overcoming all threats, disturbances, obstacles, and challenges both directly and indirectly from outside or inside (Tan et al., 2017). Various types and economic systems vary greatly and have their own characteristics in order to create economic resilience. One effort to create economic resilience is to develop Micro, Small and Medium Enterprises (MSMEs) among the wider community.

The Indonesian nation consists of 17,502 islands, and a coastline of 81,000 km with an area of fisheries in the sea of around 5.8 million Km2, which consists of islands and territorial waters covering 3.1 million Km2 and waters of the Indonesian Exclusive Economic Zone and covering an area of 2.7 million Km2. This fact shows that the prospect of Indonesia's fisheries and marine development is considered very bright and is one of the strategic economic activities. Fish resources that live in Indonesian waters are considered to have the highest level of bio-diversity. These resources cover at least 37% of the world's fish species. In the territorial waters of Indonesia, there are several types of high-value fish, among others: tuna, skipjack, shrimp, cob, mackerel, snapper, squid, reef fish (grouper, baronage, lobster/ barong), ornamental fish and assault including seaweed. There are various gaps that still characterize fisheries development in Indonesia both nationally and locally in administrative management. Various infrastructure built by the government, such as the construction of fishing ports and fish landing sites scattered in various regions have not provided satisfactory results as expected, various models of regulation and policy took have not been able to touch well on the underlying problems.

2.4 Strategy Management

According to some experts, management strategy can be defined as art and science to formulate, implement, and evaluate cross-functional decisions that enable organizations to achieve their goals (Olesen et al., 2014). Historically, the main benefits of strategic management have helped organizations formulate better strategies using a more systematic, logical and rational approach to strategic choices. Management strategy is a series of managerial decisions and actions that determine performance in the long run. Management development strategies include environmental observation, strategy formulation (strategic planning or long-term planning), strategy implementation, and evaluation and control. Management development strategies emphasize the observation and evaluation of environmental opportunities and threats by looking at strengths and weaknesses (Elentably, 2015).

Management strategies can be defined as art and science in formulating, implementing, and evaluating cross-functional decisions that enable organizations to achieve their goals. The aim of management strategy is to utilize and create new and different opportunities for tomorrow; Long-term planning, on the contrary, tries to optimize for tomorrow's trends today. The results of strategic plans from difficult managerial choices are among the many good alternatives, and that signifies a commitment to certain markets, policies, procedures, and operations in lieu of other action programs (Huang et al., 2012).

2.5 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:

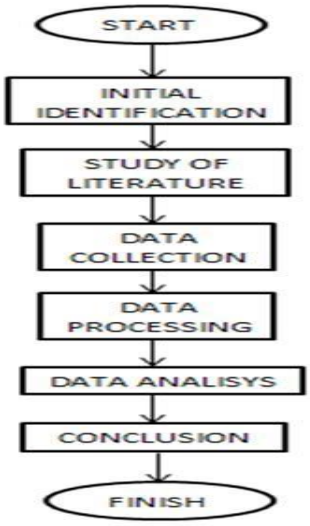


Fig 1. Research Methodology

3. RESULT AND RESEARCH ANALYSIS

SWOT analysis that emphasizes four aspects, namely Strength, Weakness, Opportunity, and Threat. This SWOT analysis will identify internal and external factors in developing PPN Brondong so that potentials can be developed in the future and overcome weaknesses - weaknesses that exist. From the internal side, there are factors formulation of the strategy, while the strengths or weaknesses are possessed for the development of Brondong Archipelago Fisheries Port strategies. using the SWOT method.

Referring to the goals and objectives of evaluating and implementing the SWOT analysis, it will be known, and the opportunities that support the development of the Brondong Archipelago Fisheries Port and the threats that will be faced in the development:

a. Strength

The definition of Strength in a SWOT analysis is the strength or strength that exists in a company or organization that affects the strategic decision-making process. Strength found in the development of Brondong Archipelago Fisheries Port is The strategic position of the Lamongan region, which is rich in fish, Empowering coastal communities that have been going well, Port facilities that are adequate, Large amount of fish production.

b.. Weakness

The definition of Weakness in a SWOT analysis is a weakness that exists in a company or organization that influences strategic decision-making processes. Weakness that is found in the development of Brondong Archipelago Fisheries Port is Port facilities that are less minimal, Communities are reluctant to move to hygienic TPI, Risk management has not been implemented, Fire fighting facilities do not yet exist.

c. Opportunities

The definition of opportunity in a SWOT analysis is the opportunity that exists in a company or organization that influences strategic decision-making processes, which is an opportunity found in the development of Brondong Archipelago Fisheries Port is The amount of demand for fish is high, Many fish processing industries, Stable economic growth, The existence of sea security patrols that benefit fishermen.

d. Threats

The definition of Threat in a SWOT analysis is the threat that exists in a company or organization that influences the strategic decision making process that poses a threat to the development of Brondong Archipelago Fisheries Port is Threats of economic resilience, Threats of theft of marine resources, Facilities and infrastructure are still minimal, The use of marine technology is still small.

The SWOT analysis data were obtained through observations on the object of research on the basis of the existing theory and then proceeded with the interview on the object of assessment after questioning was carried out on the stakeholders in the Brondong Archipelago Fisheries Port. In analyzing with the SWOT method approach, stages of identification of aspects and criteria are carried out which are the variables in the study. The

research aspects and criteria identified were influential variables and interacted with Brondong Archipelago Fisheries Port development strategy.

Variable Identification Stages carried out by conducting literature studies and conducting interviews with Expert. From the process of understanding the study of literature and conducting interviews with the Expert, there are influential variables. The following is the identification of the variables shown in table 3.

Table 3. Matrix SWOT of Brondong Archipelago Fisheries Port

Strength	**Opportunity**
• The strategic position of the Lamongan region, which is rich in fish • Empowering coastal communities that have been going well • Port facilities that are adequate • Large amount of fish production	• The amount of demand for fish is high • Many fish processing industries • Stable economic growth • The existence of sea security patrols that benefit fishermen
Weakness	**Threat**
• Port facilities that are less minimal • Communities are reluctant to move to hygienic TPI • Risk management has not been implemented • Fire fighting facilities does not yet exist	• Threats of economic resilience • Threats of theft of marine resources • Facilities and infrastructure are still minimal • The use of marine technology is still small

Based on data on the strengths, weaknesses, opportunities and threats that have been obtained after developing a strategic approach as follows Strenght - Opportunities use existing forces to create opportunities, Strength - Threats uses existing strengths to avoid and eliminate threats - threats that exist, Weakness - Opportunities eliminate weaknesses that exist to create opportunities, Weakness - Threat eliminates weaknesses in order to avoid threats. The strategic approach is like table 4. below.

Table 4: SWOT Strategic Approach

X	S	W
	Strategy S-O	**Strategy W-O**
O	1. Socialization results of high quality fish 2. Use of labor in the fish processing industry sector 3. The utilization of port facilities is as large as for strengthening the economy of the community 4. Intensifying marine security patrols to ensure the availability of fish resources	1. Carrying out dredging ponds to facilitate ship traffic 2. Stronger socialization so that people are aware and move to Higinis Fish Landing Sites 3. Implement risk management for fishing boats that sail to ensure safety 4. Increasing the welfare of fishermen
	Strategy S-T	**Strategy W-T**
T	1. Increasing and strengthening the role of science and technology 2. Increasing research and marine information systems. 3. Strengthening and government policy in achieving economic resilience 4. Build maritime domain awareness	1. Establish a task force to eradicate illegal fishing and terrorism 2. Development of human resource competency standards in maritime affairs 3. Development of Ecotourism potential 4. Carry out community empowerment towards economic resilience

The SWOT strategy approach consists of 4 categories consisting of strategy I (Strength-Opportunity), strategy II (Weakness-Opportunity), strategy III (Strength-Threat), strategy IV (Weakness-Threat). A Strategy I has 4 strategies. strategy II there are 4 strategies. Strategy III has 4 strategies. Strategy IV has 4 strategies. The strategies mentioned above are grouped or sorted from Strength-Opportunity in numbers 1 to 4, Weakness-Opportunity in numbers 5 to 8, Strength-Threat numbers 9 to 12, Weakness-Threats numbers 13 to 16, according to table 5 symbols and strategies.

Table 5 Symbols and strategies

No	Strategy	Symbol
1	Socialization results of high quality fish	(SO)1
2	Use of labor in the fish processing industry sector	(SO)2
3	The utilization of port facilities is as large as	(SO)3
4	Intensifying marine security patrols to ensure the availability of fish resources	(SO)4
5	Carry out dredges ponds to facilitate boat traffic	(WO)1
6	Stronger socialization so that people are aware and move to the Higinis Fish Landing Site	(WO)2
7	Implement risk management for fishing boats that sail to ensure safety	(WO) 3
8	Improving the welfare of fishermen	(WO) 4
9	Increasing and strengthening the role of science and technology	(ST) 1
10	Increased research and marine information systems	(ST) 2
11	Strengthening and government policies in achieving economic resilience	(ST) 3
12	Build maritime domain awareness	(ST) 4
13	Form a task force to eradicate illegal fishing and terrorism	(WT)1
14	Development of human resource competency standards in maritime affairs	(WT)2
15	Development of Ecotourism potential	(WT)3
16	Carry out community empowerment towards economic resilience	(WT)4

Based on the SWOT analysis, the total strategies that have been formulated are the sixteen sub-strategies that determine the Brondong Archipelago Fisheries Port development strategy to become a port that is adequate and can empower coastal communities to achieve economic resilience.

Based on the SWOT analysis, the priority strategy for developing Brondong Archipelago Fisheries Port is:

1. Socialization results of high-quality fish
2. Use of labor in the fish processing industry sector
3. The utilization of port facilities is as large as
4. Intensifying marine security patrols to ensure the availability of fish resources
5. Carry out dredges ponds to facilitate boat traffic
6. Stronger socialization so that people are aware and move to the Higgins Fish Landing Site
7. Implement risk management for fishing boats that sail to ensure safety
8. Improving the welfare of fishermen
9. Increasing and strengthening the role of science and technology
10. Increased research and marine information systems

11. Strengthening and government policies in achieving economic resilience
12. Build maritime domain awareness
13. Form a task force to eradicate illegal fishing and terrorism
14. Development of human resource competency standards in maritime affairs
15. Development of Ecotourism potential
16. Carry out community empowerment towards economic resilience

For the next in order to sort the priorities in doing with several other methods

4. CONCLUSIONS

To develop Brondong Archipelago Fisheries Port to become a port that is adequate and can empower coastal communities to achieve economic resilience, it is necessary to Socialization results of high quality fish, Use of labor in the fish processing industry sector, The utilization of port facilities is as large as, Intensifying marine security patrols to ensure the availability of fish resources.

Great limitations can be overcome by collaborating with government institutions so that the maritime research can be carried out properly.

REFERENCE

Amin, S.H., Yan, N. and Morris, D. (2018) 'Analysis of Transportation Modes by Evaluating SWOT Factors and Pairwise Comparisons: A Case Study', *Multi-Criteria Methods and Techniques Applied to Supply Chain Management*, pp. 57-72.

Augustin, D.S. and Akossiwa, D.L. (2018) 'SWOT Analysis for Developing Dry Ports in Togo', *American Journal of Industrial and Business Management*, pp. 1407-1417.

Bentaleb, F., Mabrouk, C. and Semma, A. (2015) 'Dry Port Development: A Systematic Review', *Journal of ETA Maritime Science*, pp. 75-96.

Elentably, A. (2015) 'Strategic and Operational Plan Implementation of Seaports (Utilization Jeddah Port)', *the International Journal on Marine Navigation and Safety of Sea Transportation* , pp. 489-497.

Ercui, Z. and Man, Q. (2012) 'The SWOT Analysis of Qingdao Marine Culture Industry', *Advances in Asian Social Science (AASS)*, pp. 629-634.

Guo, L. (2014) 'Supply Chain Strategic Alliances Partner Selection for Rizhao Port', *International Journal of Scientific and Research Publications*, pp. 1-9.

Huang, W.-C., Kuo, T.-C., Wu, C.-T. and Kuo, C.-C. (2012) 'Port Management Improvement Strategies Based on Simulating Model', *Journal of Marine Science and Technology*, pp. 492-507.

Kakderi, C. (2017) 'Regional economic resilience: the role of national and regional policies', *European Planning Studies*, pp. 1435-1453.

Olesen, P.B., Dukovska, I., Hvolby, H.-H. and Jensen, K.S. (2014) 'Strategic port development: identifying a development approach for small and medium-sized ports', *Proceedings from the Annual Transport Conference*, pp. 1-16.

PPN-Brondong (2016) *Profile Pelabuhan Perikanan Brondong, Lamongan*, 1st edition, Lamongan: PPN Brondong.

Singh.Z (2016) 'Sustainable development goals: Challenges and opportunities', *Indian Journal of Public Health*, pp. 247-250.

Tan, J., Lo, K., Liu, W., Li, J. and Zhang, P. (2017) 'Regional Economic Resilience: Resistance and Recoverability of Resource-Based Cities during Economic Crises in Northeast China', *Journal of Sustainability*, pp. 1-11.

Vladi, E. (2014) 'Tourism Development Strategies, SWOT analysis and improvement of Albania's image', *European Journal of Sustainable Development* , pp. 167-178.

STRATEGY FOR SHIP INDUSTRY DEVELOPMENT IN SUPPORTING STATE DEFENSE

Sukarno, Sutrisno, Suprayitno

Indonesian Naval Technology College, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia

ABSTRACT

The location of Indonesia's strategic position and wealth of natural resources and having 3 ALKIs have great economic potential and have a serious level of vulnerability and security. To demand integrity and territory of sovereignty a strong national defense is needed by supporting all components of the nation. National industry as one of the supporting components in the national defense system has an important meaning including national industry in the shipping industry sector, has a great opportunity to improve the national economy. However, the shipping industry still needs to be developed to be able to fulfill the demand for shipbuilding or repairing and maintaining ships. In this study discussed the strategy of developing the shipping industry to strengthen national defense. The research method used was descriptive qualitative and quantitative SWOT analysis. This study found the strategy of developing the shipping industry is to improve shipyard facilities and infrastructure and also by increasing quality human resources, to improve management and mastery of technology and policy support from the government.

Keywords*: National Defense, shipping industry, SWOT.*

1. INTRODUCTION

Indonesia is the largest archipelagic country in the world with an area of 2/3 of the ocean (5.9 million km2), with details of 0.8 million km² of territorial sea; 2.3 million km² of island sea; and 2.7 million km² Exclusive Economic Zone (C.S. Marnani, 2016). Indonesia is also a country that has the world's number two longest coastline after Canada with the length of the Indonesian coastline reaching 95,161 km (Lasabuda1, 2013). Indonesia has abundant natural resources both energy reserves, fisheries, marine tourism. The source of Indonesia's natural wealth if it reaches Rp. 200,000 trillion Besides that, Indonesia also has three Indonesian archipelagic pathways (ALKI), making it a strategic shipping lane that can be utilized as an economic, geopolitical and martim culture development. This indicates that the ship has a very important role.

In an effort to safeguard and protect the sovereignty and wealth of natural resources therein requires an effort to form a strong national defense system. To realize strong resistance, a national defense strategy is needed to determine the direction of policy, posture and development of national defense, both military and non-military defense strategies. (Kemenhan, 2014). A strong and reliable defense system, namely a defense system that involves all components of the nation involving all citizens, the region and resources that are held in a sustainable manner to safeguard and uphold the sovereignty of the country, the safety and integrity of the entire nation and state (Kemensetneg, 2002).

National Industry is one part of the national defense component that is included in the supporting component. This is in line with the Government's vision to build Indonesia as one of the toughest industrial countries, as stated in Presidential Regulation No. 28 of 2008. The vision of Indonesia's National Industrial Development is Become a Tangguh Industrial Country. The Tangguh industry is characterized by first having a strong, deep, healthy and just national industrial structure, both industries that are highly competitive at the global level and the three industries that are innovation and technology based (Puskom, 2015). In the national industrial development plan contains the

mainstay industry of the future, supporting industries and upstream industries, where the three industry groups require basic capital in the form of natural resources, human resources, as well as technology, innovation and creativity. Future industrial development also requires prerequisites in the form of adequate infrastructure and financing, and supported by effective policies and regulations. To achieve the vision of becoming a strong industrial country, it is necessary to strengthen and control the mainstay industries of the future, one of which is the transportation industry such as the automotive industry, shipping industry, aerospace industry and the fire ship industry. (Puskom, 2015).

As a maritime country, the shipping industry which is part of the future mainstay industry has a very important role to support the sustainability of the sea transportation sector, both regarding repair, maintenance and new shipbuilding. Looking at the important and urgent function and role of the shipbuilding industry, it is appropriate that the shipbuilding industry is a very strategic maritime industry in the future. In accordance with the presidential instruction (INPRES) number 5 of 2005 concerning the empowerment of the national shipping industry, in its implementation it also depends also on the readiness of the national shipping industry.

UNCTAD on October 3, 2018 has published Review of Maritime Transport (RMT). In the review, one of them, wrote the number of merchant fleet fleets in the world as of January 1, 2018 was 94171 units, with a total tonnage of 1.92 billion DWT. Of the total vessels, the largest population is Dry Bulk Carrier, which is 42.5 percent by dwt. Followed by tanker type (29.2) and container (13,1). Dry bulk carrier ships grew by 20 million dwt in 2017. But growth, the largest type of gas carrier ship, reached 7 percent compared to 2016. Of the total number of vessels, tonnage of vessel ownership was Greece (17.3%), Japan (11.7%), China (9.6%), and Germany (5.6%). Chinese-owned vessels account for 5512 units, the most in the world in a population. Followed by Greece (4371), Japan (3841), Germany (2869), and Singapore (2629). Indonesia ranks 8th with 1948 ships. But it is ranked 20th if it is calculated based on tonnage (20 million dwt). Throughout 2017, 65 million gross tons (gt) of new vessels were completed. While the ships that were scraped aka those that were sold were 23 million gt.

Taking into account the current condition of the national shipping industry, this study discusses "How to develop a shipping industry in terms of facilities, facilities and infrastructure, human resources and mastery of shipping technology to support national defense at sea". This research is expected to be able to provide an overview of strategies for the development of the domestic shipping industry so as to be able to carry out the process of maintenance, repair and overhaul of ships in general and in handling warships.

2. MATEIAL/METODHOLOGY

2.1 National Defense Strategy

Security strategies are made to determine risks and threats and what actions if an attack occurs, what steps must be followed to minimize the effects and capture the attacker (Nastasiu, 2016). National defense is organized and prepared early by the government through efforts to build and foster the ability to realize the deterrence of the nation and state. National defense is also called national defense is all efforts to defend the sovereignty of the country, the integrity of the territory of a country and the safety of all nations from threats and disruptions to the integrity of the nation and state both from within and from outside. National defense is a joint force (civil and military) organized by a State to guarantee its territorial integrity, protection from people and / or safeguard its interests.

In Republic of Indonesia Law Number 3 of 2002, Indonesian defense adheres to the Universal Defense System to deal with all forms of threats and disturbances that threaten the sovereignty of the state both from outside and arising within the country. In the universal defense system to face the threat of the military placing the TNI as the main component and all other national resources, as a reserve component and supporting component. In the face of non-military threats, the Universal Defense System places government institutions outside the defense sector as the main elements in accordance with the form and nature of the threats faced and supported by other elements of the nation's strength. Thus, in the face of non-military threats, the TNI became one of the supporting elements

2.2 National Industry

National industrial development contains a future mainstay industry, supporting industries, and upstream industries. To support this industry group, the availability of natural resources, human resources, technology, innovation and creativity is needed. Future industrial development also requires prerequisites in the form of adequate infrastructure and financing, and supported by effective policies and regulations. National industry is a means of driving national economic growth. in increasing the competitiveness of the national economy, national industry is one sector that can be used as a foundation, this must be balanced by increasing through the production process, the distribution process and the consumption of products produced by national industries.

In an effort to achieve national industrial development goals priority industry development programs are carried out jointly by the Government, State-Owned Enterprises, and the private sector. The government in establishing national industrial policies determines 10 priority industries which are grouped into mainstay industries, supporting industries and upstream industries, one of which is in the mainstay industry, namely the transportation industry consisting of the motor vehicle industry, shipping industry and the aerospace industry.

2.3 Strategy Theory

Strategic Management is the process of revising and analyzing internal and external environments to plan, implement and observe strategies (Charu Shri, 2015). At first the term strategy was used in the military world which was interpreted as a way of using all military power to win a war. While in terms of terminology many experts have proposed a definition of strategy with a different point of view, but basically all of them have the same meaning or meaning, namely achieving goals effectively and efficiently, among experts who formulate the definition of strategy is one of the processes by which to achieve a goal and oriented towards the future to interact in a competition to achieve the goal. According to (Istiqomah, 2017) management strategy can be defined as art and science to formulate, implement, and evaluate cross-functional decisions that enable organizations to achieve their goals

According to (David, 2011) management strategy can be defined as art and science to formulate, implement, and evaluate cross-functional decisions that enable organizations to achieve their goals. Historically, the main benefits of strategic management have helped organizations formulate better strategies using a more systematic, logical and rational approach to strategy choices. While (Hunger & Wheelen, 2010) explained that management strategy is a series of managerial decisions and actions that determine long-term performance. Management strategies include environmental observation, strategy formulation

(strategic planning or long-term planning), strategy implementation, and evaluation and control. Strategy management emphasizes the observation and evaluation of environmental opportunities and threats by looking at strengths and weaknesses. According to Bijah Subijanto (2004) on a strategy based on law number 3 of 2002 concerning National Defense it is said that the purpose of national defense is to safeguard the sovereignty of the State, maintain regional integration, and protect the safety of the Indonesian people.

2.4 Analisis SWOT

SWOT is one of the most popular strategies that aims to identify organizational strengths and weaknesses and opportunities and threats in the environment (X.P. Wang*1, 2014). SWOT analysis is used to understand and evaluate current positions in terms of strengths, weaknesses, opportunities, and threats in an organization, company, project or business speculation (Rangkuti., 2012). Of the four factors that make up the SWOT acronym (strengths, weaknesses, opportunities, and threats). In the process of SWOT analysis involves the direction of specific goals of business or project speculation in determining and identifying internal and external factors that have influence or not in achieving the expected goals.

SWOT analysis can be applied by analyzing and sorting out various things that affect the four factors, then applying them in the SWOT matrix image, where the application is how strengths are able to take advantage of existing opportunities, how to overcome weaknesses (weaknesses) which prevents the existing opportunities, then how strengths are able to deal with existing threats, and finally how to overcome weaknesses that are able to make threats become real or create a new threat.

2.5 Determination of IFAS and EFAS Matrix

Having known internal and external factors, after internal and external strategy factors of a company identified, after the data has been processed included in an IFAS and EFAS table prepared to formulate these internal strategy factors in the framework of Strength and Weakness. As for the external strategy factor in the framework of Opportunities and Threats (Nurcahya Dwi Asmoro, 2018). From the results of the respondents' questionnaires, the results of the identification of each variable are then sorted according to rank or rated using the number 4 (good), 3 (good enough), 2 (not good) and 1 (bad). Then we determine the weight of each variable based on the results of the comparison of the rating by means of the rating compared to the rating of all the variables in the table. Then the sum of all weights is 1.0.

2.6 Metodologi

This study uses a bibliographic with quantitative, namely a combination of descriptive qualitative approaches to literature. Secondary data obtained from library documentation data and theoretical data. Meanwhile, the primary data of the study was obtained relying on observations in the field of informant / respondent data related to the subject of the study. To determine the respondent, purposive sampling technique was used by preparing the respondent's target beforehand but in its development the respondent could be replaced. From the data obtained then the data is processed using the SWOT method, namely by identifying and analyzing and determining the existing data grouped into internal and external factors.

2.7 Thinking Framework

From the description above can help develop the shipping industry, it is necessary to consider internal and external factors, so that it can produce a

highly competitive shipping industry, provide added value for regional economic development, and improve its managers.

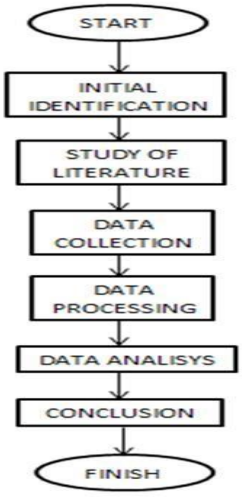


Figure 1. Thinking Framework

Target : The purpose of this study is to provide an analysis of the importance of the strategy of developing the marine industry in supporting defense especially in preparing defense equipment in maintaining sovereignty at sea.

Steps : The step of this research is step 1 to examine the condition of the current shipping industry resistance, step 2 to do an analysis, step 3 provides a conceptualization of the development strategy of the shipping industry, step 4 draws conclusions.

3. RESULTS AND DISCUSSION

3.1 Maritime Industry

The drive to develop a maritime-based industry came from the Ministry of Industry. This is indeed intended to advance the economy. One of the concerns of the government is the development of the shipyard industry. For the repair shipyard industry there are 250 units of production facilities with reparation capabilities reaching capacities of up to 12 million deadweight tonnage (DWT) / year, 85% utilization. While the new shipyard has 160 production facilities with a capacity of one million DWT / year, and 45% utilization. From the Ministry of Industry note that in 2017, there were 218,300 gross tonnage (GT) orders. To meet the needs of the domestic market, only 83% can be fulfilled, which can be fulfilled around 120 units or 135,440 GT, while the rest is for exports. This causes the number of development orders from the government in 2018 to be limited, so some shipyard facilities are not used (Kontan.co.id, 2018). Besides that, in the case of spare parts there is no support from the manufacturers of components / spare parts that are needed in the construction of ships, so that 60% - 70% of the components must be imported from abroad. (S.Saroso, 2015). This condition is a weakness for the domestic maritime industry that has to find a solution. Government policy to build a maritime industry is an opportunity for industry players in this sector, including foreign investors.

3.2 Availability of Parts

To ensure the smooth operation of ships, they can operate safely and smoothly, so support from the availability of spare parts or spare parts is needed. To ensure the availability of these spare parts special attention is needed from industrial management, to be able to provide stock of the main spare parts of the ship. Especially the spart parts that cannot be produced from domestic industries such as cylinder liners and cylinder blocks, because these two components can only be fulfilled from the producer country (S.Saroso, 2015). So that many of the national ship ships carry out repairs and maintenance of ships in foreign shipyards

3.3 Human Resources

Strategic quality improvement for Human Resources is the main requirement in the era of globalization to be able to compete and be independent. This is what is being faced in the

context of the MEA which has started running since the beginning of 2016 ago. Employees involved have a high level of energy, are enthusiastic about their work, and they are often fully immersed in their work so time passes. (Despoina Xanthopoulou a, 2009) In an effort to improve the quality of maritime human resources, the government implemented several separate policies to strengthen Indonesian maritime human resources. Some of these policies are improving marine services, developing HR competency standards, improving science and technology, researching and developing marine information systems, improving community nutrition, protecting workers, compiling education curricula with maritime visions, improving the quality and number of maritime colleges, improving quality and the number of shipping and fisheries schools, as well as developing marine science and technology facilities and infrastructure (KemenkoKemaritiman, 2017).

3.4. Identification of Internal-External Environment (IE) Via IE Matrix

Internal analysis is done to get the strength factor that will be used and the weakness factor that will be anticipated. To evaluate it, the IE evaluation matrix (Internal-External) is used. The following are the results of environmental analysis. Important points that can be taken from the results of the analysis affect the strategic decision making. The influential factors are summarized in Table 1.

Table 1. Factors Affecting Decision Making

	Influential factor
1	General managerial in the shipping industry
2	Government program on maritime axis through the sea highway program
3	Ability to build ships by domestic shipping industry
4	Ability to repair ships by domestic shipping industry
5	Spare parts depend on the supplier
6	Technology demands on the shipping industry
7	Quality of Human Resources in the country
8	Implementation of government policies through the Cabotage Principle
9	Request for domestically-made fleets
10	Weakened Capital Sector
11	National Shipyard Empowerment

From these decision-making points, it is then processed into the SWOT matrix table by entering these points into groups of internal factors in the position of strength or weaksness, and also in the external factor in the opportunity position or treats according to the results obtained from respondents

The position of these points can be seen in Table 2.

Internal / Eksternal	**Strength** • Ability to repair ships by domestic shipping industry • Ability to build ships by domestic shipping industry • Availability of shipping industry facilities	**Weaksness** • Spare parts depend on the supplier • Quality of Human Resources in the country
Opportunity • Government program on maritime axis through the sea highway program • Implementation of government policies through the Cabotage Principle • National shipping industry Empowerment • Request for domestically-made fleets	**Strategy SO** Make a strategy by optimizing the power to take advantage of opportunities	**Strategy WO** Make a Strategy by minimizing weaknesses to take advantage of opportunities

Treats	Strategy ST	Strategy WT
• Technology demands on the shipping industry • Weakened Capital Sector	Make a strategy by optimizing the power to overcome threats	Make a strategy by minimizing flexibility and overcoming threats

After the influential factors are grouped into the SWOT matrix, proceed with weighting on internal factor (IFE) and external factor (EFE). Weighting values use members from 1 to 4 which are obtained from the results of questionnaires from the respondents. IFE weighting processing as in table 3 and EFE in table 4.

Tabel 3. Internal Faktor Evaluation

Strenght	**Rating**	**Weight**	**Skor (rating x weight)**
Amenities Human Resource Ability	4 3	0.57 0.43	2,29 1,29
Total		**1,00**	**3,58**
Weakness			
Quality of Human Resources Availability of Parts	**3** **3**	**0,5** **0,5**	**1,5** **1,5**
Total		**1,00**	**3,0**

Tabel 4. Eksternal Faktor Evaluation

Opportunity	**Rating**	**Weight**	**Skor (rating x weight)**
World maritime axis Cabotage Principle shipping industry Empowerment Ship Request	3 2 3 2	0,3 0,2 0,3 0,2	0,9 0,4 0,9 0,4
Total		**1,00**	**2,60**
Treats			
Technology demands Weak Capital	3 3	0,5 0,5	1,5 1,5
Total		1,00	3,00

From the results of IFE and EFE table processing, then determine the position of the strategic quadrant by entering into the weight score table by putting the value of Strenght (S) and Weakness (W) in the Internal column and the difference between (S) and W as the X axis. Opportunity (O) and Treats (T) are placed in 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 value of the X axis is 0.98 and the value of the Y axis is 0.40.

Table 5. Processing of Quadrants

Internal (X)	**Value**	**Eksternal (Y)**	**Value**
Strenght Weaksness	3,58 3,00	Opportunity Treats	2,60 3,00
Score difference	**0,58**		**-0,40**

From the difference in value in table No. 5, we enter the strategy quadrant to determine the strategy, so we can analyze what strategies are appropriate to be used in solving the problem

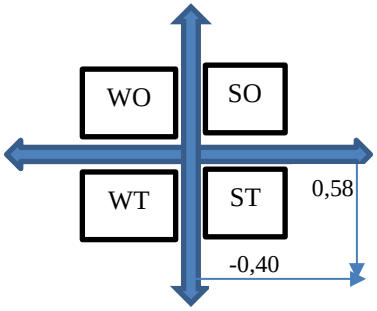


Figure 2. Strategy quadrant

Looking at the picture, that the strategy position lies in the ST quadrant, this shows that the ST strategy is used to solve the problem by optimizing the existing strength to overcome the threats faced.

4. CONCLUSION

From the results of the discussion it can be concluded that the strategy for the development of the domestic shipping industry is to improve shipyard facilities and infrastructure and also to improve HR capabilities. Of course this must be supported by improving the quality of human resources in mastering the latest technology, either by conducting training training, courses or by participating in higher education, of course this is also followed by government policies to make it easier for companies to borrow capital to advance the shipping industry

REFERENCES

C.S. Marnani, F. R. (2016). Connectivity Indonesia's Maritime Global Axis Policy. *J. Pertahanan, vol. 2, no. 1*, 53-70.

Charu Shri, M. G. (2015). Strategy Formulation for Performance Improvement of Indian Corrugated Industry: An Application of SWOT Analysis and QSPM Matrix. *Journal of Applied Packaging Research*, 60-75.

David, F. R. (2011). *Strategic management: Concepts and Cases* (14th ed.). Person Academic.

Despoina Xanthopoulou a, *. A. (2009). Reciprocal relationships between job resources, personal resources,. *Journal of Vocational Behavior 74* , 235-244.

Hunger, J. D., & Wheelen, T. L. (2010). *Essentials Of Strategic Management 5th edition.* United States of Amerika: Prentice Hall.

Istiqomah, A. (2017). Human Resource Development Strategy as an Effort to Improve the Performance of Village Apparatus by Using SWOT Analysis. *Jurnal Universitas Negeri Malang*, 1-9.

Kemenhan. (2014). *National Defense Posture.* Jakarta: Kementerian Pertahanan RI.

KemenkoKemaritiman. (2017). *White Paper on Indonesian Maritime Policy Towards World Maritime Axis.* Jakarta: Kementerian Koordinator Bidang Kemaritiman.

Kemensetneg. (2002). *Law of the Republic of Indonesia Number 3 of 2002 concerning National Defense.* Jakarta: Kementerian Sekretariat Negara.

Kontan.co.id. (2018, Juli Selasa). Retrieved from Industri galangan kapal perlu mendapat perhatian dari pemerintah: https://industri.kontan.co.id/news/industri-galangan-kapal-perlu-mendapat-perhatian-dari-pemerintah

Lasabuda1, R. (2013). Development of Coastal Areas and Oceans in the Perspective of the Archipelago of the Republic of Indonesia. *Jurnal Ilmiah Platax*, Vol. I-2, Januari 2013.

Nastasiu, C.-I. (2016). Cyber security strategies in the internet era. *Scientific research and education in the air force-afases*, 619-624.

Nurcahya Dwi Asmoro, B. S. (2018). Formulation of Maritime Industry Mastery Strategy to Strengthen National Defense. *Jurnal Optimasi Sistem Industri - VOL. 17 NO. 2*, 162-170.

Puskom. (2015). *2015-2035 National Industrial Development Master Plan.* Jakarta: Kementerian Perindustrian.

Rangkuti., F. (2012). *SWOT Balanced Scorecard.* Jakarta: PT Gramedia.

S.Saroso, L. L. (2015). Design of Information System Models in the Process of Providing Main Ship Engine Parts. *Jurnal PASTI*, 138-148.

S.Saroso, L. L. (2015). Design of Information System Models in the Process of Providing Main Ship Engine Parts. *Jurnal PASTI*, 138-148.

X.P. Wang*1, J. Z. (2014). Hybrid SWOT Approach for Strategic Planning and Formulation in. *Journal of Applied Research and Technology*, 230-238.

WORKLOAD ANALYSIS TO DETERMINE THE OPTIMAL NUMBER OF PERSONNEL AND WORK EFFICIENCY IN THE CONTEXT OF ORGANIZATIONAL DEVELOPMENT

Wahyu Endriyanto, Adi Bandono, Bambang Suharjo

Indonesian Naval Technology College, STTAL
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia

ABSTRACT

An organization must always maintain the performance of personnel so that the effectiveness and efficiency of performance are realized. Performance effectiveness is influenced by the composition of the organizational structure, number of personnel and workload. The Human Resources Development Unit (HRD) in the Navy is inseparable from the problem of the lack of personnel with the workload faced in each part of its work area. The determination of the number of personnel requirements in the HRD Unit is currently based on applicable regulations in the Navy as an analysis of its workload. This workload calculation method focuses more on physical workload and does not involve the mental workload in its calculations. This study aims to determine the optimal number of personnel by measuring the workload of each officer in the work section so as to create performance efficiency. The method of approach used is the approach of job duty assignments according to the Perpang/93/X/2011 to measure physical workload, while to measure mental workload using the Fuzzy NASA-TLX method. Furthermore, the two workload methods are combined as a calculation of optimal personnel requirements. The results obtained were the largest physical workload index in the Head of Administrative and the largest mental workload on the Head of Screening Subsection. There are 7 types of work that are not suitable/less number of personnel with optimal conditions, namely Head of Administration 1 person, Head of Operations Section 4 people, Head of Operation Planning Sub-Section 1 person, Head of Provision Administration Section 5 people, Head of Sub-Department of Settlement 3 people, Head of Prospective Administrative Affairs for Civil Servants 4 people, Head of Study Section 4 people, Head of Data Subdivision 1 person, Head of Evaluation and Report Sub-Section 2 personnel. It is recommended that there be an increase in the number of personnel from the initial DSP to 56 people to 75 people, so that there needs to be an additional 19 people.

Keywords: *Human Resources Development, Workload, Job Assignment Task Load, fuzzy logic, NASA TLX.*

1. INTRODUCTION.

In order to safeguard the sovereignty of the territorial waters of the Unitary State of the Republic of Indonesia, the Navy always maintains the performance of the organization performance in order to create effectiveness and efficiency of performance (Harky, 2018). Performance is influenced by quality human resources. In Navy qualified human resources are prepared to maneuver the increasingly sophisticated and modern Navy cysts and in facing challenges in the era of the industrial revolution (Mashudi, 2019), Therefore planning for the provision of human resources is very important to do. This has also been regulated according to the regulations in force in the Navy, which includes several stages. These stages include: 1. Provision, 2. Education, 3. Use, 4. Care, 5. Separation of personnel (Indonesian Navy Headquarters, 2013). The Provisioning Phase is the most important stage, because it requires a quality and credible Human Resources Development Unit (HRD) as its executor.

The HRD Unit is the implementing unit for the provision of Human Resources that has functions including: 1. Campaign / socialization, 2. Acceptance / recruitment, 3. First education, 4. Appointment, 5. First Service Association (IDP). In general, selection and recruitment are a part of human resource management that has a critical impact on organizational performance (Costello, 2006). The HRD Unit is headed by a Head of HRD Unit and this is a strategic position in the function of providing

Human Resources in the Navy. The Head of the Unit is assisted by staff as a supporting element in his daily activities.

In carrying out work activities in the HRD Unit, it has been arranged according to the Job Description and List of Personnel Arrangements (DSP) as the basis for placement of personnel in each division unit. In addition, the composition of the personnel in the organizational structure concerning the number of personnel and the level of workload greatly determines the effectiveness of the work faced by the HRD Unit. Basically the workload comes from routine, periodic and situational activities carried out by personnel within a certain period of time (Dasgupta, 2013). There is a mismatch between the number of personnel in each part and the workload faced, so that the function of the organization will not run optimally. There is still an excess of work / lack of personnel, so that each person has a different workload. The workload also increased, resulting in decreased fatigue and health of personnel and illness.

High workloads can lead to job stress and result in a decrease in personnel performance (Ali, et al., 2014). In every organization both large and small, complex work issues also cause work stress (Qureshi, 2013). This will also have an impact on health and performance, and will increase over time (Shah, et al., 2011). Besides the complexity of the work can also cause high workloads (Shabbir & Naqvi, 2017). Health personnel are influenced by the imbalance between the ability of personnel and workload on their work (Behesti, 2015). Additions to the number of employees, the addition of work incentives and work rotation include policies that can reduce the workload of employees (Wutsqo, 2017).

Based on this, an analysis or measurement of workload and job efficiency is needed so that the optimal number of personnel and positions is needed (Budiman & Putranto, 2015), especially in the HRD Unit.

The measurement of the workload of personnel in the Navy used the applicable regulatory basis in the Navy regarding administrative instructions for assessing and calculating workloads within the Indonesian National Armed Forces with an assigned task assignment approach. This calculation refers more to the physical workload because it uses the standard time in completing the task. While the mental workload has not been accommodated in the measurement of workload using this method. Even though the measurement of mental workload is an important aspect in designing or analyzing the results of work (Didomenico & Nussbaum, 2011). Along with the development of machine and computer technology, the assessment of mental workload is very important in the world of offices or staff because it deals with coordination and planning (Eraslan, 2013). In the science of industrial ergonomics, the workload is divided into two, namely physical workload and mental workload. Many jobs have a small physical workload, but the mental workload is large, and vice versa.

Then the formulation of the problem in this study is how the mental workload and physical workload of personnel in the HRD Unit and how to determine the optimal number of personnel needed, as well as how the position structure (job value) and class position (job class) in the Unit are appropriate. The purpose of this study is to measure the physical and mental workload of HRD Unit personnel on each type of division work, determine the optimal number of personnel needed and make efficient structure of positions in the Unit. The method used in this study is the method of assignment duty assignment method and the NASA TLX method that is integrated with Fuzzy Logic to measure mental workload. Furthermore, both methods are combined to obtain

the results of the optimal number of personnel needed.

This study refers to journals and literature, including Fuzzy-TLX: *Using Fuzzy Integrals For Evaluating Mental Workload With NASA Task Load Indexes In Laboratory And Field Studies* (Amady, et al., 2013), *Evaluation of Rating Scale Mental Effort (RSME) effectiveness of the mental workload assessment in nurses* (Ghanbarry, et al., 2016), *A Survey on Analysis and Classification of Workload in Cloud* (Chethan, et al., 2016)*. Maximizing Efficiency and Reducing Robotic Surgery Costs Using the NASA Task Load Index* (Walters & J. Webb, 2017)*, Impact of Workload and Job Complexity on Employee Job Performance with the Moderating Role of Social Support and Mediating Role of Job Stress* (Shabbir & Naqvi, 2017), *The effect of performance failure and task demand on the perception of mental workload* (Hancock, 1989), *Development of NASA-TLX (Task Load Index): Results of Empirical and Theoretical Research* (Hart & Staveland, 1988), *Comparison of Four Subjective Workload Rating Scales* (Hill, et al., 1992), *Evaluation of Subjective Mental Workload: A Comparison of SWAT, NASA-TLX, and Workload Profile Methods* (Rubio, et al., 2004), *The Impact of Job Satisfaction, Job Attitude and Equity on Employee Performance* (Inuwa, 2015), *Influence of Mental Workload on Job Performance* (Omolayo & Omole, 2013), *Using NASA-TLX to evaluate the flight deck design in Design Phase of Aircraft* (Yiyuan, et al., 2011), *Operations in a Fuzzy-Valued Logic* (Dubois, 1979), *Fuzzy Logic and Approximate Reasoning* (Zadeh, 1975).

The benefit of this measurement and calculation is that it can be used to determine the optimal number of personnel needs and determine the grade of the position in the HRD Unit as an organization validation material. In addition to creating equal workload to each part of his work.

2. MATERIAL/METHODOLOGY.

2.1. Work Load Analysis.

Work Load Analysis is a number of work targets or target results that must be achieved in a certain unit of time. Or a management technique that is carried out systematically to obtain information about the level of effectiveness and work efficiency of an organization based on work volume. The workload is divided into 2 types, namely physical and mental workload.

Physical workload tends to lead to the burden that an employee receives in a job related to his physiological condition. Based on applicable regulations in the Navy there are 4 methods of approach in measuring workload, namely the work result approach, work object approach, work equipment approach and job assignment task approach. In this study, the assignment task assignment approach was used.

Mental workload is a factor that affects a person's mentality in a job, among others, because of the type of work, the work situation of response time, available completion time and individual factors (level of motivation, expertise, fatigue, allowable tolerance and performance tolerance). According to (Chang & Chen, 2006), pengukuran beban kerja mental dapat dilakukan dengan dua cara yaitu pengukuran secara objektif dan pengukuran secara subjektif

2.2. Measuring the Job Assignment Task Load (Applicable Regulations of the Navy).

This measurement or calculation involves 3 aspects of assessment, namely the workload index, average capability standard and work completion time. The formula for this calculation is:

$$\text{Number of Personnel} = \frac{\sum \text{Time end of the job}}{\sum \text{Effective time job}}$$

2.3. NASA-TLX (*NASA - Task Load Index).*

The NASA-TLX method was developed by Sandra G. Hart of NASA - Ames Research Center and Lowell E. Staveland of San Jose State University in 1981. NASA TLX uses 6 (six) dimensions to assess workload, namely mental needs, physical needs, time requirements, the level of frustration, performance and level of effort (Hart & Staveland, 1988) From each measure of workload, there is a scale that will be filled by respondents. Scale measurements on each indicator are explained in table 1. Scale and description of NASA-TLX dimensions.

Table 1. Scale and Dimension of NASA-TLX.

Dimensions	Scale
Mental Demand (MD) How much demand for mental and perceptual activities is needed in your work (example: thinking, deciding, counting, remembering, seeing and searching). Is the job easy or difficult, simple or complex, loose or tight?	Low - High
Physical Demand (PD) How much physical activity is needed in your work (example: pushing, pulling, rotating, controlling, running, etc.). Is the job easy or difficult, slow or fast, calm or hurry?	Low - High
Time Demand (TD) How much time pressure do you feel during work or elements of work taking place? Is the job slow and relaxed, or fast and tiring?	Low - High
Performance (P) How big is your success in achieving your work target? How satisfied are you with your performance in achieving these targets?	Low - High
Effort (EF) How much effort do you spend mentally and physically needed to reach your level of performance?	Low - High
Frustation (FR) How big is insecurity, despair, offense, stress, and disturbance compared to feeling safe, satisfied, suitable, comfortable, and self-satisfaction that is felt during the work?	Low - High

Steps to measuring mental workload with NASA-TLX method as follows:

a. Calculate product value

Product = Rating x Weight Factor... (1)

b. Calculate the value of Weighted Work Load (WWL)

WWL = $\sum Produk$..... (2)

c. Calculate the average of WWL

Average WWL = WWL / 15..... (3)

From the average value of WWL, the workload value of a worker will be known and in the category where the workload of the personnel is. The workload category is classified into 5 (five) categories, as shown in Table 2. Categories of Mental Workload.

Table 2. Mental Work Load Category NASA-TLX.

No	Average WWL Value Range	Category of Workload
1	0 - 20	Very low
2	21 - 40	Low
3	41 - 59	Medium
4	60 - 79	High
5	80 - 100	Very High

2.4. Fuzzy Logic.

Fuzzy logic is a method for processing variables that are biased or fuzzy and cannot be described with certainty (Zadeh, 1975). In fuzzy logic, fuzzy variables are described as sets whose members are the crisp value and membership function in the set. A Triangular Fuzzy Number is denoted as M = (a, b, c) where a <b <c, is a special fuzzy number and has a triangular type membership function as follows:

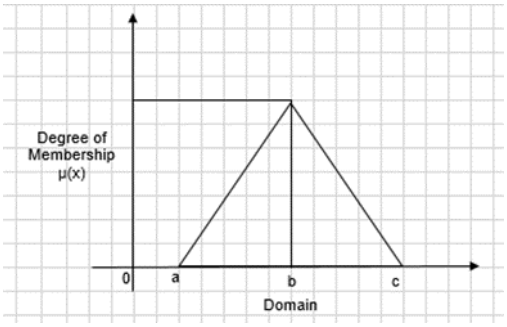


Fig. 1. Function of the Triangle Curve (Source: Zadeh, 1975).

$$\mu(x) \begin{cases} 0, & \text{if } x < a \\ (x-a)/(b-a), & \text{if } a < x \le b \\ (C-x)/(c-b), & \text{if } b < x \le c \\ 0, & \text{if } x > c \end{cases} \quad \dots (4)$$

(Source: Zadeh, 1975**).**

The next step is defuzzyfication. This stage is a calculation to obtain the output crips. There are several defuzzification methods, including the Maximum Membership Principle, the Centroid Method or Center of Gravity, the Average Weighted Method, the Mean Membership Method.

2.5. Methodology of Research.

The research design as outlined in the research flow diagram is shown in the following figure:

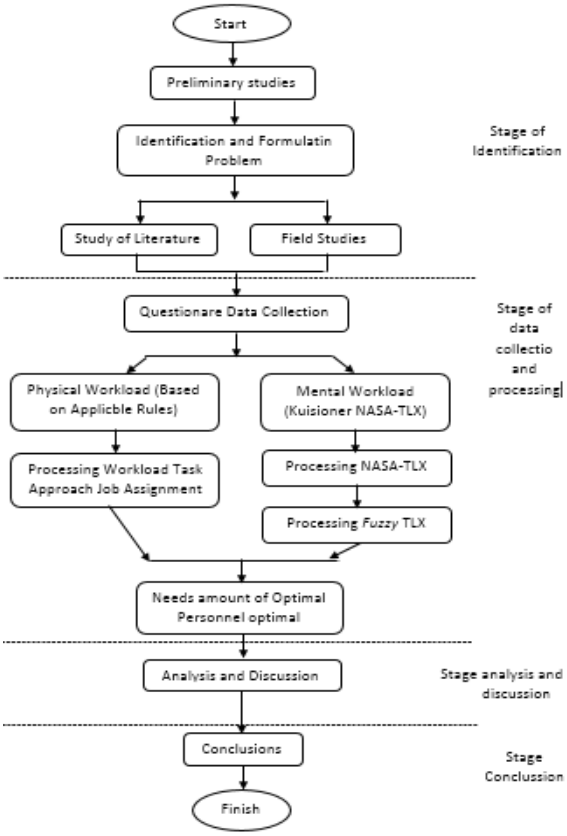


Fig. 2. Flow Chart of Research.

This stage starts from introduction, problem identification, liturgical and field studies, Job Description data collection in the HRD Unit, making NASA-TLX questionnaires, distributing questionnaires to respondents, processing data, analyzing data, conclusions and suggestions. This data retrieval process is carried out in the HRD Unit in each part of its work.

The data in this study consisted of primary data and secondary data. In the process of collecting, there are two stages, namely data to calculate workload based on the Work Load Analysis method (as a physical workload) and data to calculate the mental workload. For physical workload data collection refers to the job description while the mental workload by distributing questionnaires. The NASA TLX questionnaire consisted of two types, namely the questionnaire for weighting (Table 3) and the ranking questionnaire (Figure 3).

Table 3. Weighting Questionnaire.

No	Mental Work Load Indicator		
1	MD *(Mental Demand)*	vs	PD (Physical Demand)
2	MD *(Mental Demand)*	vs	TD (Temporal Demand)
3	MD *(Mental Demand)*	vs	P (Performance)
4	MD *(Mental Demand)*	vs	EF (Effort)
5	MD *(Mental Demand)*	vs	FR (Frustation)
6	PD (Physical Demand)	vs	TD (Temporal Demand)
7	PD (Physical Demand)	vs	P (Performance)
8	PD (Physical Demand)	vs	EF (Effort)
9	PD (Physical Demand)	vs	FR (Frustation)
10	TD (Temporal Demand)	vs	P (Performance)
11	TD (Temporal Demand)	vs	EF (Effort)
12	TD (Temporal Demand)	vs	FR (Frustation)
13	P (Performance)	vs	EF (Effort)
14	P (Performance)	vs	FR (Frustation)
15	EF (Effort)	vs	FR (Frustation)

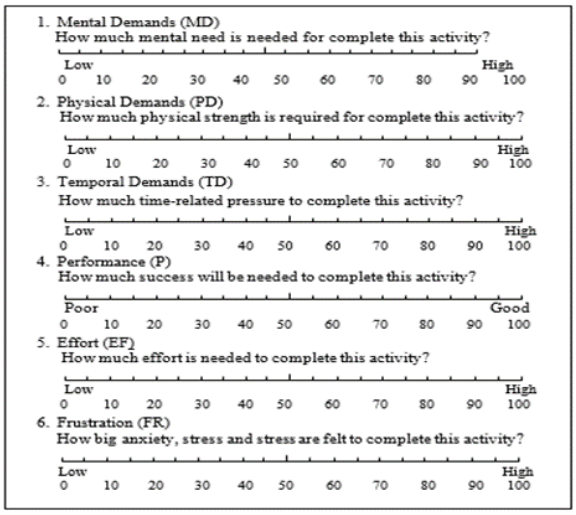


Fig. 3. Rating Questionnaire.

Data collection is carried out in the HRD Unit. The types of jobs in this unit when carrying out routine activities according to Job Description there are 55 types of work tasks, as shown in table 4.

Table 4. Type of work in the HRD Unit.

Work Section	Job type / Position	Total
Administrative Affairs	Head of Administrative	1
	Head of Administrative Affairs	1
	Staf	5
	Administrative Affairs Officer	1
	Staf	3
	Head Of Internal Service Affairs	1
	Staf	14
Section Operation	Head Of The Operations Section	1
	Head of Operation Planning Sub-Section	1
	Staf	2
	Head of Screening Sub-Section	1
	Staf	4
Provision Administration on Section	Head of Provision Administration Section	1
	Head of Budget Administration Sub Section	1
	Staf	3
	Head of Sub-Department of Settlement	1
	Head of Prospective Administrative Affairs for Civil Servants	1
	Officer for Administrative Affairs for Prospective Soldiers	1
	Staf	2
Study Section	Head of Study Section	1
	Head of Data Subdivision	1
	Staf	2
	Head of Evaluation and Report Sub-Section	1
	Staf	2
State Property Affairs	Officers of State Property	1
	Staf	2

The process of measuring the physical workload of personnel in this study includes several stages, namely determining the effective work time, setting the average ability standard (SKR) and calculating the workload with the assigned task assignment method. As a support unit of operation for allowance (allowance) of 30% so that the effective working time is 237 days = 5.67 hours = 340.2 minutes. According to table 5. Effective working time.

Table 5. Effective Working Time.

Effective Working Time		Hour	Minute
Allowance Operating Unit (20%)	Day	6,48	388,8
	Week	32,4	1.944,00
	Month	129,6	7.776,00
	Year	1.522,80	91.368,00
Allowance Operations Support Unit (30%)	Day	5,67	340,2
	Week	28,4	1.701,00
	Month	113,4	6.804,00
	Year	1.332,50	79.947,00

In the regulations in force in the Navy, the average standard ability score has been determined for each job both in the operating unit and in the supporting unit. In this study, for Standard Ability Standards that were not yet in the regulations in the Navy, data were collected directly to personnel in the HRD Unit. As an example of the calculation of workload based on applicable Regulations in the Navy with the job assignment task approach shown in table 6. Operating Section workload.

Table 6. Section of Operating Work Loads

NO	DESCRIPTION OF ACTIVITIES PER POST	UNIT RESULTS	WORK VOLUME / WORK LOAD						SAA	WORK LOAD/ DUTY
			DAY	WEEK	MONTH	TW	SMT	YEAR		
1	2	3	4	5	6	7	8	9	10	11
A	**MAIN TASKS**									
1	Prepare a plan of activities / implementation of the provision of career warriors and civil servants.	Scripts & Activities				4		2	462	138,60
2	Plan the determination of the city / area that is the place of registration based on observations and the results of coordination with the assessment section	Scripts & Activities				4		2	462	138,60
3	Oversee the operation of the tests both at the regional level and at the Central level.	Scripts & Activities				4		2	462	138,60
4	Coordinate with other Satker related to the use of examiners	Scripts & Activities				1		1	462	38,50
5	Coordinate with Kotama who is appointed by the Indonesian Navy Chief about the use of Indonesian Navy's KRI and Pesud if needed.	Scripts & Activities		1					450	390,00
6	Coordinate with Paban - II Binteman Spers Kasal about the target number and target honesty according to the Probability of the Indonesian Navy.	Activities		1					120	104,00
7	Carry out publications to the public.	Activities				1		1	462	38,50
8	Submitting considerations and suggestions to Kalapetal, especially regarding matters relating to the field of work.	Coordination	1						60	235,00
B	**ADDITIONAL TASKS**									
1	Morning Roll call	Activities	1						30	117,50
2	Afternoon Roll Call	Activities	1						15	58,75
3	Flag Raising Ceremony	Activities			1				60	12,00
4	Coordination meetings	Activities		1	2	2	2	10	120	196,00
5	National Day Ceremony	Activities						6	60	6,00
6	Indonesian Navy Day Ceremony	Activities						6	60	6,00
7	Record the disposition of incoming letters from Aspers Kasal	Activities	1						30	117,50
9	Make a draft letter out	Activities		1					60	52,00
12	Working Group Coordination Meeting	Activities		1					45	39,00
13	Make a concept of candidate acceptance / selection activities	Scripts & Activities		1					120	104,00
14	Make a concept of socialization / campaign activities	Activities		1					120	104,00
15	Carry out werving activities	Activities			1				1440	288,00
16	Concept training activities	Coordinatio	1						120	470,00
17	Carry out direct supervision of the reception selection process	Activities		1					120	104,00
	TOTAL WORK LOADS									**2896,55**

In the same way workloads are sought for all types of work. After knowing the total workload and effective time of work, it can be known the needs of personnel to carry out these work tasks, as shown in table 6. Total workload and personnel needs based on calculations in the Navy. From these results it is known the personnel needs of each job.

After obtaining the results of personnel requirements based on the prevailing regulations in the Navy with the job assignment task approach, the next step is measuring the mental workload of each soldier, where the number of respondents to fill in the NASA TLX rating questionnaire is in figure 3. The respondents to the weighting questionnaire are officers from each part of the work area.

Table 7. Total Workload and Personnel Requirements Based on Applicable Calculations.

Job/Position	Total Work Load	Time Work Effective	Personal Needs
Head of Administrative	7375,75	1333	6
Head of Administrative Affairs	2896,55	1333	2
Administrative Affairs Officer	6897,25	1333	5
Head of Administrative Affairs Officer	6192,25	1333	5
Head Of Internal Service Affairs	5145,45	1333	4
Head Of The Operations Section	4722,95	1333	4
Head of Operation Planning Subsection	7145,75	1333	5
Head of Screening Subsection	6906,25	1333	5
Head of Provision Administration Section	5326,35	1333	4
Head of Budget Administration Sub Section	4722,95	1333	4
Head of Sub-Department of Settlement	6906,25	1333	5
Head of Prospective Administrative Affairs of Civil Servants	2896,55	1333	2
Officer for Administrative Affairs for Prospective Soldiers	5145,45	1333	4
Head of Study Section	4722,95	1333	4
Head of Data Subdivision	6906,25	1333	5
Head of Evaluation and Report Subsection	5326,35	1333	4
Officers of State Property	7145,75	1333	5
Number Personal Optimal			**73**

After getting the questionnaire sheet from all respondents, the next step is to calculate the results of the rating and the results of the weight comparison. Where the number of ratings per point is multiplied by the number of weights generated by the weighting of NASA TLX at each point called the Weighted Workload (WWL), then the results of multiplication between the rating and the weight of each indicator are summed and divided by Divided Constant equal to 15 (number of comparators), it will obtain Average Weighted Workload (AVG WWL) or average Workload. The results of the questionnaire for Weighting Values from each work section are shown in Table 8. Weighting of NASA TLX. While the results of the mental workload rating questionnaire and the results of the Average Weighted Workload (AVG WWL) are shown in table 9 Recapitulation of the NASA TLX Questionnaire.

Table 8. Weighting of NASA-TLX.

	Administrative Affairs	Operation Section	Administration Section Provision	Assessment Section
Mental Demand (MD)	3	2	1	2
Physical Demand (PD)	2	1	4	4
Temporal Demand (TD)	3	3	3	4
Performance (P)	2	4	2	1
Effort (EF)	4	3	4	3
Frustration (FR)	1	2	1	1
Total	15	15	15	15

Table 9. Recapitulation of the NASA-TLX Questionnaire.

Administrative Affairs	Resp	Weight / Rating							Product Value							WWL	DC	Average WWL
		MD3	PD2	TD3	P2	EF4	FR1		MD	PD	TD	P	EF	FR				
Head of Administration	1	80	70	80	90	80	60		240	140	240	180	320	60		1180	15	78.67
Head of Administrative Affairs	1	70	70	80	80	70	60		210	140	240	160	280	60		1090	15	72.67
Administrative Affairs Officer	1	80	80	60	60	60	40		240	160	180	120	240	40		980	15	65.33
Head Of Administration	1	80	50	70	60	70	40		240	100	210	120	280	40		990	15	66.00
Head Of Internal Service Affairs	1	80	70	70	70	70	60		240	140	210	140	280	60		1070	15	71.33

Operation Section	Resp	Weight / Rating							Product Value							WWL	DC	Average WWL
		MD2	PD1	TD3	P4	EF3	FR2		MD	PD	TD	P	EF	FR				
Head Of The Operations Section	1	60	70	60	70	80	50		120	70	180	280	240	100		990	15	66.00
Head of Operation Planning Subsection	1	60	70	50	70	70	70		120	70	150	280	210	140		970	15	64.67
Head of Screening Subsection	3	70	70	60	70	70	70		140	70	180	280	210	140		1020	15	68.00

Provision Administration Section	Resp	Weight / Rating							Product Value							WWL	DC	Average WWL
		MD1	PD4	TD3	P2	EF4	FR1		MD	PD	TD	P	EF	FR				
Head of Provision Administration Section	1	80	80	70	80	80	70		80	320	210	160	320	70		1160	15	77.33
Head of Budget Administration Sub Section	2	80	80	90	90	80	50		80	320	270	180	320	50		1220	15	81.33
Head of Sub-Department of Settlement	3	90	90	80	90	70	70		90	360	240	180	280	70		1220	15	81.33
Head of Prospective Administrative Affairs of Civil Servants	4	80	80	90	90	70	50		80	320	270	180	280	50		1180	15	78.67
Officer for Administrative Affairs for Prospective Soldiers	5	80	90	80	80	80	50		80	360	240	160	320	50		1210	15	80.67

Study Section	Resp	Weight / Rating							Product Value							WWL	DC	Average WWL
		MD2	PD4	TD4	P1	EF3	FR1		MD	PD	TD	P	EF	FR				
Head of Study Section	1	70	90	80	90	80	50		140	360	320	90	240	50		1200	15	80.00
Head of Data Subdivision	2	80	80	80	80	80	60		160	320	320	80	240	60		1180	15	78.67
Head of Evaluation and Report Subsection	3	70	80	80	80	80	70		140	320	320	80	240	70		1170	15	78.00
Officers of State Property	4	80	80	90	90	70	50		80	320	270	180	280	50		1180	15	78.67

After obtaining the results of processing mental workload data, then processed by Fuzzy method. This is done because of the uncertainty of the value of the workload of personnel carrying out the same task. In this method there are two stages, namely fuzzification and defuzzyfication.

a. Fuzzification.

At this stage the input crips are determined first. The requirement to change input crips into fuzzy input is to determine the membership function for each input. The WWL Average Value of the results of processing questionnaire data is used as Input crips Value, as shown in table 4 Crips Input. To determine the membership function, use the triangle curve function.

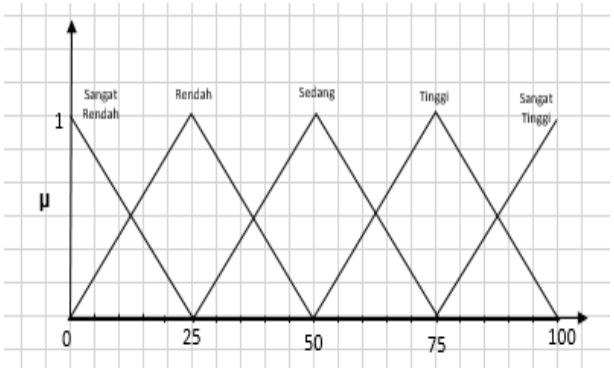


Fig. 4. Triangle curve.

In this fuzzification process, a calculation sample of Head of Administrative respondents will be taken. In the type of work the Head of Administrative has Crisp Input 78.67. Where the value of 78.67 is found in "high" and "very high" linguistic scales. The segitinga curve for the Head of Administrative is shown in Figure 5. Triangle Head of Administrative Curve.

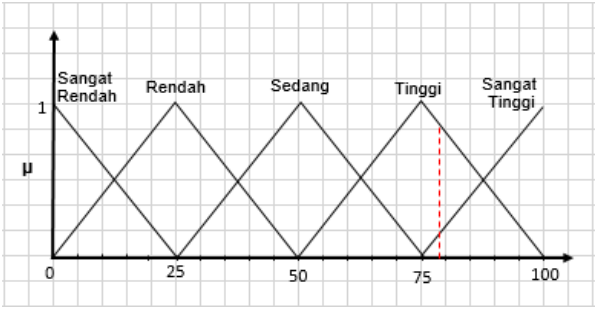


Fig. 5. Triangle Curve Head of Administrative.

From the Head of Administrative with input value of 78.67 crisp, then at linguistic scale height is at b≤x≤c, where x is the value of 78.67, b is the middle value of high linguistic that is 75, and c is the value of 100. So the degree of membership from the Head of Administrative for high linguistic scales is as follows:

$$\mu A = \frac{(x-a)}{(b-a)}$$

$$\mu A = \frac{(100-78{,}67)}{(100-75)}$$

$$\mu A = 0,\ 85$$

While on the linguistic scale is very high, the location of the value of 78.67 is in a≤x≤b, where x is the value of 78.67, b is the value of 100, while a is the lower limit value of a very high scale of 75. So the degree of Head of The administration for very high linguistic scales is as follows:

$$\mu A = \frac{(c-x)}{(c-b)}$$

$$\mu A = \frac{(78{,}67-75)}{(100-75)}$$

$$= 0,\ 15$$

In the same way also calculated for each respondent from each job, the results obtained from the degree of membership as shown in table 10 Fuzzification.

Table 10. Fuzification.Administrative Affairs.

No	Job Position	Linguistic Scale	X	μA
1	Head of Administrative	High	78.67	0.85
		Very High	78.67	0.15
2	Head of Administrative Affairs	Medium	72.67	0.09
		High	72.67	0.91
3	Administrative Affairs Officer	Medium	74.00	0.04
		High	74.00	0.96
4	Head of Administrative Affairs Officer	Medium	65.33	0.39
		High	65.33	0.61
5	Head Of Internal Service Affairs	Medium	66.00	0.36
		High	66.00	0.64

Operation Section.

No	Job Position	Linguistic Scale	X	μA
1	Head Of The Operations Section	Medium	66.00	0.36
		High	66.00	0.64
2	Head of Operation Planning Subsection	Medium	64.67	0.41
		High	64.67	0.59
3	Head of Screening Subsection	Medium	68.00	0.28
		High	68.00	0.72

Provision Administration Section.

No	Job Position	Linguistic Scale	X	μA
1	Head of Provision Administration Section	High	77.33	0.91
		Very High	77.33	0.09
2	Head of Budget Administration Sub Section	High	81.33	0.75
		Very High	81.33	0.25
3	Head of Sub-Department of Settlement	High	81.33	0.75
		Very High	81.33	0.25
4	Head of Prospective Administrative Affairs of Civil Servants	High	78.67	0.85
		Very High	78.67	0.15
5	Officer for Administrative Affairs for Prospective Soldiers	High	80.67	0.77
		Very High	80.67	0.23

Study Section.

No	Job Position	Linguistic Scale	X	μA
1	Head of Study Section	High	80.00	0.80
		Very High	80.00	0.20
2	Head of Data Subdivision	High	78.67	0.85
		Very high	78.67	0.15
3	Head of Evaluation and Report Subsection	High	78.00	0.88
		Very High	78.00	0.12
4	Officers of State Property	High	78.00	0.88
		Very High	78.00	0.12

b. Defuzification

After fuzification is carried out, the next step is Defuzification, which is the step of changing the value of fuzy into output crips. The method used is the method of COG (Center Of Gravity). Defuzzification calculations in the Administrative Affairs work are as follows:

$$COG = \frac{\sum x.\mu\,()}{\sum \mu(A)}$$

$$= \frac{(78{,}67 \text{ x } 0{,}85)+(78{,}67 \text{ x } 0{,}15)}{(0{,}85 + 0{,}15)}$$

$$= 78,\ 67$$

So the defuzification value of Administrative Affairs is 78, 67. For the complete results of the defuzification calculation for each type of work in the HRD Unit, it is shown in Table 11. Defuzification Results.

Table 11. Defuzifikasi.

Section	Job Position	Value (COG)
Administrative Affairs	Head of Administrative	75.11
	Head of Administrative Affairs	67.11
	Administrative Affairs Officer	69.11
	Head of Administrative Affairs Officer	78.89
	Head Of Internal Service Affairs	77.00
Operation Section	Head Of The Operations Section	67.19
	Head of Operation Planning Subsection	71.33
	Head of Screening Subsection	79.93
Provision Administration Section	Head of Provision Administration Section	72.00
	Head of Budget Administration Sub Section	71.25

Section	Job Position	Value
Provision Administration Section	Head of Sub-Department of Settlement	79.00
	Head of Prospective Administrative Affairs of Civil Servants	67.17
	Officer for Administrative Affairs for Prospective Soldiers	67.17
Study Section	Head of Study Section	72.00
	Head of Data Subdivision	71.25
	Head of Evaluation and Report Subsection	79.00
	Officers of State Property	67.17

3. DISCUSSION.

Regulations that apply in Navy, according to the Administrative Instructions for Assessment and Calculation of Workloads in the Soldiers Organization Environment are guidelines for calculating workloads and determining the number of personnel in the Navy organizational environment. In this regulation, it is indicated as a physical workload. The results of the calculation of workload based on the assignment of job officers can be seen in figure 6. Total workload.

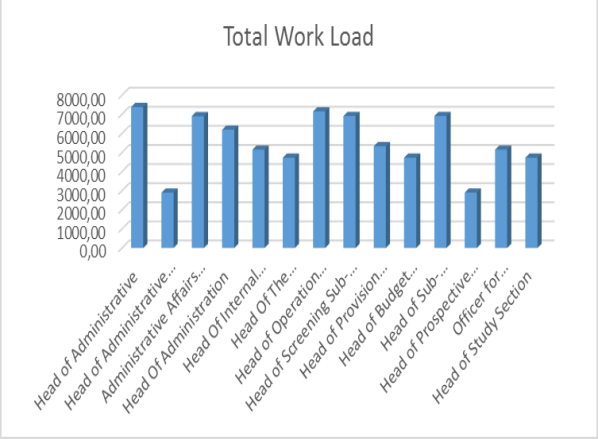


Fig. 6. Total Workload of HRD Unit Personnel.

The graph shows that the greatest total workload is the work of the Head of Administrative with a total workload of 7375, 75, while they work with the lowest total workload is the Head of Administrative Affairs and the Head of Prospective Administrative Affairs for Civil Servants with a value of 2896, 55. The personnel requirements of each type of work based on this method are 5, 53 Head of Administrative, 2,17 Head of Administrative Affairs, 5,17 Administrative Affairs Officer, 4,65 Head Of Administration, 3,86 Head of Internal Service Affairs, Head Of The Operations Section 3,54, Head of Operation Planning Sub-Section 5.36, Head of Screening Sub-Section 5,18, Head of Provision Administration Section 4,00, Head of Budget Administration Sub Section 3,54, Head of Sub-Department of Settlement 5,18, Head of Prospective Administrative Affairs for Civil Servants 2,17, Officer for Administrative Affairs for Prospective Soldiers 3,86, Head of Study Section 3,54, Head of Data Subdivision 5,18, Head of Evaluation and Report Sub-Section 4,00 and Officers of Property State 5,36.

The mental workload felt by each head official in each section is different. For example, the mental workload at work The Head of Administrative has a workload of 78.67, Head of Operations Section 66.00, Head of Provision Administration Section 77, 33 and Head of Study Section 80.00. After being defuzzi, the Head of Administrative mental workload value is 75.11. The complete results of mental workload value are in accordance with table 11.

After knowing the personnel requirements based on the applicable regulation in the Navy, which is indicated as a physical workload and the mental workload value of each personnel per job, then the two results of the calculation are combined to obtain the optimal number of personnel. Before being combined, the results of the mental workload were changed to index NASA TLX in the form of

percent consisting of 4 categories, namely low, sufficient, normal and excessive. In accordance with figure 7. NASA-TLX Index Category.

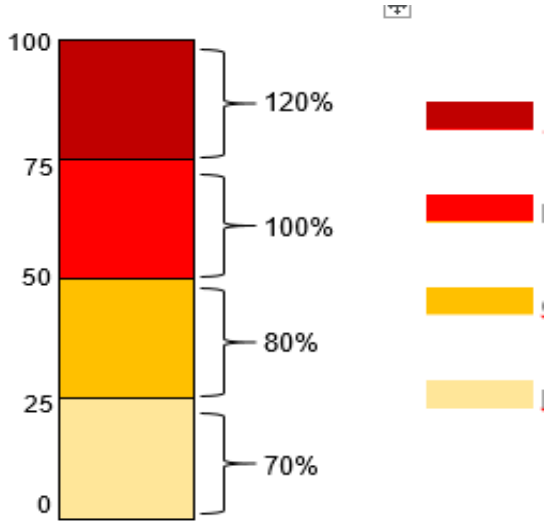


Fig. 7. NASA-TLX Index Category.

The above information is: 120% excess, 100% Normal, 80% sufficient, 70% lower. The results of the calculation of mental workload after being converted are the results that 11 positions / sections are included in the category of sufficient mental workload, while 6 positions / sections are in the lowest category. To calculate the optimal personnel requirements with the following formula:

$$Z = X * Y$$

Information:

Z : Number of personnel needed

X : Result of calculation of physical workload

By : Result of mental workload conversion into NASA-TLX Index

The results of calculating the optimal number of personnel requirements are shown in table 12. Amount of Personnel Requirements of part of work.

Table 12. Number of Personnel Needs Part of Job.

No	Work Position	Personel Needs (perpang TNI)	NASA TLX		Optimal personal needs
			Nasa TLX	Indeks Nasa TLX	
1	Head of Administrative	6	75,11	120%	0,85
2	Head of Administrative Affairs	2	67,11	100%	2,17
3	Administrative Affairs Officer	5	69,11	100%	5,17
4	Head Of Administration	5	78,89	120%	5,58
5	Head Of Internal Service Affairs	4	77	120%	4,63
6	Head Of The Operations Section	4	67,19	100%	3,54
7	Head of Operation Planning Sub-Section	5	71,33	100%	5,36
8	Head of Screening Sub-Section	5	79,93	120%	6,22
9	Head of Provision Administration Section	4	72	100%	4
10	Head of Budget Administration Sub Section	4	71,25	120%	4,25
11	Head of Sub-Department of Settlement	5	79	120%	6,22
12	Head of Prospective Administrative Affairs for Civil Servants	2	67,17	100%	2,17
13	Officer for Administrative Affairs for Prospective Soldiers	4	67,17	120%	4,63
14	Head of Study Section	4	72	100%	3,54
15	Head of Data Subdivision	5	71,25	100%	5,18
16	Head of Evaluation and Report Sub-Section	4	79	120%	4,8
17	Officers of State Property	5	67,17	100%	5,36

The results of this calculation are then compared with the existing conditions to find out the advantages and disadvantages of the number of personnel in the HRD Unit. To make it easier to compare the number of personnel, the results of these calculations are rounded up first, as shown in table 13.

Table 13. Comparison of Personnel Requirements (Applicable Regulations of the Navy) with Mental Workload Requirements.

Work/ Position	Personel Needs (perpang TNI)	Rounding	Personel Needs (Perpang TNI) + Mental Work Load	Rounding
Head of Administrative	5,53	6	0,85	1
Head of Administrative Affairs	2,17	2	2,17	2
Administrative Affairs Officer	5,17	5	5,17	5
Head Of Administration	4,65	5	5,58	6
Head Of Internal Service Affairs	3,86	4	4,63	5
Head Of The Operations Section	3,54	4	3,54	4
Head of Operation Planning Sub-Section	5,36	5	5,36	5
Head of Screening Sub-Section	5,18	5	6,22	6
Head of Provision Administration Section	4	4	4	4
Head of Budget Administration Sub Section	3,54	4	4,25	4
Head of Sub-Department of Settlement	5,18	5	6,22	6
Head of Prospective Administrative Affairs for Civil Servants	2,17	2	2,17	2
Officer for Administrative Affairs for Prospective Soldiers	3,86	4	4,63	5
Head of Study Section	3,54	4	3,54	4
Head of Data Subdivision	5,18	5	5,18	5
Head of Evaluation and Report Sub-Section	4	4	4,8	5
Officers of State Property	5,36	5	5,36	5
		73		74

Table 14. Comparison of Needs for Number of Personnel Results of Calculation with Existing Conditions.

Work Position	Work Load Analysis + Fuzzy Nasa TLX	Eksisting
Head of Administrative	1	1
Administrative Affairs Officer	1	1
Staf	1	5
Head Of Administration	1	1
Staf	4	3
Head Of Internal Service Affairs	1	1
Staf	5	14
Head Of The Operations Section	1	1
Staf	4	0
Head of Operation Planning Sub-Section	1	1
Staf	3	2
Head of Screening Sub-Section	1	1
Staf	4	4
Head of Provision Administration Section	1	1
Staf	5	0
Head of Budget Administration Sub Section	1	1
Staf	3	3
Head of Sub-Department of Settlement	1	1
Staf	3	0
Head of Prospective Administrative Affairs for Civil Serva	1	1
Staf	5	1
Officer for Administrative Affairs for Prospective Soldiers	1	1
Staf	1	2
Head of Study Section	1	1
Staf	4	0
Head of Data Subdivision	1	1
Staf	3	2
Head of Evaluation and Report Sub-Section	1	1
Staf	4	2
Officers of State Property	1	1
Staf	4	2
Total Personel	**74**	**55**

The comparison results can be illustrated by the following graph:

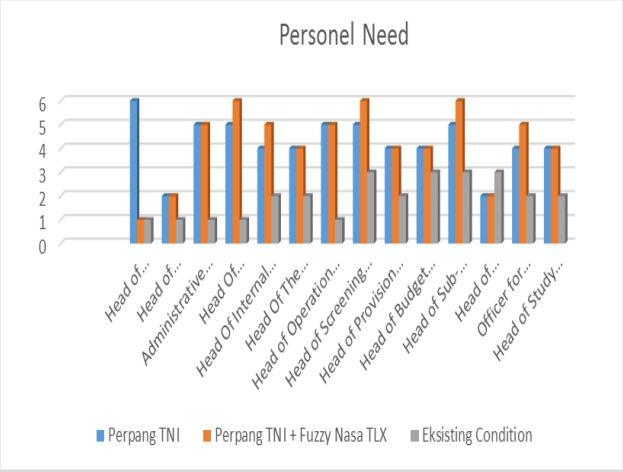


Fig. 8. Comparison of personnel requirements.

From the graph it can be explained that there are 10 types of work that still lack personnel, namely Head of Administration needs of 1 person, Head of Operations Section 4 people, Head of Operation Planning Subsection 1 person, Head of Provision Administration Section 5 people, Head of Sub-Department of Settlement 3 people, Head of Prospective Administrative Affairs for Civil Servants 4 people, Head of Study Section 4 people, Head of Data Subdivision 1 person, Head of Evaluation and Report Subsection 2 personnel. Whereas the excess personnel are in the Administrative Affairs Officer where the optimal needs are 2 people, but the existing conditions are 6 people, the Head Of Internal Service Affairs is optimal needs of 6 people, but the existing conditions are 15 people, the Officer for Administrative Affairs for Prospective Soldiers 2 people are optimal needs but the existing conditions are 3 people.

4. CONCLUSION.

From the results of this study, it is known that the workload of personnel in each job in the HRD Unit that is carrying out tasks is different. Based on the calculation based on Work Load Analysis with the job assignment task approach indicated as physical workload the results show that the highest total workload is the Head of Administrative with a total workload value of 7375,75 and for the work with the lowest total workload is the Head of Administrative Affairs and Head of Prospective Administrative Affairs for Civil Servants with total workload value of 2896,55. As for the mental workload of HRD Unit personnel, the work of the Head of Screening Subsection has the highest mental workload with a workload value of 79.93 which falls into the high category. While the work that has the lowest mental workload of Head of Administrative Affairs with a workload value of 67.11. By combining the two results of the calculation can be obtained the optimal number of personnel needs. The optimal number of personnel needs for each of these jobs per part of the work is the Administrative section of 15 people, Operation

Section 14 people, Administration and Provision Section 22 people, Study Section 19 people. The optimal number of personnel is 74 people and 1 Head of HRD Unit.

BIBLIOGRAPHY.

Ali, W., Raheem, A., Navaz, A. & Imamudin, K., 2014. Impact of Stress on Job Performance: An Empirical study of the Employees of Private Sector Universities of Karachi. *Research Journal of Management Sciences,* pp. 14-17.

Amady, M. M., Raufaste, E., Pride, H. & Meyer, J. P., 2013. Fuzzy-TLX: using fuzzy integrals for evaluating human mental workload with NASA-Task Load in laboratory and field studies. *Ergonomics Journal,* Volume 56, pp. 752-763.

Behesti, M., 2015. The role of workload and job satisfaction in general health. *Original Artikel,* 3(1).

Budiman, Y. & Putranto, A., 2015. Workload Analysis For Planning Needs of Employee In PT. Batuwangi Putra Sejahtera. *Business and Management ITB,* 4(4), pp. 494-500.

Chang, S. & Chen, T., 2006. *Discriminating Relative Workload Level by Data Envelopment Analysis.* s.l.:Industrial Ergonomic.

Chethan, Pushpalatha & Boraiah, R., 2016. A Survey on Analysis and Classification of Workload in Cloud. *International Journal of Recent Trends in Enginering & Research,* pp. 182-189.

Costello, D., 2006. Leveraging the Employee Life Cycle. *CRM Magazine,* 10(12), pp. 40-48.

Dasgupta, P., 2013. Volatility of workload on employee performance and significance of motivation: IT sector. *Science Journal of Business and Management,* 1(1), pp. 1-7.

Didomenico, A. & Nussbaum, M., 2011. Effect of Diffrent Physical Work Load Parameters on Mental Work Load and Performance. *International Journal of Industrial Ergonomics,* pp. 255-260.

Dubois, D., 1979. Operations in a Fuzzy-Valued Logic. *Information and Control,* Volume 43, pp. 224-240.

Eraslan, E., 2013. An Integrated Mental Work Load Assessment Method by Using AHP. *Engineering Faculty, Department of Industrial Engineering Baskent University.*

Ghanbarry, S., Ashnagar, M., Habibi, E. & Sadeghi, S., 2016. Evaluation of Rating Scale Mental Effort (RSME) effectiveness of the mental workload assessment in nurses. *JOHE Autumn,* 5(4), pp. 211-217.

Hancock, P., 1989. The effect of performance failure and task demand on the perception of mental workload. *Applied Ergonomics,* 20(3), pp. 197-205.

Harky, Y. F. M., 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,* February, 09(02), pp. 20393-20401.

Hart, S. G. & Staveland, L. E., 1988. Development of NASA_TLX (Task Load Index): Results of Empirical and Theoretical Research. *Advances in Psychology,* pp. 139-183.

Hill, S. G. et al., 1992. Comparison of Four Subjective Workload Rating Scales. *The Journal of the Human Factors and Ergonomics Society ,* pp. 429-439.

Indonesian Navy Headquarters, 2013. Master Guide for the Development of the Navy Personnel and Manpower Fields (PUM-6)..

Inuwa, M., 2015. The Impact of Job Satisfaction, Job Attitude and Equity on Employee Performance. *The International Journal Of Business & Management ,* 3(5), pp. 288-293.

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,* January, 10(1), pp. 27-33.

Omolayo, B. O. & Omole, O. C., 2013. Influence of Mental Workload on Job Performance. *International Journal of Humanities and Social Science ,* Volume 3, pp. 238-246.

Qureshi, M., 2013. Relationship Between Job Stress, Workload, Environment and Employees Turnover Intentions: What We Know, What Should We Know. *World Applied Sciences Journal,* pp. 764-770.

Rubio, S., Díaz, E. & Martín, J., 2004. Evaluation of Subjective Mental Workload: A Comparison of SWAT, NASA-TLX, and Workload Profile Methods. *Applied Psychology : An International Review,* Volume 53, pp. 61-86.

Shabbir, B. & Naqvi, R., 2017. Impact of Workload and Job Complexity on Employee Job Performance with the Moderating Role of Social Support and Mediating Role of Job Stress. *Journal of Accounting & Marketing* , 6(1), pp. 1-7.

Shabbir, B. & Naqvi, R., 2017. Impact of Workload and Job Complexity on Employee Job Performance with the Moderating Role of Social Support and Mediating Role of Job Stress. *Journal of Accounting & Marketing,* 6(214).

Shah, S. S. H. et al., 2011. Workload and Performance of Employees. *Interdisciplinary Journal of Contemporary Research in Business,* September, 3(5), pp. 256-267.

Walters, C. & J. Webb, P., 2017. Maximizing Efficiency and Reducing Robotic Surgery Costs Using the NASA Task Load Index. *AORN Journal,* October, 106(4), pp. 283-294.

Wutsqo, W. U., 2017. *Pengaruh Mutasi dan Pemberian Insentif terhadap Kinerja Pegawai..* Yogyakarta: Universitas Negeri Yogyakarta.

Yiyuan, Z., Tangwen, Y., Dayong, D. & Shan, F., 2011. Using NASA-TLX to evaluate the flight deck design in Design Phase of Aircraft. *Procedia Engineering,* Volume 17, pp. 77-83.

Zadeh, L. A., 1975. Fuzzy Logic and Approximate Reasoning. *Synthese,* pp. 407-428.

APPLYING MODELS AND STRATEGIES LEARNING BASED ON INFORMATION TECHNOLOGY FOR MARCH EDUCATION IN BASIC, MEDIUM AND HIGH EDUCATION INSTITUTIONS

Adi Bandono[1], Sukmo Hadi Nugroho[2], Eny Fariatul Fahyuni[3]

[1,2] Indonesian Naval Technology College, STTAL Surabaya, Indonesia
[3] Muhammadiyah University, Umsida Sidoarjo, Indonesia

ABSTRACT

Maritime policy that is promoted nationally by the Government must be balanced with policies implementing Maritime education. Maritime Education Policy has a high urgency to be applied in learning in basic education institutions (Playgroup, Primary school)), medium (junior high school,senior high school, intermediate school, and high (state college/ private college). This urgency needs to be supported by effective, efficient and attractive efforts through the application of information technology-based learning models and strategies that have now reached the level of the industrial revolution 4.0. The emergence of various applications such as distance learning implemented by the Open University, e-learning utilization at various universities to improve learning services, TV-Education broadcasting published by the Ministry of Education and Culture, and other applications that are managed professionally by the private sector such as Ruang- Teachers who are now national and are widely followed by teachers, provide many alternative models and IT-based learning strategies that can be applied to the successful implementation of Maritime Education in Indonesia. The optimal utilization of IT-based learning will provide full support and success to civilizing Maritime Education at all levels of education.

Keywords: *Maritime Education, learning models and strategies, information technology.*

1. INTRODUCTION

When writing the title of this paper, "Information Technology (IT) Based Learning Models and Strategy for Maritime Education in Primary, Secondary and Higher Education Institutions", I was reminded of the book published by AECT and written by Januszewski and Molenda in 2007 entitled "Educational Technology: a Definition With Commentary". It was stated in the book that science and technology (science and technology) always experiences the dynamics of change and development that is so fast and rapid. The dynamics of change and development need to be addressed by practitioners, developers and educational technology scientists who must continually improve their mindset as an innovator through reflective research and practice activities to build methodological constructs that are as good as theoretical constructions. Thus the theory and practice in the field of educational technology will increasingly develop beyond existing traditional concepts.

In the past, research methodology was still limited to the scope of quantitative and qualitative research fields and other forms of other research method disciplines. Along with the development of science and technology (mainly information technology), research activities are now increasingly having very good habits in generating new ideas and evaluative processes to help improve the quality of learning practices. At this time research in the field of learning technology has evolved from research that tries to "prove" that media and technology are effective tools for teaching, to research formulations to examine and test approaches to the application of processes and technology in order to improve the quality of learning. The development of a learning model and strategy is an example of a new breakthrough in creating research formulations in

the field of learning technology in order to improve the quality of learning towards a better direction.

The development of learning models in the field of learning technology has been influenced by developments and changes in learning theory, management of information and communication technology and other fields. The development of the theory of behaviorism, cognitivism and constructivism has changed the emphasis in the field of teaching and learning. The development of technology and communication has changed the flexibility of access to learning, which initially relies on a particular place and time, is now online that can be carried out anytime and anywhere students are. Attention to learners' perspectives, characteristics and ownership of the learning process has also grown and developed with the creation of learning models including new and more innovative learning media.

The theoretical shift has dramatically changed the orientation of the field from the field of design driven by teaching that is dominated by the role of the learner, now developing towards various formats that seek to create a learning environment where students can explore their own understanding. The emphasis of research in the field of learning technology has now shifted from learning design in routine perspective to a learning design environment that is able to facilitate learning.

Given the new paradigm shift in learning theories where there has come a greater recognition of the role of students in ownership and responsibility for learning activities, it is necessary to develop a learning model including the development of learning media that is able to build meaningfulness in learning by facilitating the existence of various kinds of hardware and software from information technology that is growing rapidly. With the rapid advancement of information and communication technology, maritime education can increasingly be applied more effectively, efficiently and highly attractive. Thus maritime characterization through information technology-based learning can be faster and more appropriate to be applied in daily learning activities, so that the mindset that was initially leaning towards the mainland can be changed to a maritime mindset.

1.1. Study and Learning

The conception of learning develops rapidly along with the dynamics of human life and the changing strategic environment. The development of the conception of learning is always followed by the development of learning practices. Thus, learning and learning are two conceptions that cannot be separated and are dynamic in keeping with the changing times.

Learning and learning is not a simple and easy process to be carried out, since the learning process itself involves various internal variables within the learner, and requires external stimulants in the form of efforts to learn the learner. Therefore, an understanding of the learning process is very useful for learners in applying the action of learning. Inaccuracy in implementing learning actions will have a negative impact on students, both on cognitive abilities, psychomotor and affective in a relatively long period of time.

The study of learning theory and learning can basically be divided into two, namely descriptive and prescriptive theories (Reigeluth, 1983 and Landa, 1983). Learning theory is descriptive, because it describes the learning process, whereas learning theory is more prescriptive, because the main purpose of learning theory is to establish learning methods (Degeng, 1989). Learning theory pays attention to the relationship between variables that determine learning outcomes, while learning theory pays attention to how a person influences other people to make the learning process happen.

Learning events experienced by students are strongly influenced by views of the learning process itself. There are three major views on the learning process that developed to date, namely: behaviorism, cognitivism and constructivism. The three approaches to learning theory provide guidance to the level of application in the form of efforts in learning actions. From the third approach of learning theory, learning theory was born.

Behaviorism theory. This theory views learning as a process of behavior change. Learning can be achieved through appropriate behavior from a number of responses or through a reinforcement approach, which is expected to be formed gradually, can be measured and observed. The application of behaviorism theory provides a set of systematically organized learning design instructions and reinforcement values based on the needs of individual learners. Learners as the designer of learning must follow the steps and progress of individual students. Learning objectives are clearly formulated, can be measured and quantified the results, while other processes that occur in the mind are ignored

Theory of Cognitivism. Cognitivism theory emphasizes the study of mental models and processes such as thinking, remembering and problem solving. Key memory structures and their processes are identified, defined as computers of the human memory system. Learning design that adopts cognitive theory focuses on promoting thought activities. The lessons and units are developed by layout arrangement, graphic design, presentation of content framework, etc. The learning design is focused so that it can help students in processing new information.

Constructivism Theory. Since the 1980s, a new view of learning has emerged, namely the theory of constructivism, which views that the learning process is an internal activity of students in building or constructing knowledge. Learners build meaningfulness through the application of knowledge to solve problems, interact with others and through the apprenticeship process. The learning design that adopts the theory of constructivism focuses on the activities of students in interacting with their social environment so that students are able to discover the meaningfulness of their own knowledge.

1.2. Learning Models and Learning Development Models

The model according to the Indonesian general dictionary (2006) is defined as a pattern (for example, references, variations) of something that will be made or produced. The model according to Murdick and Ross (1982) is a depiction of a reality or a planned one. The model according to Seels & Richey (1994) is an abstraction from something used to understand something that cannot be seen or experienced directly. Richey (1986) asserts that the model is a pattern of representation of a reality that is presented with structure and sequence. So it can be concluded that the model is a pattern to describe an abstract reality, and has a structure and sequence.

The model referred to in this discussion is the learning model. Learning media are included in a small part of the learning model. Reigeluth (1983) argues that the learning model is a representation of a learning method that contains a set of integrated learning strategies and is described in detail as a guide in implementing learning practices. The position of the model in the learning variable, can be described as follows:

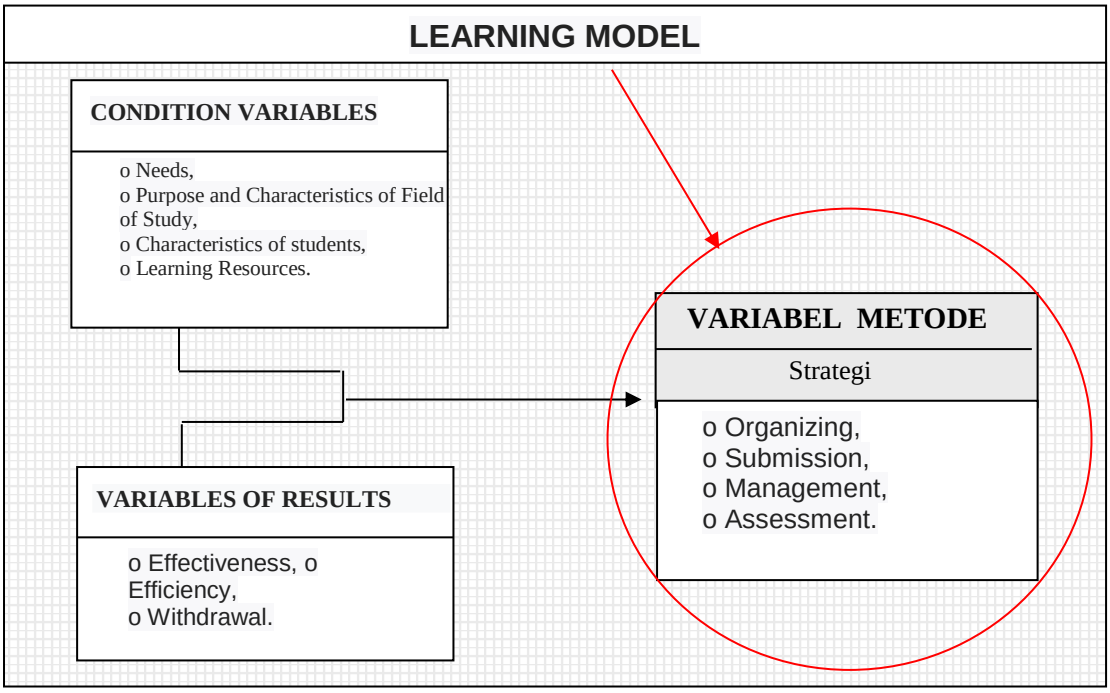


Figure 1: Model Position in Learning Variables
(modification of Reigeluth's thinking (1983) and Degeng (1989).

Model bridges between theory and practice, meaning that the model is translating from theory into a concrete and practical world. Therefore a model is prescriptive. As a model, the entire set of activities is based on theories including: system theory, communication theory, learning theory and learning theory. This means that a model must be able to bridge between theory and practice, where its role can be described as follows:

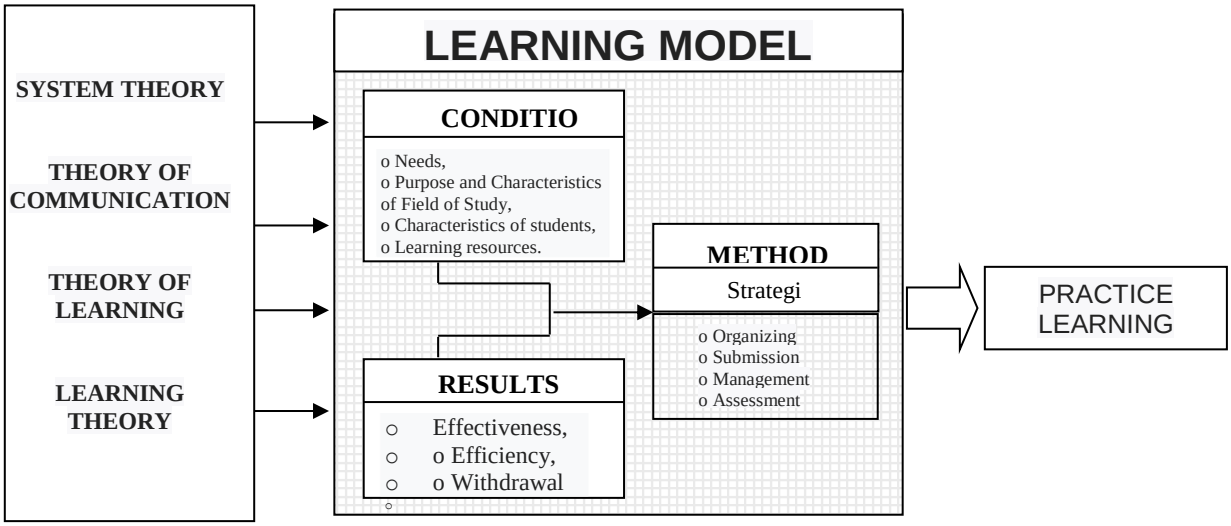


Figure 2: The Model Becomes a Bridge between Theory and Practice
(modification of Reigeluth's (1983) and Degeng (1989) thinking, Rickey (1986)

The learning model is distinguished from the learning development model. The scope of the learning model is a micro-scope, how a learning method with all the strategic procedures is applied and described in detail. The scope of the learning development model is the scope of the macro, how a learning method, selected through a series of analysis processes, is designed, developed, produced, applied, evaluated and installed as a series of learning development processes.

Heinich, Molenda and Russel (1993) describe the development of learning as a process of needs analysis, determining material, setting goals, designing material to achieve goals, carrying out trials and revising programs. Morrison, Ross and Kemp (2004) emphasize that learning development activities describe management functions in a systematic learning plan, including determining and supervising personnel, as well as allocating budgets, etc.

There are many types of learning models. Molenda, et al. (1996), divides into two groups, namely the Micromorf and Paramorf models. Micromorf is a visual model that is physically tangible, for example: Planetariums, Bridge Simulators, etc. Paramorf, is a symbolic model that is described verbally. The Paramorf model is divided into three, covering conceptual, procedural and mathematical models.

Conceptual model, is a model that describes relevant events based on the deductive process of logic or analysis and also the conclusion of an observation. Procedural model, is a model that describes certain steps to carry out a work with certain procedures. While the mathematical model, is a model that describes the relationship of various components in a situation

Gustafson (1981) divides the learning model into four groups, including: (1) Classroom ID Models, which focus on improving the quality of learning components in the classroom, (2) Product Development models, which emphasize more on the goal of producing a specific product so learning runs optimally. (3) Systems Development Models, are systems oriented models. and (4) Organization Development Models, more emphasis on improving the quality of learning outcomes through modification or adaptation of organizations and personnel into a new environment.

Joyce & Weil (1996) divided learning models into four large groups, namely: (1) Social Models, which are oriented to the theory of constructivism. (2) Information Processing Models, which are oriented to the theory of cognitivism. (3) Personal Models, oriented to the theory of cognitivism. (4) Behavioral Systems Models which base on behaviorism theory. In addition to the types of learning models, there are also many types of learning development models, including: Dick and Carey, Jerrold Kemp's, MRK (Morison, Ross and Kemp), Assure (Media Development Model), Degeng, R2D2, Four Quadran, NCFL (Naval Collaboration Flexible Learning), etc

Amory (2007) suggested that every software development should be based on learning theories. Ardhana (2008) added that to improve the quality of educational practice, research is needed on the theory of learning more and more quality. This needs to be done, because as Pogrow said (in Ardhana, 2008), when looking at the history of education reform almost always ends in a worse situation. Why is that? The answer is because the research is not supported by a strong theoretical foundation and quality. In this sense, every activity in the product elements of the learning design must be designed and built using a theoretical foundation as an approach to learning. The theoretical perspective of the learning development models, can be described in table 1 as follows:

NAME MODEL	MARK		
	Theory Perspective	**Developer**	**Re-developer**
Dick and Carey	Behaviorisme	Dick And Carey	
Defence Training Model (DTM)	Behaviorisme	Houston	
Jerrold Kemp's	Behavirorisme	Jerrold Kemp's	-
Mrk (Morrison, Ross And Kemp).	Behaviorisme	Mrk (Morrison, Ross And Kemp).	
Model Pengembangan Media Assure	Kognitivisme	Smaldino, Russells, Heinich, & Molenda,	
Degeng	Kognitivisme	Degeng	
R2D2	Konstruktivisme	Willis	
Four Quadran	Behaviorisme and Konstruktivisme	Cronje'	
NCFL (Naval Collaboration Flexible Learning)	Multiple Learning Perspective	Adi Bandono	

1.3. Development of Learning Models in the Domain of Learning Technology

The conception of learning technology has developed in all fields along with the development of learning and learning theories. Therefore, AECT (2007) in defining learning technology always adapts to the present context, is temporary and is only appropriate for its time. The conception of learning technology is currently defined as "Study and practice of ethics to facilitate learning and improve performance by creating, using, and managing appropriate technological processes and resources. So learning technology is a discipline that has a double meaning that can be as an abstract concept or theory and as a field of practice.

An understanding of theory and practice in learning technology, implies that knowledge must be continually developed and improved through reflective research and practice activities, where the term is also included as the meaning of studies, ie studies that refer to information gathering and analysis activities beyond traditional concepts research. This includes quantitative and qualitative research as well as other forms of other research method disciplines. Strictly speaking, research activities have good habits in generating new ideas and evaluative processes to help improve the quality of practice. Research activities can be carried out based on various methodological constructs that are as good as theoretical constructions.

At present research in the field of learning technology has evolved from research that tries to "prove" that media and technology are effective tools for teaching, towards research formulations to examine and test approaches to the application of processes and technology in order to enhance learning. The development of a learning model is one example of new breakthroughs in creating research formulations in the field of learning technology in order to improve the quality of learning towards a better direction.

The development of learning models in the field of learning technology has been influenced by developments and changes in learning theory, information management, communication and other fields. The development of the theory of behaviorism, cognitivism and constructivism has changed the emphasis in the field of teaching and learning. Attention to learners' perspectives, characteristics and ownership of the learning process has grown and developed with the creation of new and innovative learning models.

The theoretical shift has dramatically changed the orientation of the field from the field of design driven by teaching that is dominated by the role of the learner, now developing towards various formats

that seek to create a learning environment where students can explore their own understanding. The emphasis of research in the field of learning technology has now shifted from learning design in routine perspective to a learning design environment that is able to facilitate learning.

Given the new paradigm shift in learning theories where there has been greater recognition of the role of students in ownership and responsibility for their learning activities, it is necessary to develop a learning model that is able to build meaningfulness in learning by facilitating a variety of technologies that are increasingly developing rapidly.

2. Examples of Learning Model / Strategy Development

Of the many learning development models, on this occasion the author will present several (three) examples of learning development models that are often used as approaches in developing learning models, including: Defense Training Model (Houston, 2006), Degeng (2001), R2D2 (Reflective , Recursive, Design, and Development) (Willis, 2000). The learning development model can be explained as follows:

2.1. DTM (Defense Training Model) Development Model

The Defense Training Model was developed by Houston (2006) for learning needs in the Australian Defense Force. The DTM model has five main elements, consisting of Analyze, Design, Develop, Conduct, and Evaluate. The DTM model is categorized into the ISD (Instructional System Development) model family based on behaviorism theory. The ISD model is now applied to organize learning in the Navy's educational institutions. The five main elements in the DTM model can be described as follows:

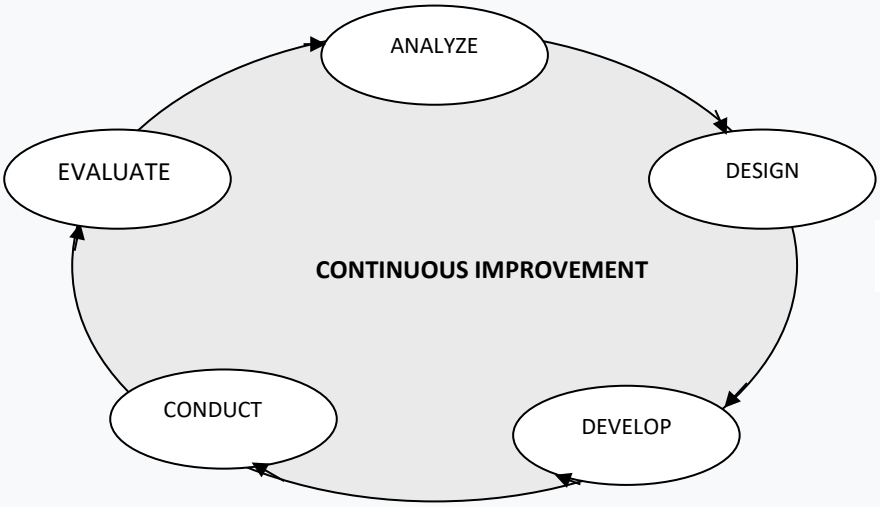


Fig 3: DTM Development Model from Houston (2006)

The DTM model is always preceded by an analysis step (analyze), namely needs analysis. The results of the analysis are used as a condition leading to the design step (design), which is a set of steps specifically planned in the framework of effectiveness, efficiency and relevance to needs. Development (development) is an effort relating to how the material is developed into a product and implemented (conduct) in learning practices. Meanwhile, evaluate (evaluate) to measure the process and results that can be achieved at each stage of the activity. The main idea of the DTM model that is often applied to the development of learning models is the need to conduct a needs

analysis and evaluation activity. Requirements analysis is part of a series of conditions analysis activities that determine the next steps. Evaluation is also an important step to evaluate the process and learning outcomes to be achieved.

2.2. Degeng Development Model

Degeng learning development model is based on the paradigm of cognitivism

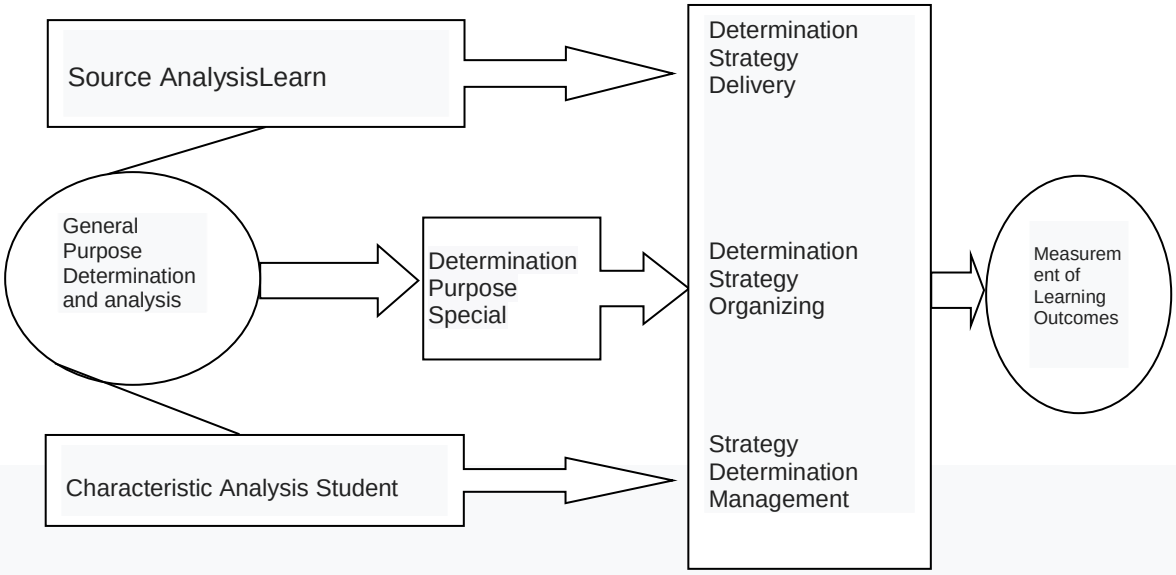


Figure 4: Degeng Learning Development Mode

The syntax in the Degeng model (Degeng, 2001), can be described as follows:

a. Analysis of Objectives and Course Characteristics. This step is intended to find out what learning objectives are expected, learning orientative objectives: whether conceptual, procedural or theoretical and supporting objectives that facilitate the achievement of the orientative goals. Analysis of the characteristics of the course content is intended to determine the type of content of the course students will learn, whether in the form of facts, concepts, procedures, or principles.

b. Learning Resource Analysis. Analysis of learning resources is an analysis activity to find out the learning resources available and can be used in conveying learning content. The results of the analysis of learning resources in the form of a list of available learning resources that can support the learning process.

c. Analysis of Student Characteristics. Analysis of student characteristics is an activity analysis of individual student characteristics which include talent, learning style, maturity level of thinking, motivation and initial abilities. The results of the analysis of student characteristics include information about individual student characteristics

d. Setting Learning Objectives and Learning Content. Establishing learning objectives and learning content is a step in compiling a list of learning objectives, types and structure of content to be learned by students to achieve the specified learning goals.

e. Establish Strategies for Organizing Learning Content. Strategies for organizing learning content can be carried out, after going through analysis and

determining the types and characteristics of learning content. The choice of organizing learning strategies is strongly influenced by what type of content the course is studied and how it is structured. The results of this step are in the form of establishing models for organizing course content, both at the macro and micro level.

f. Establish Learning Content Delivery Strategies. Determination of learning delivery strategy based on the analysis of learning resources. The results of the analysis of learning resources in the form of a list of learning resources available and can be used to support the learning process. The results of the analysis of learning resources are used as a basis for determining learning delivery strategies. Establish Learning Management Strategies. Learning management strategies are influenced by the results of the analysis of the characteristics of students. The results of the activities of this step are in the form of determining the scheduling of the use of components of the organizing and delivery of learning strategies, motivational management, making notes about student learning progress and learning control.

g. Development of Learning Outcomes Measurement Procedures. The activity of developing learning outcomes measurement procedures includes measuring the effectiveness, efficiency and attractiveness of learning strategies. The level of effectiveness of learning outcomes is measured by the level of student achievement in the specified learning goals.

h. The main ideas of the Degeng model that are often applied to the development of this learning model include: the importance of analyzing the objectives and characteristics of the subject, analysis of learning resources, analysis of student characteristics, setting learning objectives and learning content, setting organizational strategies, establishing delivery strategies, establishing strategies management, and development of procedures for measuring learning outcomes. The basic steps of the Degeng model are often used by developers and other learning scientists in developing learning models.

2.3. R2D2 Development Model

The R2D2 learning development model was developed by Willis (2000) using the constructivist paradigm or Constructivist Instructional Design (C-ID) which means Reflective, Recursive, Design and Development (R2D2). This model has 7 characteristics consisting of: (1) the process of developing learning that is recursive, non-linear and coatic (chaotic or irregular), (2) design is organic, developmental, reflective and collaborative, (3) goals emerge from design work and develop, (4) general learning development experts do not exist, (5) learning emphasizes learning in a meaningful context, (6) formative evaluation determines, (7) subjective data may be more valuable.

The R2D2 model has 3 focuses, namely (1) Define, (2) Design and Development and (3) Dissemination. An overview of the R2D2 model can be seen in the following image:

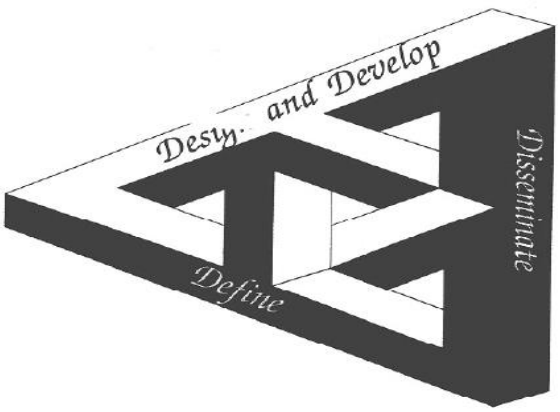


Figure 6: R2D2 Learning Development Model

At the Define stage, a participation team is formed with the task of 3 main activities, including: (1) creating and supporting participation teams, (2) progressively solving problem solutions, (3) developing pronesis or contextual understanding. At the Design and Development stage which is a unit, there are 4 activities carried out, including: (1) choosing the development environment, (2) choosing the format and media, (3) evaluation procedures, (4) product design and development. In choosing a development environment, it is necessary to pay attention to 3 important characteristics, namely power, flexibility, and accessibility with 2 main components including equipment / equipment design (tool of design) and design process (design process). At the design and development stage, a formative evaluation is carried out using a qualitative approach. Product design and development in general, consists of (1) surveillance design (surface design), (2) interpace design in the form of views, user interactions, help and support, and (3) scenarios, namely the sequence of simulation choices and results. At the dissemination stage, there are 4 basic activities, including: (1) summative evaluation, (2) final package, (3) diffusion, and (4) adoption

The main advantage of the R2D2 learning development model which is widely adopted by developers and other learning scientists from this model is the importance of forming a participation team in developing models, design and development activities are an inseparable unit, there are formative and summative evaluations, evaluations are carried out with a qualitative approach , and the characteristics of the model are open and flexible.

3. Result and discussion

3.1. Maritime Education.

Indonesia is a maritime nation, with a variety of natural resources, most of which are 2/3 derived from the ocean, and the rest comes from land-based natural resources. Therefore the Indonesian nation is also referred to as a seamen or a maritime nation. When analyzing the legacy of Indonesian ancestors, such as reliefs on the walls of Borobodur, Central Java, there are at least 10 high-mast sails. Not surprisingly, in the 8th century, Indonesian sailors sailed to reach Madagascar on the African Continent, Mainland China, Burma, Sri Lanka and Australia. In the 8th to 16th centuries, three major kingdoms appeared at that time, namely the Srivijaya Kingdom in Sumatra in 683 to 1030, Singosari Kingdom and Mojopahit Kingdom in 1293 to 1478. All three kingdoms were recorded as having a fleet of war (war fleet and commerce) which is very strong and resilient. But along with the fall of the Mojopahit kingdom, VOCs from the Dutch kingdom entered Indonesia, controlled the trade routes of the archipelago and then colonized the Indonesian people for hundreds of years. As a result, a process of decline in the spirit and soul of the nation's marriages and changes in values in Indonesian society. Marine idealism has since changed to continental or continental idealism.

The mindset shift from sea to land was experienced by the Indonesian people for a very long time. So that the Indonesian people now lost their identity as a maritime nation. From the economic side, for the past three decades, the marine sector has always been positioned as a stepchild in national economic development. From the political side, government policies still tend to be in the form of populist symbolic activities but there has been no further action. Although major events have been held to provide encouragement and enthusiasm for the Indonesian people to immediately revive as a maritime nation, but the pace of marine development seems to continue very slowly. The education sector has not yet received maximum attention and the government as a vehicle

for the socialization of marine development. One of the efforts to rebuild the spirit of Indonesian people's happiness is to include maritime conceptions in the national education curriculum, especially in the formal education pathway at the level of basic education (elementary, junior high, MI, MTS), secondary (high school, STM, vocational, MA) as well as high (PTN, PTS). With the inclusion of Maritime Education material as an integral part of the national education curriculum, it is expected to be able to instill a positive image of maritime in children who will later become cadres of the future generation of the nation. The existence of Maritime Education is a form of long-term investment that can lift the image of the Indonesian nation as a maritime nation. Moreover, currently supported by learning media infrastructure that has been based on the internet of things, then Maritime education is applied to each school in each level of education, guaranteed to be more effective, efficient and attractive

Maritime Education in all formal education units listed in the national education curriculum is to inculcate and regain the spirit and soul of the nation's happiness. The form of content in the curriculum, can be in the form of providing maritime education subjects directly or packaged in other existing subjects. If in the form of maritime education subjects it will have consequences for the provision of teachers or lecturers in the field of study. However, if it is included in existing subjects, the education unit does not need to provide teachers or lecturers in the field of study. However, training needs to be prepared for teachers or lecturers whose subjects are to be given maritime content. With the stipulation of maritime material content in the national education curriculum, it is assumed that later all Indonesian citizens will receive maritime education lessons. Thus the continental or land view will soon erode and will be replaced with a new view of maritime insight

3.2. **Development of Information Technology-Based Maritime Education Learning Model.**

Information technology is developing very fast with the dynamics of hardware and software developments that are also constantly changing. Information technology makes the situation of the learning environment in Maritime Education more flexible. According to Collin and Moonen (2006) dimensions of flexibility can be viewed from several sides, including: (a) Flexible relating to space and time, (b) Flexible relating to the content of the material, (c) Flexible relating to approaches and sources learning, and (d) Flexible relating to the technical delivery of messages. Therefore, in developing a learning model of maritime education based on information technology must be based on the principles of flexible learning.

In flexible learning, it does not limit the movement of students' social interactions. This theory argues that students must be given the opportunity to choose and carry out learning activities, and learners only act as facilitators (Collin and Moonen, 2006). In its development, this theory was developed in internet-based online learning.

Flexible learning is a process of giving freedom to move from one learning situation to another learning situation so that an effective learning process occurs. Flexible learning is a strategy that refers to learning activities and emphasizes student choice as the main component (Collin and Moonen, 2006). The provision of a flexible learning environment has now been considered as a new way of looking at learning, where methods and practices can be implemented both classically and online. According to Newton & Ellis (2006) flexible learning is the organization of a flexible online learning environment which is a combination of computer based learning

with distance learning. Hill (2006) asserts that a flexible learning environment is an area that is provided based on the choice of students in conducting learning activities and how students implement learning activities.

From these views, it can be concluded that flexible learning can be used as a basis for developing a learning model of information technology-based Maritime Education. Flexible learning can be done either classically (face-to-face) in the classroom, laboratory or field or online through a network network or remotely via the internet, individually or in groups, independently or guided, by paying attention to choices and desires learners in conducting learning activities that fit their needs. Judging from the characteristics of flexible learning, it can be assumed that the application of flexibility in managing learning will be able to support the successful achievement of competencies as expected. The basis for the use of flexible learning, looks at flexible learning management strategies.

4. CONCLUSION

Which learning development model would be used so that the learning of Maritime Education can take place effectively, efficiently and has an appeal? All types of learning development models can in principle be used to develop a learning model of maritime education based on information technology that is effective, efficient and attractive. The principle that must be considered by a developer and learning scientist is setting goals to be achieved and existing conditions, and then determining which development model is most appropriate.

REFERENCES

AECT. 2007. *Educational technology : A definition with commentary* (ed.Januszewski, Molenda). New York: AECT.

Amory, A. 2007. Game Object Model Version II: a Theoritical Framework for Educational Game Development, *Educational Technology Research & Development,* 55(10): 51-77.

Ardhana. 2008. The Role of Quantitative Research in Learning Technology. Paper presented at the National Seminar on Research Issues in Learning Technology on November 5, 2008 in Batu Malang.

Collin & Moonen. 2006. *Flexible Learning in a Digital World Experiences and Expectations*, Great Britain: Biddles, ltd. www.biddles.co.uk.

Degeng, I.N.S., 1989. *Ilmu Pengajaran: Taksonomi Variabel*. Jakarta: P2LPTK.

Degeng, I N.S. 2001. Learning Design, Towards Superior Personality Through Improving Learning Quality in Higher Education. Malang: Educational and Learning Development Institution (LP3) Malang State University.Dick, Carey & Carey. 2004. *The Systematic Design of Instruction (6th Edition)*, Addison Wesley: Educational Publisher.Inc.

Gustafson, L. K. 1981. *Survey of Instructional Development Models,* ERIC, Clearinghouse on Information Resources Syracuse University.

Heinich, R., Molenda, M., dan Russel, J.D. 1993. *Instructional Media and the new technologies of instruction.* New York : MacMillan Publising Cp.

Heinich, R., Molenda M., Russel, J.D., & Smaldino, S.E. 2002. *Instructional media and the new technologies of instruction* (7th ed.) Englewood Cliff, NJ: Prentice Hall.

Hill, & Hill, 1993. *The Collaborative Classroom.* Australia: Eleannor Curtain Publishing..

Horison, P.J., Seeman, B., Behm, R., Saba, F., Molise, G., & William, M.D.1991. Development of a distance education assessment instrument. *Educational Technology Research and Development,* 39 (4), 65-77.

Houston. 2006. *The Defence Training Model.* Australia: Australian Defence Forces.

Joyce, B & Weil, M. 1996. *Models of Teaching.* Boston: Allyn and Bacon

Landa, L.N., 1983. Descriptive and Prescriptive Theories of Learning and Instruction: Analysis on their relationships and interactions, in C.M . Reigeluth *Instructional Design Theories and Models: An Overview of their current status.* Hillsdale, NJ: Lawrence Erlbaum Associates, 55-73 (ed.)

Morrison, G. R., Ross, S. M., & Kemp, J. E. 2004. *Designing effective instruction (4rd ed.).* New York: John Wiley & Sons, Inc.

Murdick dan Ross, 1982. *In Formation System for Modern Management,* New Delhi: Prentice-Hall of India.

Newton, D & Ellis, A.2006. A model for e-learning integration. In T Reeves & S Yamashita (Eds.). *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2006*. Honohulu. Hawai. Oktober. Association for the Advancement of Computing in Education. Chesapeake, VA.

Reigeluth.C.M. 1983. Instructional Design: What Is it and Why is it? In C.M. Reigeluth (Ed.), *Instructional Design Theories and Models: An Overview of Their Current Status.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Richey, R.C. 1986. *The Theoritical and Conceptual Bases of Instructional Design.* New York: Nichols Publishing.

Seels, B.B., & Richey, R.C. 1994. *Instructional technology: The definition and domains of the field.* Washington DC; AECT.

Willis, J., 2000. Maturing of Constructivist Instructional Design: Some Basic Principles That Can Guide Practice, *Educational Technology* Jan-Peb, Nop-Des. 5-14.

THE CONCEPTUAL MODEL OF POLICY EVALUATION ON PERFORMANCE ASSESSMENT OF MILITARY LOGISTIC OFFICERS

Marsiningsih [1], R. Madhakomala [2], Kazan Gunawan [3]

[1] Doctoral Student of Human Resources Management, Jakarta State University UNJ.
[2,3] Lecturer, Jakarta State University, UNJ Indonesia.

ABSTRACT

Performance assessment is a very important thing in improving organizational quality. Based on various environmental developments, military organizations are required to be increasingly professional in organizational management and development. In this case, the assessment of the performance capabilities of military personnel is absolutely necessary for organizational progress. The military organization has a policy on evaluating the performance of its soldiers. But at the application level there are still a number of problems, namely: The Military Commander's decision is still general and does not look at corps or profession, the formulation of indicators is not yet operational details, and is still subjectivity, namely the tendency to supervisor perceptions so that they cannot be used as performance assessment tools for staff whose work units handle logistics. This study aims to build a conceptual model of policy evaluation on the assessment of the performance of military logistics officers. In the conceptual development process of the model, the Discrepancy Evaluation Model (DEM) is used and integrated with Structural Equation Model (SEM). Furthermore, in the development of a logistics staff performance assessment model, the Key Performance Indicator (KPI) is used. The output of this study is a conceptual model that can be used to evaluate the performance of military logistics officers.

Keywords: *Conceptual Model, Performance Assessment, Military Logistics Officer.*

I. INTRODUCTION

In state life, the defense aspect is a very essential factor in ensuring the survival of the country. Without being able to defend themselves against threats from abroad or from within the country, a country will not be able to maintain its existence.

National Defense is an effort to maintain the sovereignty of the country, the territorial integrity of the Unitary Republic of Indonesia, and the safety of all nations from threats and disturbances to the integrity of the nation and state. State Defense is carried out by the government and prepared early with the national defense system through efforts to build and foster the capabilities and deterrence of the state and nation and overcome any threats (Suharyo O.S, 2017).

The Indonesian National Army has the main task of upholding the sovereignty of the state, maintaining the territory of the Unitary Republic of Indonesia. The main task was carried out through Military Operations for War and Military Operations Other Than War (Indonesia Ministry of Defense, 2015).

In order to carry out the function of the main task, logistical support in military organizations becomes very important and becomes the key to success and victory. Specific needs for logistical planning are based on the details of the mission, including the length of the mission, the division of the existing logistics business with the number of personnel involved, and the technology used. During the implementation of the process of coaching, development, and use of military power, logistics plays a role that should not be underestimated. In order to guarantee the success of the implementation of military main tasks, logistical planning and control are needed to provide personnel, materials, and services according to operating needs (Jhonson, 2015).

Logistics is an important part in supporting the preparedness of military operational units to be able to carry out their main tasks. Logistics is defined as integrated development planning, organizing and controlling all flows of goods and materials and related information flows, from suppliers to shipping products to customers, including recycling and waste disposal.

The logistics system consists of several components, namely: customer service, inventory management, transportation, storage and material handling,

packaging, information processing, demand forecasting, production planning, purchasing, the location of facilities and other activities. In certain organizations can include tasks as part of after-sales service logistics activities, maintenance functions, handling of used goods and recycling operations (Susilo A.K, 2017).

Thus the role and logical function of debriefing from the determination of the needs planning to the distribution to the user is very decisive and must be supported by a solid organization supported by a solid organizational structure, qualified personnel conditions, a conducive working environment and relationships so that the logistics distribution channel can sure to run well and smoothly.

Once the role of logistics is important in supporting the achievement of a military operation task, logistical support will not be able to run effectively and efficiently, if it is not supported by the existence of human resources with reliable logistical competence. HR performance is very influential on the quality of organizational performance. In order for HR performance in an organization to increase dynamically, it requires the need for adequate human resources and capabilities. HR performance is very influential on the quality of organizational performance.

In military organizations, human resources are assets and function as capital (non-material and non-financial). The purpose of understanding and studying human resource management in military organizations is to gain the deep knowledge needed to solve military problems, especially the performance of military personnel in this case Military Logistics Officers (Patrichi, 2015).

Military Logistics Officers have great potential to carry out organizational activities. The existence of Military Logistics Officers in a military organization plays a very important role. In order to improve the performance of Military Logistics Officers dynamically, a systematic, gradual and sustainable assessment model is needed. The potential of Military Logistics Officer resources in the organization must be utilized as well as possible so as to provide maximum results (Indonesia Ministry of Defense, 2015).

Assessment of Military Logistics Officers Performance

The military as a non-profit organization has carried out a series of assessments of HR performance, in this case, the soldiers they have. At present, the Indonesian military has a policy basis for evaluating the performance of individual soldiers, especially military logistics officers. The results of the initial survey conducted by the researchers showed the findings that at the application level there were still several potential problems, as follows:

1. Performance indicators are still general in nature, which applies to all personnel of military personnel regardless of the corps and profession so that the policy has not specifically measured performance in accordance with the corps and profession of each personnel.
2. The formulation of performance indicators is not yet operational so that it is deemed not yet able to measure the expected competence or performance.
3. At the level of assessment, subjectivity is still constrained in the assessment and has a tendency to perceive judgments from superiors.
4. Appraisal supervisors do not yet understand the appraisal mechanism correctly so that the values made seem only as a formality or complete administrative assessment.
5. Observers' observations of those assessed have not been carried out continuously and continuously.
6. The valuation method used still uses only one type of assessment tool, namely, rating, and is not triangulated with other assessment tools or methods, so that subjectivity is still very high.

The phenomenon of the problem makes researchers to conduct research in more depth, as well as developing the model of military logistics officer performance appraisal that has been applied previously. Findings in the results of the preliminary survey indicate that the existing performance assessment has not represented precisely all activities of the military organization's work units.

On the other hand, performance appraisal in a military organization is a very important thing to do, because all organizations need to evaluate and plan the performance of their personnel, so that there is a continuous performance improvement process, in the form of interrelated and non-intermittent cycles, so that the paradigm of improving performance in military logistics officers can be sustainable (Anita, 2013).

Assessment of sustainable performance will lead to the achievement of better and better quality HR performance. For those whose performance is good and qualified as a consequence will get an award

in the form of appointments, promotions, benefits, promotions, and education. Whereas those with declining performance can be subject to sanctions or mutations. Aspects assessed in performance appraisal can cover all aspects of performance behavior, including integrity, loyalty, commitment, discipline, collaboration, leadership, and success in meeting performance targets. If the performance assessment can be carried out properly, the management of human resources in the organization can also run well (Patrichi, 2015).

Based on the results of mapping the complexity of existing problems, this study aims to build a model of evaluation of performance appraisal policies on military logistics officers. This research has renewed in terms of the formulation of policy evaluation models for performance appraisal systems within the military in an integrated and systemic process stage, especially for military logistics officers.

II. MATERIAL AND METHODS

The Concept of Logistics Management.

Logistics is the management of the flow of goods between the point of origin and the point of consumption to meet several requirements, for example, customers or companies. Resources managed in logistics can include physical goods, such as food, materials, animals, equipment, and liquids, as well as abstract items, such as time, information, particles, and energy. Physical logistics usually involves the integration of information flows, material handling, production, packaging, inventory, transportation, warehousing, and often security. Logistics complexity can be modeled, analyzed, visualized, and optimized by special simulation software. Minimizing the use of resources is a general motivation in the field of logistics for imports and exports (Anwar, 2016).

In the military realm, logistics provides the basic strength of combat troops. Logistics can be described as a bridge that connects a country's economy with a state war force. Logistics is the process of planning and implementing the movement and sustainability of the operating forces in the implementation of military strategies and operations (Patrichi, 2015).

Logistics art is how to integrate strategic, operational, and tactical support efforts in the theater while scheduling the mobilization and deployment of units, personnel, and supplies to support the working concept of geographical combat commanders.

Logistics is the science of planning in carrying out the movement and maintenance of strength. In the most comprehensive sense, aspects of military operations are related to 1) Design and development, acquisition, storage, transportation, distribution, maintenance, evacuation and disposal of materials; 2) Transportation personnel; 3) Acquisition or construction, maintenance, operation and disposition of facilities; 4) Acquisition or provision of services; 5) Support for medical and health services (Wantara, 2013).

The Concept of Logistic System Main Activity.

The main activities in the logistics system consist of several parts, namely:

1. Customer Service.

Everyone who works in the logistics sector must remember that they choose, hold, store, or distribute products to meet customer needs.

2. Product Selection.

The product chosen for use will have an impact on the logistics system, so logistical requirements must be considered during product selection.

3. Quantification.

After the product is selected, the quantity and cost required for each product must be determined. Quantification is the process of estimating the quantity and cost of a product needed for a particular health program (or service), and, to ensure an undisturbed supply for the program, determines when the product must be purchased and distributed.

4. Procurement.

After the supply plan has been developed as part of the quantification process, the quantity of product must be obtained. However, procurement must follow a series of special procedures that ensure an open and transparent process that supports six rights.

5. Inventory Management, Deviation, and Distribution.

After the goods have been obtained and received by the system, the goods must be transported to the service delivery level where the client will receive the product. During this process, the product must be stored until it is sent to the next lower level, or until the customer needs it. Almost all businesses store the amount of stock for future customer needs.

The Concept of Logistics Functions.

It is important to recognize that various logistical functions are united to form the totality of logistical support. A logistics expert from one discipline will often work with staff from other disciplines. For example, logistical planning comes from national policy guidelines and must be coordinated with all relevant staff branches, whether they are operational, administrative or logistical, military or civilian.
Support requirements regarding the main logistical functions consist of six functional areas (Dessler, 2015), namely:
1. Supply System.

Obtain, manage, receive, store and issue materials needed by the operations forces to complement and maintain the strength of deployment through combat operations and re-deployment.
2. Maintenance.

Maintenance includes actions taken to store equipment in repairable conditions, to restore it to service, or to update and improve its capabilities.
3. Transportation.

Transportation is the movement of units, personnel, equipment, and supplies from the point of origin to the final destination.
4. General Engineering.

Provision of construction, repair of damage, and operation and maintenance of facilities or improvement of logistics needed by combatant commanders to provide housing, warehousing, hospitals, water and sewage treatment, and distribution of water and fuel storage to improve the provision of support and services.
5. Health Services.

Health services include evacuation, hospitalization, medical logistics, medical laboratory services, blood management, vector control, preventive medicine services, veterinary services, dental services, and necessary orders, controls, and communications.

The Concept of Logistics Principles.

Every logistics community must use these principles and imperatives as a guide (Kasie, 2013), the logistical principles include:
1. Responsive. Provide appropriate support when and where needed.
2. Simplicity. Minimalization of complexity in logistics operations.
3. Flexibility. The ability to improvise and adapt logistical structures and procedures to change the situation, mission, and operational requirements.
4. Economy. The number of resources needed to provide specific results.
5. Can be achieved. A guarantee that the minimum basic supplies and services needed to carry out the operation will be available.
6. Sustainability. Ability to maintain the level and duration of operational activities needed to achieve military objectives.
7. Survive ability. Organizational capacity to win in the face of potential threats.

The Concept of Performance Evaluation.

Evaluation plays an important role in determining the effectiveness, efficiency, benefits, acceleration, and sustainability of a program or policy. Evaluation provides an overview of a learning that is focused on an activity or delivery of an emphasis. Evacuation is sometimes also used to refer to the study of a behavior (Harvey N, 2001).

Evaluation program performance is a key part of the governance strategy for managing the ultimate goal. Evaluation ensures that every teacher's performance in the system shows a minimum level of competence taking into account the success of military personnel.

From the definition above it can be interpreted that evaluation is a systematic investigation of several objects. Operationally, evaluation is the process of describing, obtaining, reporting, and applying descriptive and evaluative information about the benefits of several objects, values, meanings, and honesty to guide decision making, accountability, support, disseminate effective practices and increase understanding of the involvement of phenomena (Khalid, 2015).

Evaluation is carried out with a purpose. In general view, evaluation has four different objectives (Joseph, 2014), including (1) ethical goals, (2) managerial objectives, (3) decision objectives, (4) educational goals and motivation. In addition to goals, there are several advantages in carrying out an evaluation. Evaluation helps answer several questions about the intervention, namely: (1) What is the impact of the intervention, (2) Does the intervention go according to plan, (3) Are there differences throughout the location when the intervention is carried out, (4) Who benefits from this intervention. Based on the theories stated above, it can be concluded that program performance evaluation is an attempt to collect, compile, process and analyze facts, data and information about a program, office, organization or institution.

The Concept of Personnel Performance.

Performance is a concept that is defined in the quality and quantity of business activities, factors of personality, skills, and abilities needed to predict or evaluate the performance of personnel. Individual performance is a key indicator of the company and contributes to the productivity and competitiveness of the company. Performance is an intrinsic construction in the strategy literature. Performance can be approached as the ultimate goal of management, its own objectives can be highlighted at the level of individual managers, teams, businesses, and companies (Jankingthong, 2012).

Personnel performance is one of the most important criteria in industrial and organizational psychology research. Performance as a form of individual effort that is not directly related to its main task function. Performance depends very much on perceptions, values, and attitudes. Performance is judged by the subjective impression of the reporting officer who assesses performance in terms of executive quality that is intangible (Sone, 2011).

From some of these experts, it can be concluded that what is meant by the performance of military personnel is the results achieved by a military personnel who are both quantity and quality in accordance with the responsibilities imposed on him. When a military personnel can complete the work properly, then in some organizations are given awards or rewards for the work achievements that have been achieved.

The Methods of Research

This study aims to build a conceptual model of policy evaluation on the assessment of the performance of military logistics officers. In the conceptual development process of the model, researchers used the Discrepancy Evaluation Model (DEM) that was integrated with Structural Equation Models (SEM) and Key Performance Indicators.

The Methods of Discrepancy Evaluation Model (DEM).

The gap evaluation model focuses on comparing evaluation results with predetermined performance standards. Furthermore, the results of the evaluation are used in the framework of policymakers about the programs that have been implemented.

This gap evaluation model consists of 4 stages of activities, where the stages are in accordance with the stages of the program to be evaluated, the four stages are (Poduval, 2015):

1. Identify the program. At this stage, the evaluation focuses on determining and formulating objectives.
2. Program preparation. At this stage, the evaluation focuses on the content or substance in the program, ways, methods, mechanisms in achieving program objectives.
3. Program implementation. At this stage, it is focused to find out the extent of the difference between the results achieved and the intended goals.
4. Program achievement results. At this stage, it is focused on integrating the findings and providing reports on policymakers. This policy can be in the form of a program revision or continuation of an activity program.

The program evaluation process uses the Discrepancy Evaluation Model, first of all, it must collect data through interviews, observation and documentation that are validated through Focus Group Discussion (FGD) activities and cover 5 (five) aspects, namely; a). Design Aspect. b). Installation Aspects consist of Organization, Capital Resources, Programs, Profit Management, Bookkeeping, and Financial Accountability. c). Process Aspects. d). Result Aspect e). Cost and Benefit Analysis (Johari, 2015).

The Methods Structural Equation Model (SEM).

Structural Equation Modeling (SEM) is a statistical modeling technique that is cross-sectional, linear and general. Another definition, SEM is a statistical technique used to construct and test statistical models in the form of causal models. SEM is a stronger analysis technique because it considers interaction modeling, nonlinearity, correlated independent variables, measurement error, correlated error terms, several latent independent variables where each is measured by using many indicators, and one or two variables depending on the latent which are also measured by several indicators (Poduval, 2015).

SEM has characteristics that are as analytical techniques to further confirm (confirm) rather than explain. That is, a researcher is more likely to use SEM to determine whether a particular model is valid or not, even though SEM analysis often includes elements that are used to explain (Calidoni-Lundberg, 2006).

Some SEM functions, including a) Allows for more flexible assumptions; b) The use of confirmatory factor analysis to reduce measurement errors by having many indicators in one latent variable; c) The

attractiveness of the graphical modeling interface to make it easier for users to read the results of the analysis; d) The possibility of testing the model as a whole rather than the coefficients individually; e) The ability to test models using several dependent variables; f) The ability to model models of intermediaries; g) Ability to create error term models; h) Ability to test coefficients outside between several subject groups; i) The ability to deal with difficult data, such as time series data with autocorrelation errors, abnormal data, and incomplete data (Mardani, 2017).

The general objectives of SEM modeling, among others: a) Provide an efficient and appropriate way to describe the structure of latent variables that underlie a set of observed variables; b) Express with a diagram or use mathematical equations; c) Arranging the postulate using a statistical model based on the researcher's knowledge of the appropriate theory, empirical research studies, or a combination of theory and empirical; d) Determine the Goodness of Fit between the models hypothesized with the sample data; e) Test how suitable the observation data is with the model structure made; f) Knowing residuals/differences between models hypothesized by observation data (Khine, 2013).

Key Performance Indicator (KPI).

In medium / large industrial organizations, evaluating the performance of timely and effective staff through strategic tools must be able to design an integrated key performance indicator system (KPI), hierarchically structured at all levels and organically related to strategic objectives and tactical organizations. The Main Performance Indicator (KPI) is a performance assessment tool that identifies the level of achievement of the desired parameters in an industrial production line, which is very important for the success of companies (Koopmans, 2014).

In all organizations, employees know that there are activities that are very important for the management team. In the sense of defining an indicator control package that represents the success of several business conceptions the main performance indicators emerge. The main performance indicators (KPIs) are financial and non-financial indicators that organizations use to testify to how successful they are in achieving long-term goals. KPI is a static and stable indicator that brings more meaning when comparing information. It helps to eliminate emotions from business objects and gets that focused on things that are actually done by the work, and that results in profit (Armstrong, 2010).

KPI represents a landmark that helps employees and company managers to understand the relevance of their work and the results to be achieved. They can be predetermined or chosen by company management to assess competencies and how they perceive individual business goals. If the implementation is needed, that in 90% of cases, respondents fully or partially correlate employee rewards with their KPI results. This leverage leads to disruption of discipline in the departmental, team and individual strategic goals and to focus their efforts on achieving activity performance (Fred, 2011).

The benefits of KPI indicators on reports because applications in industrial companies are: a) They offer perspectives on documentation and organizational performance indicators; b) Success in its use is facilitated by selection, alignment with the company's internal organizational objectives and detailed documentation facilitating their understanding and use of standard companies; c) Increase response time to market changes; d) Identify costs that can be eliminated; e) Optimization of labor; f) Improving the overall decision is compressed into one, interactive dashboard, because of the risk of supply disruptions; g) Increased ability to manage supplier portfolios, through identification, evaluation, and monitoring of various areas of risk exposure related to suppliers; h) Identify, predict future earnings and capitalization opportunities; i) Minimizing standard risks that are not imposed; j) Creating a picture of the market by combining management risks and management strategies; k) Reducing production downtime; l) Increase profitability by being able to anticipate supply chain risks; m) Ad-hoc analysis of approximate scenarios that determine the impact of supplier contract changes or changing conditions for profitable growth; n) Evaluation of labor through dashboards and reports of data related to personnel and related costs (Koopmans, 2014).

III. RESULT AND DISCUSSION

Military logistics officer performance assessment model uses the integration of two methods with their respective functions. The process of determining policies, strategies and efforts, still refers to the principles of achieving the goals and objectives, which are visible, sustainable, legitimate by being confronted with a rationale, in the form of legislation at the

national level and military development policy. Based on the development of the existing model in the study, the design model of Military Logistics Officer Performance Evaluation is an evaluative method that integrates the DEM method with the SEM method. The research model design was formed to evaluate each stage and the interrelationship between stages with the DEM method. The evaluation process starts by collecting data from each stage of the DEM model that produces evaluation criteria.

There are several stages used to achieve the goal.

1. The first stage, identifying the reaction or response.
2. The second stage, analysis of criteria and weighting of measurements.
3. The third stage, the analysis phase of the evaluation results and comparison of the gap between the results of the evaluation and policy objectives.
4. The fourth stage formulates a performance appraisal model for military logistics staff officers.

The first stage consists of identifying the reaction or response in the form of criteria with an evaluation aspect approach. The results of the identification are the first step in the implementation of policy evaluation.

The second stage provides analysis and weighting of the criteria obtained in the first stage. Next, determine objects from measurement criteria based on criteria. These criteria are then given value weights to provide quantitative analysis in the evaluation framework. At this stage, the Evaluation approach is used. The weighting method is also used at this stage to determine the weight of each criterion object.

The third stage identifies the results of the policy evaluation from the second phase. The results of the policy evaluation are quantitative models derived from respondents' answers. The evaluation results are compared with predetermined linguistic values, so the calculation of gap evaluation can be known. In this stage, the approach of the Discrepancy Evaluation Model (DEM) method is used.

The fourth stage formulates a performance assessment model for military logistics staff officers. Formulation of performance assessment models in accordance with the performance of the percent performance indicators, then the determination of the assessment criteria will be determined by the professional approach and function of the logistics staff. In this stage, the Structural Equation Model (SEM) method is used.

Table 1. Describes the stages, variables, activities and research methods.

Table 1. The Stages, Variables, Activities and Research Methods

The Stages	Variables	Activities	Research Methods
I	1. Vision, Mission, and Objectives of the Performance Assessment Program. 2. Legal Basis of Performance Assessment Program. 3. Analysis Process Performance Assessment Program. 4. Socialization of the implementation of the Performance Assessment Program. 5. The ways to Socialize Performance Assessment Policies. 6. The Condition of existing Assessment Instruments. 7. Implementation of current Performance Assessment Policies. 8. The Condition of existing Research Instruments.	Identification of reactions or responses in the form of criteria with an evaluation aspect approach.	1. Interview. 2. Observation. 3. Data Analysis .

II	1. Weighting the criteria that have been determined using the Scoring Weighting method 2. What are the values and performance standards of these values?	Analysis and weighting criteria. Determine the object from the measurement criteria.	1. Respondents. 2. Observation. 3. Data Analysis.
III	1. Assessment of criteria by respondents 2. Quantitative and qualitative calculation of gaps.	Identify the results of the policy evaluation from the second stage. The results of the policy evaluation are quantitative models derived from respondents' answers	1. Data Analysis 2. DEM Method, *Discrepancy Evaluation Model*
IV	1. Development of a Military Logistics officer performance assessment model. 2. Determination of criteria and weighting of the latest criteria in the design of performance assessment models	Formulate a performance assessment model for military logistics officers.	1. Respondents. 2. Observation. 3. Data Analysis. 4. SEM method *Structural Equation Model* 5. KPI *Key Performance Indicators*

Furthermore, based on Stages, Variables, Activities and Research Methods as shown in Table 1. The Conceptual Model of Policy Evaluation on Military Logistics Officer was compiled. This conceptual model is the initial concept to represent the evaluation of the performance of military logistics officers. This model consists of at least 4 key variables in Performance Evaluation, namely Performance Achievement, Knowledge, Skill and Expertise, and Attitude in the context of military logistics officers. Each key variable is then determined by the key performance indicator that significantly affects the performance evaluation of military logistics officers. Key performance indicators are denoted in F1-F4 notation for variable Performance Achievement, LG1-LG4 for Knowledge variables, PI1-PI4 for Skill and Expertise variables, K1-K4 for Attitude variables. The role of key variables and key performance indicator are very determining the value of performance evaluation from military logistics officers.

The conceptual model in this study is shown in Figure 1. The Conceptual Model of Performance Assessment on Military Logistic Officers, as follows:

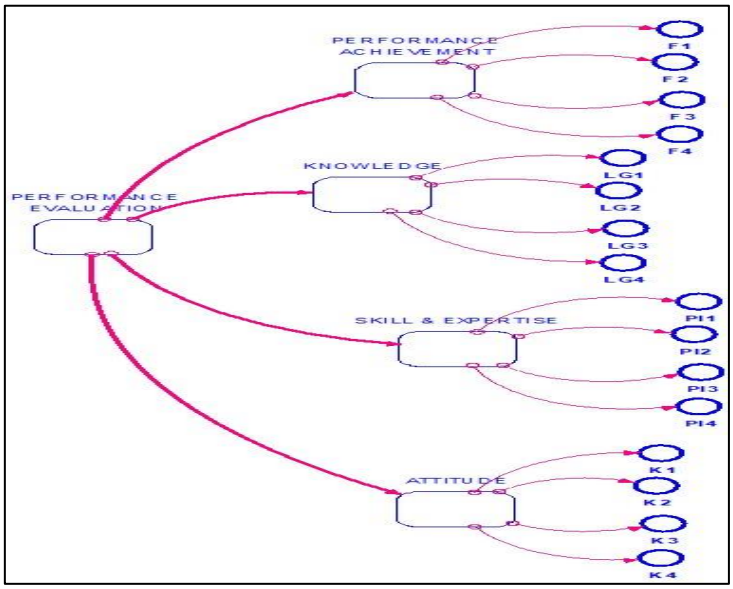


Figure 1. The Conceptual Model of Performance Assessment on Military Logistic Officers

IV. CONCLUSION

From the results of the analysis and discussion that have been described, the conclusions of this study are as follows:

1. In this research, the conceptual model of policy evaluation on performance assessment of military logistic officers has been developed. Several key variables that significantly influence the evaluation of military logistics officer performance assessment policies have been found, namely: performance achievements, knowledge, expertise and experience, and behavior or personality in the context of military logistics officers. Furthermore, these key variables can be developed again based on key performance indicators that significantly affect performance evaluation.

2. The stages and variables of modeling as the results of the research can be explained as follows:
a). Identification of reactions or responses in the form of criteria with an evaluation aspect approach, with variables:
1). Vision, Mission, and Purpose
2). Legal Foundation
3). Analysis process.
4). Implementation Socialization
5). How to socialize the policy
6) Existing assessment instruments.
7). Policy implementation
8). Instrument condition
b). Analysis and weighting criteria. Next, determine the object from the measurement criteria, with variables:
1). Weighting criteria
2). Standard and performance value
c). Identification of policy evaluation results. The results of the policy evaluation are quantitative models derived from respondents' answers, with variables:
1). Assessment criteria
2). Calculation of the gap
d). Formulate a performance assessment model for military logistics officers, with variables:
1). Development of the new models
2). Determination of criteria & weighting
3). New model design criteria.

FUTURE WORK

The output in this study is limited to the drafting of The Conceptual Model of Policy Evaluation on Performance Assessment of Military Logistic Officers so that this research can be continued and can be further developed in the direction of calculating the relationship between variables and indicators in more detail. The method that can be used is modeling with the Structural Equation Model (SEM), Discrepancy Evaluation Model (DEM) and Key Performances Indicators approach, this research will be continued by the authors in the next future.

ACKNOWLEDGMENT

The authors greatly acknowledge the support from Study Program of Human Resources Management, Jakarta State University (UNJ Jakarta) 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

Anita, S., J, T., Bell, D., & Sarwar, M., 2013, Develop a Framework of Performance Measurement and Improvement System for Lean Manufacturing Activity. International Journal of Lean Thinking, 51-65.

Anwar, J., Shah, S., & Hasnu, S., 2016, Business Strategy and Organizational Performance: Measures and Relationships. Pakistan Economic and Social Review, 99.

Amstrong, Michael, Amstrong's Essential, 2010, Human Resource Management Practice, A Guide to People Management, London: Kogan Page.

Calidoni-Lundberg, F., 2006, Evaluation: definitions, methods, and models. Östersund: Swedish Institue for Growth Policy Studies.

Dessler, Gary, 2015, Human Resource Management, Fourteenth Edition, Essex, England: Pearson.

Fred Luthans, 2011, Organizational Behavior, An Evidence-Based Approach, 12th Edition, New York: McGraw-Hill.

Harvey N. Switzky, 2001, Personality and Motivational Differences in Persons With Mental Retardation, New Jersey: Lawrence Erlbaum Associates Publishers.

Jankingthong, K., & Rurkkhum, S., 2012, Factors Affecting Job Performance: A Review of Literature. Silpakorn University Journal of Social Sciences, Humanities, and Arts, 115-127.

Johari, J., Yean, T. F., Yahya, K. K., & Adnan, Z., 2015, Elevating Job Performance Through Job Characteristics and Work Involvement. International Academic Research Journal of Social Science, 69-82.

Johnson, W. Brad dan Andersen, Gene. R., 2015, Mentoring in the US Navy, Naval War College Review, Vol. 68.

Joseph, O. B., 2014, Effectiveness of Performance Appraisal as a Tool to Measure Employee Productivity in Organisations. Journal of Public Administration and Governance, 135-148.

Kasie, F. M., & Belay, M. A., 2013, The Impact of Multi-criteria Performance Measurement on Business Performance Improvement. Journal of Industrial Engineering and Management, 6(2), 595-625.

Khalid Farooq, 2015, "Organization Citizenship Behaviour a Key for Employee Retention: An Empirical Investigation from Systematic Institutional Industry Pakistan", Journal of Political Sciences & Public Affairs.

Khine, M. S., 2013, Application of Structural Equation Modeling in Educational Research and Practice (Vol. 7). Rotterdam: Sense Publisher.

Koopmans, L., 2014, Measuring Individual Work Performance. Amsterdam: CPI Koninklijke Wöhrmann, Zutphen.

Mardani, A., Streimikiene, D., Zavadskas, E. K., Cavallaro, F., Nilashi, M., Jusoh, A., & Zare, H, 2017, Application of Structural Equation Modeling (SEM) to Solve Environmental Sustainability Problems: A Comprehensive Review and Meta-Analysis. MDPI Journal Sustainability, 9, 1-65.

Ministry of Defence, T. R., 2015, Indonesian Defence White Paper. Jakarta: Ministry of Defence of the Republic of Indonesia.

Patrichi, M. E., 2015, General Military Human Resources Management and Special Forces Human Resources Management: A Comparative Outlook. Journal of Defense Resources Management, 6, 75-82.

Poduval, P. S., P., J. R., & Pramod, V. R., 2015, Total Productive Maintenance and Role of Interpretive Structural Modeling and Structural Equation Modeling in Analyzing Barriers in Its Implementation - A Literature Review. International Journal of Scientific & Technology Research, 4, 302-315.

Sone, Raymond J., 2011, Human Resource Management Seventh Edition Queensland, John Wiley & Sons Australia, Ltd.

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.

Susilo A.K, Ahmadi, Suharyo O.S., Pratisna P., 2017, Applied of Impressed Current Cathodic Protection Design For Fuel Pipeline Network at Naval Base, Iranian Journal of Materials Science and Engineering, Vol. 14 Issue 2 pp. 41-53.

Wantara, P., 2013, Using Structural Equation Modelling to Evaluate the Service Quality, Satisfaction and Customer's Loyalty in Hypermart Department Store, Bangkalan, Indonesia. Global Journal of Management and Business Research Marketing, 13, 1-9.