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Human Resource Management Planning on The Supply Corps Officers of The Navy

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Abstract: The Indonesian Navy is one of the main components of national defense following Republic of Indonesia Law number 34 of 2004 concerning the Navy. The supply corps is part of the Indonesian Navy organization which is tasked with supporting the organization in the fields of finance, supplies, and general administration. The shortage of personnel in the Indonesian Navy, especially the supply corps at the officer level, is an implication of the imbalance between the positions that must be manned and the actual personnel currently available. Human resources (HR) are a very important asset in an organization, including military organizations. Every military organization, including the Indonesian Navy, is a career organization that has strict rules regarding HR recruitment so the recruitment and promotion system is the key to successful HR planning in the organization. HR planning is oriented towards the availability and balance of the number of personnel for each rank in the future. Therefore, an analysis is needed that can see and plan the condition of Indonesian Navy personnel in the future, one of which is Markov chain analysis. There are several stages in the Markov chain process, namely determining states, calculating opportunities between states, forming a transition probability matrix, creating a stochastic process model, initial vector values, and projections of the number of personnel. Based on the analysis of the four scenarios tried in this research, it appears that scenario 2 is a combination of treatments that has the smallest impact on the organization, in terms of the ratio of the number of personnel formed to the available position space. So, the treatment combination of scenario 2 was chosen with the number of recruits in 2021-2030 following the Indonesian Navy personnel strength development program regarding the basic policy of developing the Indonesian Navy towards minimum essential force until 2030, then in 2031-2045 the number of recruits becomes fixed every year, namely 108 personnel, taking into account the balance between the number of personnel in the organization and the available position space.

Keywords: *HR planning, Indonesian Navy, Markov chain, Supply Corps (S).*

1. Introduction

The Indonesian Navy's posture is built based on capabilities, force structure, and title patterns to face various forms of threats, both factual and potential. The approach used in compiling the Indonesian Navy Posture takes into account various aspects, both internal and external, including the scenario-based planning approach, capability-based planning, policies to strengthen the national defense system, government policies to realize Indonesia as the World's Maritime Axis, (National Long-Term Development Plan (RPJPN) 2005-2025, operational capabilities and technological developments (Ahmadi & Herdiawan, 2021). Organizational structuring is one of the aspects that are being improved in building the Indonesian Navy Posture as one of the main components of national defense (Bastari et al, 2021). The Indonesian Navy organization is expected to become an organization that can guarantee the implementation of aspects of coaching and operations of SSAT defense equipment, Integrated Fleet Weapons System (Herdiawan et al, 2020). With the development of the organization and the addition of Indonesian Navy defense equipment, new personnel are automatically needed to man the organization in the Indonesian Navy. The problem that arises is the shortage of personnel at the Officer level. The

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shortage of Indonesian Navy personnel at the Officer level is an implication of the imbalance between the job space that must be manned and the actual personnel currently available (Suharyo et al, 2017). This means that the increase in job space is not necessarily followed by an increase in the number of personnel. In other words, the planning that causes the increase in job space in this case the planning of the development of defense equipment and organizations within the Indonesian Navy structure that need to be manned is not in line with the planning of Indonesian Navy personnel needs. Likewise with the Supply Corps, where the number of Supply Corps Officer personnel currently cannot meet the existing job space (Herdiawan et al, 2020).

The Indonesian Navy is divided into several branches or corps, one of which is the Supply Corps. The Supply Corps is a corps tasked with supporting the Indonesian Navy Organization in the fields of finance, supplies, and general administration. Like the Supply Corps, one of the branches of the Indonesian Navy is required to have basic skills in administrative procedures, be able to understand how the duties of a financial and supply officer are correct, how to understand secretarial problems, and how the duties of a Head of the Logistics Department on the Navy Ships. The Indonesian Navy's financial service and operational ranks in each work unit are manned by Supply Corps officers who hold various functional and structural positions from the ranks of First Officer, Middle Officer, and High Officer. Therefore, one of the keys to the success of this main task is the need to improve the development of officer personnel who have a dominant role and broad authority in carrying out their respective duties to achieve the main objectives of the work. The strength structure and composition of each group and rank of supply corps officers have their characteristics that are different from other branch corps within the Indonesian Navy. Due to the characteristics above, the target for filling the Supply Corps officers will be different both in terms of the total number and the number of each rank. Thus, there needs to be a special personnel planning pattern (Manpower Planning) that still refers to the regulations and policies of the Indonesian Navy leadership.

Based on the background above, the formulation of the research problem is obtained, namely how to evaluate the personnel management of the Navy Supply Corps officers, and how to plan the needs of the Navy Supply Corps officers compared to the available job space with various combinations of recruitment number scenarios. Based on the formulation of the problem above, the objectives of this study can be formulated as follows, namely, to evaluate the management of the Navy Supply Corps officers, to plan the needs of the Navy Supply Corps officers compared to the available job space with various combinations of recruitment number scenarios.

2. Materials and Methods

2.1. Human Resource Planning

Human resource planning is the process of anticipating and making provisions (requirements) to regulate the flow of labor movement into, within, and out of the organization (Sudarmo, 2020). According to Tolstyakova & Batyrova (2020), the objectives of human resource planning include, supporting business goals by procuring and maintaining human resources who can carry out work effectively and efficiently. According to Al-Jedaiah & Albdareen (2020), short-term human resource planning aims to determine predictions of vacant positions and jobs that must be filled in the next year, both in terms of number and qualifications, while in the long term, it aims to predict human resource demand in the next two to five years so that the company can maintain and develop its competitive existence.

Human resource planning (HRP) is a process carried out to identify and analyze the company's human resource needs so that it can achieve the company's goals. Human resource planning is also known as Human Resource Planning (HRP). Human resource planning aims to ensure that the company has adequate, qualified, and competent human resources (Cooke et al, 2020).

2.2. Markov Chain Methods

Markov chain analysis is probabilistic information that can be used to assist decision-making that can provide a systematic method for forecasting human resource supply based on opportunities for personnel transfer or movement (Doroshkevych et al, 2020). The process of workforce movement within

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an organization can be described as a stochastic or random process (Hu, 2022). The stochastic model is used to show how the workforce moves from one state (position) to another state (position) over a certain period (Piccialli, 2020). One of the tools that is generally used in the stochastic model is the Markov chain where the basic concept of the Markov chain assumes that future events (conditions) are determined by the events (conditions) that precede them (Xu, 2022). The basic concept of Markov analysis is the state of the system or state transition. If it is known that the process is in a certain state, then the probability of the process developing in the future (X_(n+1)) only depends on the current state (X_n) and does not depend on the previous state (X_(n-1), X_(n-2), …). In other words, a Markov chain is a series of event processes where the conditional probability of a future event (X_(n+1)) only depends on (X_n) or the current event (Roy, 2020).

2.3. Research Methods

The research method used in this study uses quantitative analysis using the Markov Chain method. The data required for this study were obtained from the Indonesian Navy Personnel Administration Service and the Personnel Administration Section of the Financial Service Headquarters. The data taken for this study was for the period 2011 to 2020. After the data was obtained, the data was grouped in a table for analysis purposes, to determine the extent of the existence of the Supply Corps Officers and how much overall strength must be met to achieve the target of optimal personnel replenishment. The data grouping is as follows:

2.3.1. Indonesian Navy Officer Personnel Strength Data

This data contains the number of Indonesian Navy Officer personnel at each rank level from Second Lieutenant (Letda), First Lieutenant (Lettu), Captain (Kapten), Major (Mayor), Lieutenant Colonel (Letkol) and Colonel (Kolonel). This data comes from all Officer groups, both from the Naval Academy, Initial Career Officer Education, and Indonesian Navy Officer Formation Education. The data presented for the period 2020, as seen in Table 1 below:

Table 1.
Data on the strength of Indonesian navy officer personnel in 2020.

Year	Rank level (Pangkat)						Amount
	Letda	Lettu	Kapten	Mayor	Letkol	Kolonel	
2020	2.167	1.761	2.071	3.062	2.325	1.366	12.752

2.3.2. Data on Personnel Strength of Indonesian Navy Supply Corps Officers

This data contains the number of Indonesian Navy Supply Corps Officer personnel at each rank level from Second Lieutenant (Letda), First Lieutenant (Lettu), Captain (Kapten), Major (Mayor), Lieutenant Colonel (Letkol), and Colonel (Kolonel). This data comes from all levels of officers from the Naval Academy, First Career Officer Education, and Indonesian Navy Officer Formation Education. The data presented is from the period 2011 to 2020, as seen in Table 2 below:

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Table 2.
Data on supply corps officers for the period 2011-2020.

TAHUN	PANGKAT					
	LETDA	LETTU	KAPTEN	MAYOR	LETKOL	KOLONEL
2011	149	196	306	332	114	91
2012	143	186	288	363	139	92
2013	140	204	267	364	163	92
2014	112	199	244	375	194	89
2015	118	185	256	352	197	108
2016	151	195	256	361	210	115
2017	157	149	244	329	230	112
2018	173	149	244	319	233	129
2019	167	187	228	341	252	131
2020	232	208	224	323	261	134
Jumlah	**1638**	**1914**	**2402**	**3397**	**1739**	**1093**
Rata-rata	**164**	**191**	**240**	**340**	**174**	**109**

2.3.3. Data on Promotion of Supply Corps Officer Personnel

This data contains the number of Supply Corps Officer personnel who were promoted to a higher level, starting from the rank of Second Lieutenant (Letda), First Lieutenant (Lettu), Captain (Kapten), Major (Mayor), Lieutenant Colonel (Letkol) and Colonel (Kolonel). This data comes from all levels of officers from the Naval Academy, First Career Officer Education, and Indonesian Navy Officer Formation Education. The data presented starts from the period from 2013 to 2023 as seen in Table 3.

Table 3.
Data on rank promotion for indonesian navy supply corps officer personnel for the 2011-2020 period.

TAHUN	PANGKAT				
	LETDA Ke LETTU	LETTU Ke KAPTEN	KAPTEN Ke MAYOR	MAYOR Ke LETKOL	LETKOL Ke KOLONEL
2011	66	49	36	28	9
2012	42	41	31	29	11
2013	40	38	33	27	8
2014	53	39	30	29	13
2015	38	58	38	27	10
2016	43	35	33	31	9
2017	26	33	31	30	12
2018	43	40	38	31	11
2019	1	9	52	35	11
2020	75	34	13	28	14
Raat-rata	42,7	37,6	33,5	29,5	10,8

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2.3.4. Data on the Appointment of Supply Corps Officer Personnel

This data contains the number of personnel appointed as new officers. The input of new personnel is only carried out at the Letda level. The data presented is from the period 2011 to 2020, as seen in Table 4 below:

Table 4.
Data on the appointment of pama corps supply personnel.

TAHUN	SUMBER PENGANGKATAN			JUMLAH
	AAL	SEPA PK	DIKTUKPA	
2011	32	0	23	55
2012	12	0	28	40
2013	11	0	34	45
2014	7	1	19	27
2015	10	0	34	44
2016	9	1	70	80
2017	9	2	17	28
2018	13	6	46	65
2019	17	4	53	74
2020	9	1	50	60

2.3.5. Data on Supply Corps Officers is Decreasing

This data contains the number of Supply Corps Officer personnel who left the Indonesian Navy organization due to retirement, death, honorable and dishonorable resignations, transfers outside the Indonesian Navy organization, and promotion to Pati or Admiral. Data is presented from the period 2011 to 2020 as seen in Table 5 below.

Table 5.
Data on the decline in the Indonesian navy supply corps officers for the 2011-2020 Period.

TAHUN	PANGKAT					
	LETDA	LETTU	KAPTEN	MAYOR	LETKOL	KOLONEL
2011	1	0	3	4	5	12
2012	0	1	1	3	3	10
2013	1	2	2	6	4	9
2014	0	1	1	7	2	11
2015	1	0	1	6	3	10
2016	0	1	4	4	5	12
2017	2	2	3	3	4	11
2018	0	0	1	5	4	8
2019	1	1	1	4	3	9
2020	0	0	2	5	5	14

2.3.6. List of Personnel Composition (DSP).

This data is a list of personnel strengths that must exist at each ideal level to fill each position in the organization. The current DSP is the 2020 DSP as seen in Table 6 below.

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Table 6.
List of officers of the Indonesian navy supply corps.

PANGKAT	DSP TNI AL		KOLATERAL	TOTAL
	MURNI 'S'	MULTILATERAL		
LETDA	110	261	5	376
LETTU	358	238	15	611
KAPTEN	419	259	11	689
MAYOR	302	136	17	455
LETKOL	134	129	26	289
KOLONEL	35	56	33	124
TOTAL	**1.358**	**1.079**	**107**	**2.544**

Based on Table 6, the Pure Navy Officer Composition List column is data on the number of positions that can only be filled by supply corps officers in the financial field or profession with a total of 1,358 positions. Meanwhile, the Multilateral DSP Indonesian Navy position space column is data on the number of position spaces that can be filled by Indonesian Navy supply corps officers outside the financial profession such as the supply profession, general administration, Inspectorate, Personnel, Planning and budget as well as State Property (BMN) with totals. 1,079 office spaces. The collateral column is the number of supply corps officers who currently hold positions outside the Indonesian Navy organization such as Navy Headquarters, Ministry of Defense, Defense University, Maritime Security Agency (Bakamla), Coordinating Ministry for Political, Legal, and Security Affairs with a total of 107 positions. So the total number of positions is 2,544 positions for officers of the Indonesian Navy Supply Corps.

3. Result and Discussion

The data obtained is then used to process the data to obtain the calculation results. The calculation results can be used to analyze and interpret the results of data processing to obtain a conclusion.

3.1. Determining The State

The initial step in the Markov process is to determine what states exist in the system. As explained in the research procedure, the determination of the state in this study is based on 2 groups, namely:
a. Rank level of Indonesian Navy Officers. This study is limited to the rank level of First Officer and Middle Officer so only six rank strata are used as states.
b. State of outgoing personnel, caused by personnel retiring, dying, honorably or dishonorably retiring, and Promotion to the rank of Pati/Admiral.
The following are the seven states formed in this study according to Table 7.

Table 7.
State Markov chain analysis.

State	Rank level (Pangkat)
1	Letda
2	Lettu
3	Kapten
4	Mayor
5	Letkol
6	Kolonel
7	Personnel reduction

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3.2. Calculation of Probability Values Between States

The first procedure of Markov chain analysis in this study is to identify the reduction and promotion of personnel at each rank level. From the average data of the last 10 years, it can be shown that the value of the opportunity for promotion and reduction of personnel during the last 10 years is according to Table 8.

Table 8.
Promotion opportunities and personnel outgoing.

Rank Level / Pangkat	Promotion	Conversion (Promotion)	Outgoing
Letda	0,260365854	0,223560209	0,003658537
Lettu	0,196858639	0,156666667	0,004188482
Kapten	0,139583333	0,098529412	0,007916667
Mayor	0,086764706	0,16954023	0,013823529
Letkol	0,062068966	0,099082569	0,02183908
Kolonel	0	0	0,097247706

In Table 9, the value of the conversion opportunity for the rank of Second Lieutenant is obtained from the average number of personnel with the rank of Second Lieutenant (Letda) in 10 years divided by the average number of personnel with the rank of Second Lieutenant (Letda) then multiplied by the value of the promotion opportunity. As an example, below for the rank of Second Lieutenant (Letda).

$$\frac{164}{191} \times 0{,}260365854 = 0{,}223560209$$

The promotion value itself is obtained from the calculation of the average promotion of Second Lieutenant (Letda) to First Lieutenant (Lettu) for 10 years, divided by the average number of personnel with the rank of Lieutenant for 10 years, and so on the calculation for other ranks. Meanwhile, for outgoing personnel, it is obtained from the calculation of the number of personnel who retired, died, and left the Indonesian Navy and were promoted to the rank of Senior Officer divided by the average number according to that rank in the last 10 years. After identifying the value of promotion opportunities and the value of personnel reduction, the next step is to form a transition opportunity matrix.

3.3. Transition Probability Matrix

The value of the inter-state opportunity is a change from one rank to another rank level in the next period. The results of the inter-state opportunity values displayed in the form of a matrix are called the transition opportunity matrix. The calculation of the inter-state opportunity and also the transition opportunity matrix is done using the average of ten years of data so that in this study there is one transition opportunity matrix formed. Because each rank level in this study functions as a state, the opportunity matrix formed in this study is the number of rank levels plus the state of new personnel and outgoing personnel, so the size of the transition opportunity matrix formed is 7 x 7. An example is the inter-state opportunity value and the transition opportunity matrix formed as shown in Table 9 below.

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Table 9.
Transition probability matrix.

Dari/Ke	Letda	Lettu	Kapten	Mayor	Letkol	Kolonel	Keluar
(Masuk)	1	0	0	0	0	0	0
Letda	0,77278125	0,22356021	0	0	0	0	0,003658537
Lettu	0	0,83914485	0,15666667	0	0	0	0,004188482
Kapten	0	0	0,89355392	0,098529412	0	0	0,007916667
Mayor	0	0	0	0,816636241	0,16954023	0	0,013823529
Letkol	0	0	0	0	0,87907835	0,09908257	0,02183908
Kolonel	0	0	0	0	0	0,90275229	0,097247706

Table 9 is a transition opportunity matrix built based on data obtained from promotion opportunities and personnel reductions. From the transition opportunity matrix formed, a stochastic process model can be created to determine the flow of personnel movement of the Supply Corps officers in the Indonesian Navy organization as shown in Figure 1 below.

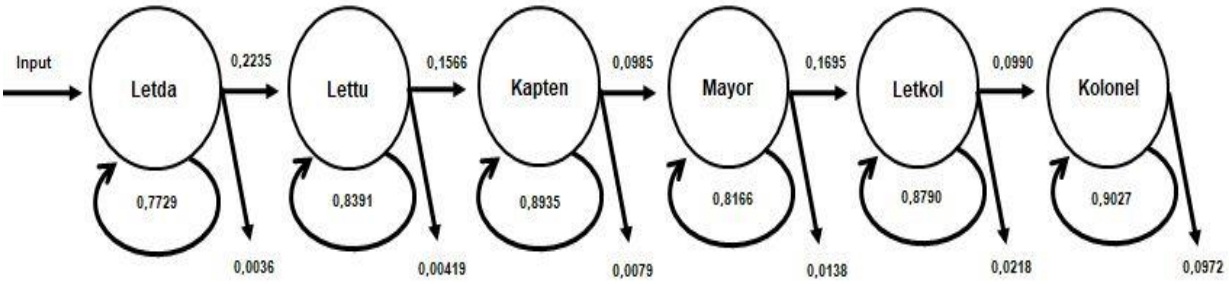

Figure 1.
Stochastic process model.

Based on Figure 1, shows that in the Second Lieutenant state, 22.35% of personnel with the rank of second lieutenant received a promotion to one level higher, namely to the rank of second lieutenant. Then in the second lieutenant state, there were also personnel who left the state by 0.36%, due to personnel who entered retirement, died, and left the Indonesian Navy organization in the sense of carrying out transfers outside the Indonesian Navy such as serving at the Navy Headquarters, the Indonesian Ministry of Defense, Bakamla and others. In addition, in the second lieutenant state, there were personnel who remained in the state itself by 77.29%, and so on the movement of personnel with the rank of second lieutenant up to colonel. In the stochastic model of the flow pattern of personnel of the supply corps officers, the state entered only from the input of new personnel at the rank of second lieutenant. At the rank of Colonel, there was no promotion because this study did not include the rank of high-ranking officers (Pati). In the colonel rank state, there were personnel who left the state by 9%, this was not purely all personnel who entered retirement, but there was also a percentage of personnel who were promoted to the rank of First Admiral. As previously explained, this study does not include the rank of Pati, so the percentage of Colonels who were promoted to Senior Officers is considered the same as retirement. For information, in 2020, out of 14 personnel who left the state, 3 personnel were promoted to First Admiral, 2 personnel died and 9 personnel entered retirement. After the personnel movement pattern has been identified from the stochastic process model, the next step is to determine the initial vector value.

3.4. Defining Initial Vector Values

After the transition matrix is formed and the stochastic process model is built, the next step is to determine the initial vector, where the initial vector in this analysis is the composition of the number of

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personnel at each rank for the period December 2020. In the next stage, the transition probability matrix is then multiplied by the number of personnel at each rank to determine changes in the composition of personnel at each rank in the future. The assumption used in this analysis is that the number of new personnel recruitments for each year is by the last recruitment in 2020, which was 60 personnel each year.

Letda	Lettu	Kapten	Mayor	Letkol	Kolonel
232	208	224	323	261	134

x

Dari/Ke	Letda	Lettu	Kapten	Mayor	Letkol	Kolonel	Keluar
(Masuk)	1	0	0	0	0	0	0
Letda	0,77278	0,22356	0	0	0	0	0,00366
Lettu	0	0,83914	0,15667	0	0	0	0,00419
Kapten	0	0	0,89355	0,09853	0	0	0,00792
Mayor	0	0	0	0,81664	0,16954	0	0,01382
Letkol	0	0	0	0	0,87908	0,09908	0,02184
Kolonel	0	0	0	0	0	0,90275	0,09725

Figure 2.

So:

Second Lieutenant (Letda) = (60 x 1) + (232 x 0.77278) + (208 x 0) + (224 x 0) + (323 x 0) + (261 x 0) + (134 x 0) – (232 x 0.00366) = 238

First Lieutenant (Lettu) = (232 x 0.22356) + (208 x 0.83914) + (224 x 0) + (323 x 0) + (261 x 0) + (134 x 0) – (208 x 0.00419) = 226

Captain (Kapten) = (232 x 0) + (208 x 0.15667) + (224 x 0.89355) + (323 x 0) + (261 x 0) + (134 x 0) – (224 x 0.00792) = 231

Major (Mayor) = (232 x 0) + (208 x 0) + (224 x 0.09853) + (323 x 0.81664) + (261 x 0) + (134 x 0) – (323 x 0.01382) = 281

Lieutenant Colonel (Letkol) = (232 x 0) + (208 x 0) + (224 x 0) + (323 x 0.16954) + (261 x 0.87908) + (134 x 0) – (261 x 0.02184) = 279

Colonel (Kolonel) = (232 x 0) + (208 x 0) + (224 x 0) + (323 x 0) + (261 x 0.0990) + (134 x 0.90275) – (134 x 0.09725) = 134

The calculation results show that the number of personnel of each rank in the first year is in Table 10 below:

Table 10.
Calculation results in the first year.

Rank Level (Pangkat)	number of personnel initial year of observation	Number of personnel in the first year
Letda	232	238
Lettu	208	226
Kapten	224	231
Mayor	323	281
Letkol	261	279
Kolonel	134	134

For the analysis of the predicted number of personnel in the second year, the data on the number of personnel for each rank in the first year can be used, then multiplied by the transition probability matrix, then the calculation process is carried out sequentially until the twenty-fifth year (2045) so that the sequence of changes in the number of personnel at each rank can be seen. The following is an estimate or forecast of the number of personnel formed from the initial year of observation (2020) to the twenty-fifth year (2045) and will then be compared with the DSP or available job space according to Table 11.

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Table 11.
Results of Estimated Number of Personnel for the Next 25 Years.

Tahun	Letda	Lettu	Kapten	Mayor	Letkol	Kolonel
2020	232	208	224	323	261	134
2040	260	346	425	194	219	114
2045	260	350	448	210	230	114
DSP murni (S)	110	358	419	302	134	35
DSP campuran	376	611	689	455	289	124

Based on Table 11. shows that there is a significant change in the composition of the number of personnel at each rank level. At the rank of Second Lieutenant (Letda), the number of personnel has increased steadily. This is because the number of new personnel recruitments has not changed according to the initial assumption of 60 people and the opportunity for promotion from Second Lieutenant (Letda) to First Lieutenant (Lettu) is quite high, which is 22%. However, from 2040 to 2045, the amount of personnel composition for the Second Lieutenant rank remains relatively constant. If faced with a position space in the pure DSP (S) for the rank of Second Lieutenant (Letda) of 110 positions, then with the condition of the number of personnel there will be 150 personnel who do not have a position in the pure (S) but if faced with a position space in the mixed DSP, then the personnel formed have no problems with the existing positions, even the available positions are excessive or lack of personnel.

At the rank of Second Lieutenant (Letda), there has also been a stable increase, and has increased every year. A different thing happened at the captain rank level which experienced a fairly large increase. In 2045, the number of lieutenant personnel is estimated to reach 350 people, which means it is estimated to increase by 142 people, when compared to the position space in the pure DSP (S) of 358 positions, then the estimated number of personnel can fill the available position space. However, when compared to the position space in the mixed DSP, the personnel formed have not been able to fill the available position space or are still lacking personnel.

Similar to the rank of lieutenant, the rank of captain also experienced an increase in the number of personnel for the next twenty-five years, with estimated personnel formed of 448 personnel. When compared to the position space in the pure DSP (S), there will be 29 people who will not get a position in the pure DSP (S). The estimated personnel formed are still below the available position space when compared to the total position space in the mixed DSP where the total available positions are 689. So that the deviation between the number of personnel and the position space available at the rank of Captain can be seen.

At the rank of Major (Mayor), the estimated number of personnel formed has decreased drastically due to the small chance of personnel being promoted from captain to major, which is only 9% and the chance of a major leaving the state is 13%, this percentage figure is very large when compared to the chance of promotion to major which is only 9%. So the estimated number of major rank personnel formed in the next twenty-five years is 210 personnel, even though for the rank of major there is a position space in the pure DSP (S) of 302 positions, resulting in around 30% of pure DSP (S) positions for majors not being able to be filled by major rank personnel. Likewise, if the major rank personnel formed are faced with a position space in the mixed DSP, the number of personnel formed is still far from the available position space or can be said to be a shortage of personnel.

At the rank of Lieutenant Colonel (Letkol), there is an unstable change. From 2020 to 2025 there was an increase in the number of personnel, but in the following years until 2045, there was a gradual decrease in the number of personnel. The decrease in the number of personnel at the lieutenant colonel rank level is because the chance of being promoted to major to lieutenant colonel is only 16% while the chance of leaving the state for lieutenant colonel is 2%. This is likely due to the high number of personnel who retire, especially for officers who graduated from Diktukpa. So the projection of the number of lieutenant colonel rank personnel formed until the 25th year is 230 personnel. When faced

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Vol. 8, No. 6: 7638-7654, 2024
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with a pure DSP (S) position space, there will be 96 supply corps personnel who fill the mixed DSP position space because there are only 134 pure DSP (S) positions available. When faced with a position space in a mixed DSP, the personnel formed have not been able to fill the existing position space. At the colonel rank, there is an increase and decrease in the number of personnel that is unstable but tends to decrease every year. This decrease is also due to the high chance of leaving the state for colonels of 9.7%. The high percentage is influenced by several factors, namely the factor of personnel entering retirement, personnel dying, personnel who carry out mutations out of the Navy organization, and colonel rank personnel who get promotions to higher ranks, namely First Admiral. So, the estimated number of personnel formed for the next twenty-five years is 114 people and if faced with the position space for colonels in the pure DSP (S) which is available there are only 35 positions, then there will be 81 personnel who cannot fill the position space in the pure DSP (S). However, when compared to the position space in the mixed DSP, the personnel formed have not been able to fill the position space.

Based on the estimated number of personnel formed at each rank in the next 25 years which has been analyzed using a Markov chain, the results show that the number of personnel formed is still below the number of available positions at each rank. Therefore, a scenario for recruiting new personnel is needed to obtain the right number of personnel according to the available positions.

3.5. Calculation of the Number of Personnel with Various Combinations of Recruitment Scenarios

To meet the need for personnel to be able to fill the existing positions, this analysis carries out several scenarios for the number of new personnel recruitments. Several scenarios will be tested to find which combination of treatments will have the smallest impact on the Indonesian Navy organization, especially in the Supply Corps, in terms of the comparison of the number of personnel to the available positions.

a. Scenario 1, by Navy Chief regulation number 5 of 2016 concerning the basic policy of developing the Indonesian Navy towards minimum essential strength (Minimum Essential Force). Where in the regulation there is a program for developing the strength of Indonesian Navy personnel which plans to increase the intake of officers with a percentage that is not constant each year as seen in Table 12 below.

Table 12.
Officer Intake Trends in Probangkuat Personnel.

Years	Officer intake percentage
Years 2017 to 2018	8%
Years 2018 to 2019	3%
Years 2019 to 2020	8%
Years 2020 to 2021	10%
Years 2021 to 2022	3%
Years 2022 to 2023	8%
Years 2023 to 2024	5%

If the percentage increase in officer intake in Table 13 is averaged, the result is 0.06 or 6%. If in determining the scenario in this study using the basis of the policy in planning the addition of officer intake. So, scenario 1 in this analysis is how the composition of the number of personnel of each rank will be in the next 20 years if the addition of officer intake is 6% each year with the number of recruitments in year 0 being 60 people.

where,

n = Number of recruitments in year 0

n + 1 = n (1 + 6%) number of recruitments in year 1

So the number of new personnel recruitments up to the 20th year is as in Table 13.

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DOI: 10.55214/25768484.v8i6.3658

Table 13.
Recruitment plan per year scenario 1.

Year	Previous year recruitment amount	Intake increase (6%)	Recruitment plan
Years-1	60	4	64
Years-2	64	4	68
Years-3	68	4	72
Years-4	72	4	76
Years-5	76	5	81
Years-n	…	…	…
Years-20	183	11	194

Based on Table 13. it can be seen that in the 20th year, recruitment of new personnel will be carried out by as many as 194 people. From scenario 1 in this analysis, an evaluation will be carried out on the calculation results of the projection of the number of personnel formed for each rank over the next 20 years. Scenario 1 in this analysis is a scenario for the number of recruitments that has included three sources of officer recruitment, namely officers who graduated from the Naval Academy (AAL), Career Soldier Officers (Pa PK), or officers who graduated with undergraduate degrees and officers from Officer Formation Education (Diktukpa) or officers who are the result of strata transfers from non-commissioned officers with a certain composition. After the Markov analysis calculation was carried out, the estimated results of the amount of personnel composition for each rank for the next twenty years were obtained by Table 14.

Table 14.
Results of scenario 1 calculation in the next 20 years compared to available job spaces.

Tahun	Letda	Lettu	Kapten	Mayor	Letkol	Kolonel
2020	232	208	224	323	261	134
2030	396	394	360	171	240	134
2040	707	703	634	252	242	119
DSP Murni (S)	110	358	419	302	134	35
DSP Campuran	376	611	689	455	289	124

Based on Table 14, it can be seen that there is a difference in the composition of the estimated number of personnel for each rank starting from the initial conditions of the observation year, namely 2020, then scenario 1 with an additional officer intake of 6% each year. In Table 14, it can be seen that in the rank of lieutenant, there has been a very drastic change in the number of personnel due to the Markov calculation which has been combined with scenario one. The estimated number of lieutenant-rank personnel formed in the next 20 years is 707 personnel, when compared to the available job space, the number of personnel is above the number of available job spaces. In the sense that there will be an excess of personnel in the lieutenant rank around 331 lieutenant personnel will not have positions or will be nonjob.

The estimated number of lieutenant-rank personnel in the next 20 years when combined with scenario one is 703 personnel. Similar to the lieutenant rank, the lieutenant rank also experiences an

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Vol. 8, No. 6: 7638-7654, 2024
DOI: 10.55214/25768484.v8i6.3658

excess of personnel. When compared to the total available job space, the personnel formed exceeds the existing job space so there will be around 92 personnel who do not have positions.

At the captain (Kapten) rank, the estimated number of personnel formed in the next 20 years is 634 personnel. When compared to the pure DSP (Supply) position space, there are 215 personnel filling positions in the mixed DSP because the pure DSP (Supply) has been fulfilled, in other words, the estimated number of personnel formed is still below the available position space. In contrast to the captain rank, the estimated number of major rank personnel formed in the next 20 years is 252 personnel, when compared to the position space in the pure DSP (S Supply), all personnel formed can be accommodated in the position space because the available position space is 302 positions. The projected number of lieutenant colonel rank personnel in the next 20 years is 242 personnel, when compared to the pure position space (S) of 134 positions, there will be 108 personnel who do not have positions in the pure position space (S) but can fill in the mixed DSP position which can be filled by the supply corps because in the mixed DSP for the lieutenant colonel rank, there are 153 positions available. So it can be said that the estimated personnel formed are still below the available job space. For the rank of colonel, the estimated number of personnel in the next 20 years is 119 personnel, when compared to the available job space for pure DSP (S) where for the rank of colonel there are 35 positions, then there will be around 85 personnel who cannot fill pure positions (S). However, the 85 personnel can still fill the job space in the mixed DSP where in the job space there are 89 positions. From the results of the Markov analysis combined with the scenario of adding officers by 6% each year that has been tried, a picture is obtained for the next 20 years, the estimated number of personnel formed has experienced a high increase in the first officer strata (Pama) while in middle officers (Pamen) it has decreased.

b. Scenario 2, In the first scenario tested, it appears that in 2030 the number of personnel formed at the rank of lieutenant has begun to have excess personnel, if the officer intake in scenario 1 of 6% is continued for each year, then the following years will automatically have an excess of lieutenant personnel. If the excess personnel at the rank of lieutenant is not anticipated as early as possible, it will result in an excess of personnel at other ranks in the future because the Indonesian Navy is a career organization that adheres to a pyramid system of positions where the higher the rank, the smaller (fewer) the available job space. Therefore, in scenario 2 the officer intake of 6% in 2030 in the calculation of scenario 1 is not continued or stopped where the intake of supply officers in that year is 108 personnel. So for the following year, namely 2031, the recruitment of new personnel is set at 108 personnel each year until the next 15 years, namely 2045, which is a continuation of the Markov process flow pattern in scenario 1. After the Markov analysis calculation is carried out in combination with scenario 2, the estimated results of the amount of personnel composition of each rank in 2045 are obtained according to Table 15 below.

Edelweiss Applied Science and Technology
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Vol. 8, No. 6: 7638-7654, 2024
DOI: 10.55214/25768484.v8i6.3658

Table 15.
Results of scenario 2 calculation in 2045 compared to available job space.

Tahun	Letda	Lettu	Kapten	Mayor	Letkol	Kolonel
2020	232	208	224	323	261	134
2045	466	606	691	300	281	128
DSP Murni (S)	110	358	419	302	134	35
DSP Campuran	376	611	689	455	289	124

From Table 15, it can be seen that the estimated number of personnel formed at the rank of lieutenant has increased significantly when compared to the initial year of observation, namely 2020, which was 466 people. Likewise, the ranks of lieutenant and captain also experienced a very drastic increase in the number of personnel. However, when faced with the available job space, the number of personnel at the rank of lieutenant exceeds the number of available job spaces. On the other hand, for the ranks of lieutenant and captain, the number of personnel formed is close to the existing job space or the existing job space can still accommodate the number of personnel formed.

The projection of the number of personnel at the rank of major formed in scenario 2 is 300 personnel. When compared to the job space in the pure DSP (S), the projection is balanced with the existing job space, but when compared to the total mixed DSP, the projection of the number of personnel formed is still below the available job space.

Meanwhile, at the rank of lieutenant colonel, the estimated number of personnel formed until 2045 is close to the available job space. Where the existing job space is 289 positions and the number of personnel formed is 281 people. Similar to the rank of colonel, in 2045 the estimated number of personnel formed is 128 personnel with available job space of 124 positions. So there are still 4 personnel who do not have a position at the rank of colonel.

c. Scenario 3, Next, the researcher tried to do the third scenario with an additional 5% recruitment each year with the number of recruitments in year 0 of 60 people. where,

n = Number of recruitments in the initial year or year 0

n+1= n (1+5%) number of recruitments in year 1

So the number of new personnel recruitments up to year 20 is as in Table 16.

Table 16.
Recruitment Plan per Year Scenario 3.

Years	Previous year recruitment	Intake increase (10%)	Recruitment plan
Years-1	60	3	63
Years-2	63	3	66
Years-3	66	3	69
Years-4	69	4	73
Years-5	73	4	77
Years-n	…	…	…
Years-20	152	7	159

Based on Table 16, a scenario three trial was conducted in this analysis, where the number of recruitments increased by 5% each year and it will be analyzed to what extent the estimated personnel formed over the next 20 years are faced with the number of available positions. Table 17 below is the result of Markov's calculation combined with scenario 3.

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Vol. 8, No. 6: 7638-7654, 2024
DOI: 10.55214/25768484.v8i6.3658

Table 17.
Results of scenario 3 calculation in the next 20 years compared to available job space.

Tahun	Letda	Lettu	Kapten	Mayor	Letkol	Kolonel
2020	232	208	224	323	261	134
2040	595	619	587	240	237	118
DSP Murni (S)	110	358	419	302	134	35
DSP Campuran	376	611	689	455	289	124

In Table 17, it can be seen that the number of personnel in the lieutenant rank has increased due to the Markov calculation that has been combined with scenario three. The estimated number of lieutenant-rank personnel formed in the next 20 years is 595 personnel, when compared to the available job space, the number of personnel cannot all be accommodated in the existing job space. In other words, there will be an excess of personnel in the lieutenant rank so around 219 lieutenant personnel will not have positions. The same is true for the lieutenant rank, the estimated number of lieutenant rank personnel in the next 20 years when combined with scenario three is 619 personnel. When faced with the available job space for the lieutenant rank of 611 positions, the number of personnel is 8 people more so that later there will be 8 people who do not have positions.

The estimated number of personnel in the captain rank also experienced an increase in personnel in the next twenty years by 587 personnel. When compared to the pure DSP (S) job space, there will be 168 people who will not get a position in the pure DSP (S) but can fill positions in the mixed DSP job space.

At the rank of Major (Mayor) to lieutenant colonel, there was a decrease in the number of personnel when viewed from the conditions in the early year of observation, and when faced with pure DSP (s), at the rank of major the personnel formed can fill the position because the position of pure DSP (S) for the rank of major is 302 while the personnel of the rank of major formed is 240 personnel. However, if the number of lieutenant colonels formed is faced with pure DSP (S) there will be 102 remaining personnel who will fill the total position space of the mixed DSP as well as with the rank of colonel where the number of colonels formed is 118 people, then there are still 6 positions that cannot be filled.

d. Scenario 4, Similar to scenario 2, in scenario 4 the researcher looks for the year where the second lieutenant personnel have exceeded the available job space in the Markov process flow pattern in scenario 3. It was found that in 2031 the second lieutenant personnel had exceeded the available job space with a recruitment of 103 personnel. Therefore, in scenario 4, the recruitment of new personnel was determined as many as 103 personnel each year from 2032 to 2045 which is a continuation of the Markov process flow pattern in scenario 3. After the Markov analysis calculation was carried out in combination with scenario 4, the estimated amount of personnel composition for each rank in 2045 was obtained according to Table 18 below.

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DOI: 10.55214/25768484.v8i6.3658

Table 18.
Calculation results of scenario 4 in 2045 compared to available job space.

Tahun	Letda	Lettu	Kapten	Mayor	Letkol	Kolonel
2020	232	208	224	323	261	134
2045	445	576	657	286	273	125
DSP Murni (S)	110	358	419	302	134	35
DSP Campuran	376	611	689	455	289	124

Based on Table 18, the estimated results of personnel formed until 2045 are not much different from the results in scenario 2. However, in the results of scenario 2, the estimated number of personnel formed is closer to the number of available positions than the results in scenario 4.

5. Conclusion

Based on the results of observations, presentations, and data processing and analysis, several conclusions can be drawn, namely the results of the evaluation of the management of supply corps officer personnel with Markov chain analysis, it was found that in the twenty-fifth year to come, the estimated number of personnel in the ranks of Second Lieutenant (Letda), First Lieutenant (Lettu), Captain (Kapten), Major (Mayor), Lieutenant Colonel (Letkol) and Colonel (Kolonel) of the Supply Corps (S) in the Indonesian Navy organization will decrease or be below the available positions if the number of personnel recruitment is still carried out at 60 personnel each year according to the number of recruitments in the last year, 2020.

Based on the planning of the needs of supply corps officer personnel, several scenarios for recruiting new personnel were carried out to obtain the composition of the number of personnel for each rank that is right according to the available positions. The results of the four scenarios tested in this study, it can be seen that scenario 2 is a combination of treatments that has the smallest impact on the organization, in terms of the comparison of the number of personnel formed to the available job space. So the combination of scenario 2 treatment was chosen with the number of recruitments in 2021-2030 by the Probangkuat personnel of the Indonesian Navy concerning the basic policy of developing the Indonesian Navy towards a minimum basic force (Minimum Essential Force) until 2030 then in 2031-2045 the number of recruitments remains constant each year, namely 108 personnel, considering the balance between the number of personnel in the organization and the available job space.

5.1. Future Work

From the analysis and conclusions that have been obtained, there are several further works proposed by the author, namely if the organization must continue to implement the recruitment of new personnel of 60 personnel each year for Supply Corps officers, then the conditions that will be achieved in 2040 will be a deviation between the composition of personnel for each rank with the composition of the DSP or available job space. In other words, the personnel of Supply Corps officers will decrease or be below the number of available job spaces so that existing personnel are unable to fill the available job spaces according to the DSP due to limited personnel. Coupled with the development of the organization in the Indonesian Navy, automatically the job space for Supply Corps officers will increase and require personnel to man the organization. Based on the findings of this study, it is recommended to increase the recruitment of new personnel to anticipate personnel shortages in the future by implementing recruitment by the Navy concerning the basic policy of Navy development towards the minimum essential force until 2030 then in 2031-2045 the number of recruitments remains constant each year at 108 personnel, with consideration of the balance between the number of personnel in the organization and the available job space. For further researchers, it is hoped that they can expand the

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DOI: 10.55214/25768484.v8i6.3658

scope of the objects studied, not only at the officer and Supply corps level but also include the non-commissioned officer strata and the enlisted strata of all corps or branches in the Indonesian Navy. Another thing that can be considered in further research is using a different analysis method, for example, dynamic program, goal programming, cross-sectional, or other analysis methods. In addition, several scenarios can also be used to see the picture of personnel manning the organization in the Indonesian Navy.

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