7. Similarity The Naval Harbours Priority Development Using Zero-One Matrix Decision Variable (ZOMDV) And Fuzzy Mcdm Methods; A Case Study

By Okol Sri Suharyo

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THE NAVAL HARBOURS PRIORITY DEVELOPMENT USING ZERO-ONE MATRIX DECISION VARIABLE (ZOMDV) AND FUZZY MCDM METHODS; A CASE STUDY

Bambang Suharjo
Sekolah Tinggi Teknologi Angkatan Laut, STTAL Surabaya, Indonesia

Okol Sri Suharyo
Sekolah Tinggi Teknologi Angkatan Laut, STTAL Surabaya, Indonesia

ABSTRACT

This study aims to select the location of Naval Harbor that already exists, with various characteristics of different regions to be developed or increased classification status becomes the main Naval Harbor. The model uses the application of the Zero-One Matrix Decision Variable (ZOMDV) and Fuz zy Multi Criteria Decision Making (Fuzzy MCDM). ZOMDV used to select the naval harbors by minimizing the number of naval where bases selected can cover and replaces other bases based on variables: ship within range of the harbor to the sector of operation, the distance between the harbor, and the ability of ships cruising distance. Fuzzy MCDM used to select the harbor by assessing the weight of the base by the political, technical and economic.

Keyword: Naval Harbours, ZOMDV, Fuzzy MCDM

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1. INTRODUCTION

Indonesian Navy divides the working area of its command into three Main Command regions that are Fleet Command I (Western), Fleet Command II and Fleet Command III (Eastern). In this research, the discussion is limited to the Naval Harbor in the Eastern Fleet Command. The Naval Harbor number in the region of Eastern Fleet Command is 26 Naval Harbors, which spread from the Java Sea to the Arafura Sea as shown in Table 1.

Table 1 Naval Harbors

Operation sectors	Available Naval Harbors in Sector (amount 26)
I	Makassar, Sangatta, Balikpapan, Tarakan, Palu, Toli (6)
II	Cilacap, Semarang, Banyuwangi, Benoa (4)
III	Mataram, Kupang, Rote, Maumere (4)
IV	Kendari, Ambon, Tual (3)
V	Tahuna, Ternate, Manado, Sorong (4)
VI	Biak, Jayapura, Manokwari (3)
VII	Timika, Aru (2)

As an archipelagic nation that is recognized internationally, Indonesia should be able to control and secure the entire area of ocean that is owned. Efforts to control maritime security operations are carried out through activities held by Navy Ships and Naval Harbor as a base of support. This study aims to select the location of Naval Harbor that already exists, with various characteristics of different regions to be developed or increased classification status becomes the main Naval Harbor, in terms of political, technical and economic aspects. The questioned research in this study is how to make the appropriate calculation model approach to choose the Naval Harbors that needs to be developed into the Main Base to support the Indonesian naval task.

2. THE METHODS

The Proposed Methods in this research can be shown in the following steps:

2.1. ZOMDV Model

The First step of this research is the selection of Naval Harbor in the operations sector with the Zero One Matrix Decision Variable (ZOMDV) model, the model can be formulated in the following sequences:

2.1.1Determining the Objective Function

1. Minimizing the number of the naval harbor -k to cover more naval harbors in the operation sector -j

2. Maximizing the range operation of the patrol ship in the naval harbor -k to operation sector -j

$$Z\ min = \sum_{k \in K}^{n} \sum_{j \in J}^{n} Xkj \ ; \qquad Z\ max = \sum_{k \in K}^{n} \sum_{j \in J}^{n} Dkj \ . \ Xkj$$

2.1.2Determining the Constraints Function

1. The distance range of patrol ship operation from naval harbor position -k to operation sector -j and return to naval harbor-k does not exceed the ability of navy ships cruising distance endurance (RE navy ship); Dkj . Xkj $\leq$ RE Navy Ship,

2. Operation sector -j covered by at least one naval harbor–k; Xkj ≥ 1

With :

Xkj = Naval harbor-k to cover navy operation sector -j

Dkj = Range operation of the navy ship in the naval harbor-k to navy operation sector j then subsequently return to naval harbor-k

RE = Cruising distance of patrol ship in once Endurance

2.1.3. Determining the Decision Variable

Table 2 ZOMDV For Naval Harbor Selection

Naval Harbor	Operating sector				
	J-1	**.**	**.**	**.**	**J-n**
K-1	X 1,1	X 1,2	X 1,3	X 1,4	X 1,n
.	X 2,1	X 2,2	X 2,3	X 2,4	X 2,n
K-n	X n,1	X n,2	X n,3	X n,4	X n,n

X kj = 0 (zero), that the Harbor -k is not selected to cover navy sector operation -j

X kj = 1 (one), the selected Harbor–k covers navy operation sector –j

2.1.4. Data process:

a. Calculation of Max Cruising Distance (RE) of the patrol ship, based on the data: speed, radar range, endurance (E) and cruising distance of patrol ship (S), as shown in Table 4.

Table 4 Calculate Max Cruising Distance (RE) of Navy Ship

No	Navy Ship	Speed (knot)	Radar (mil)	E (day)	S (mil)	RE=E*S (mil)
1	MM	14	48	4	336	1.344
2	TP	15	48	4	360	1.440
3	HB	13	48	4	312	1.248
4	TD	17	46	5	408	2.040
5	LM	17	46	5	408	2.040
6	SL	24	46	5	576	2.880
7	DT	23	42	3	552	1.656
8	WT	24	42	3	576	1.728
9	LW	25	42	3	600	1.800

b. Operation Sector of Naval Harbor Data, including the number of Harbors in each operation sector, and sector area of operation which has to be secured, Table 5.

Table 5. Navy Operation Sector Area

Operation sector	Number of Harbors	Sector Area (mil^2)
I	6	248.720
II	5	264.975
III	3	240.900
IV	3	200.070
V	4	232.215
VI	3	245.725
VII	3	256.160

c. Data of Naval Harbor, including the distance between Harbors and range of the Harbors to the operation sector as a starting point for the movement of ships (D), Table 6.

Table 6. The Distance of Naval Harbor to the Operation Sector (D; mil)

Naval Harbor	Sector I	Sector II	Sector III	Sector IV	Sector V	Sector VI	Sector VII
Cilacap	2310	1826	1835	2130	2275	2320	2380
Semarang	2235	1790	2325	2845	2310	2655	2745
Banyuwangi	2357	1820	2490	2575	2375	2690	2875
Benoa	2300	1810	2415	2510	2305	2615	2805
Makassar	1575	2515	2355	2480	2225	2580	2775
Sangatta	1662	2450	2655	2795	2873	2986	2943
Balikpapan	1675	2285	2433	2543	2690	2755	2735
Tarakan	1590	2200	2235	2305	2415	2545	2525
Palu	1660	2250	2386	2255	2425	2505	2495
Toli	1673	2412	2155	2102	2390	2410	2350
Tahuna	1802	2765	3225	2450	2375	2510	2702
Mataram	1835	3750	3115	2640	1401	2245	3675
Kupang	2850	2245	1840	2275	2750	2910	2725
Rote	3225	3310	1865	2560	2975	3275	2775
Maumere	3045	3075	1812	2255	2450	2775	2455
Kendari	2950	2875	1775	2202	2575	2810	2240
Ambon	2775	3211	2655	1535	2277	2550	2470
Tual	3150	3345	2455	1410	1365	2330	1925
Ternate	2975	3424	2375	1455	1390	2290	1990
Manado	2865	3155	2305	2110	1312	2235	2650
Sorong	2245	3576	2648	2020	1377	2285	2780
Biak	2650	3875	2723	2093	1370	1283	2365
Jayapura	2855	3890	2833	2235	2074	1295	2476
Manokwari	3035	3955	2955	2496	2255	1275	2519
Timika	2968	3825	2801	2428	2190	1225	2375
Aru	3105	3765	2791	2393	2154	2775	1390

Then the data is processed using the ZOMDV formulation to get the chosen naval base to cover the operating sector, as shown in Table 7.

Table 7 ZOMDV of Naval Harbor

Naval Harbor	**Decision Variable Of Naval Harbor Selection**						
	Navy Operation Sectors						
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**
Cilacap	0	0	0	0	0	0	0
Semarang	0	0	0	0	0	0	0
Banyuwangi	0	0	0	0	0	0	0
Benoa	0	0	0	0	0	0	0
Makassar	0	0	0	0	0	0	0
Sangatta	**1**	**1**	0	0	0	0	0
Balikpapan	0	0	0	0	0	0	0
Tarakan	0	0	0	0	0	0	0
Palu	0	0	0	0	0	0	0
Toli-toli	0	0	0	0	0	0	0
Tahuna	0	0	0	0	0	0	0
Mataram	0	0	0	0	0	0	0
Kupang	0	0	0	0	0	0	0
Rote	0	0	0	0	0	0	0
Maumere	0	0	0	0	0	0	0
Kendari	0	0	**1**	**1**	0	0	0
Ambon	0	0	0	0	0	0	0
Tual	0	0	0	0	0	0	0
Ternate	0	0	0	0	**1**	**1**	0
Manado	0	0	0	0	0	0	0
Sorong	0	0	0	0	0	0	0
Biak	0	0	0	0	0	0	0
Jayapura	0	0	0	0	0	0	0
Manokwari	0	0	0	0	0	0	0
Timika	0	0	0	0	0	0	**1**
Aru	0	0	0	0	0	0	0

1= naval harbor covers the sector; 0= naval harbor doesn't cover the sector

2.2. Step 2 Fuzzy MCDM Methods

The next step in this research is applying Fuzzy MCDM method to get the rank or weighting for placement of Naval Harbor. The weighted Naval Harbors are required as a form of giving priority to the naval Harbor which will be developed. As Table 7, the Naval Harbors are Sangatta (NB1), Kendari (NB2), Ternate (NB3), and Timika (NB4).Previously, filling the questionnaire has been done by **6 expert assessors or decision makers (E1 - E6)** who are competent in the field of Naval Harbor. Scale questionnaire is divided into two linguistic scales and a numerical scale, as the table below:

Table 3. Scale Questionnaire

Aspect / Criteria	Very Low		Low		Medium		High		Very High	
	1	2	3	4	5	6	7	8	9	10
Political Aspect										
Technical Aspect										
Economy Aspect										

Sequences of data processing using fuzzy MCDM algorithm above is as follows:

a. Weighting

The results to diagram level assessment qualitative criteria to get the value of the weight aggregates.

No	Criteria of Naval Harbor	E1	E2	E3	E4	E5	E6
A	Political Aspects						
1	Region Vulnerability	8	9	9	8	8	9
2	Society Conflict	6	5	7	8	5	8
3	Sea Crime	7	8	7	9	7	8
4	Borders Violation	7	6	5	7	8	7
5	Foreign Countries Threats	6	7	8	6	8	8
B	Technical Aspects						
6	Rock Soil Conditions	5	6	8	6	5	7
7	Climate Weather Conditions	8	6	6	7	6	8
8	Environmental Conditions	6	7	8	5	5	7
9	Hinterland Conditions	9	9	9	10	9	10
10	Maintenance Facilities	9	10	9	9	10	10
11	Logistics Facilities	5	6	5	7	6	5
12	Recreational Facilities	7	8	6	7	8	5
13	Hospital Facilities	8	6	8	8	5	8
14	Broad Waters	7	8	8	7	8	8
15	Broad Land	7	7	8	7	8	7
16	Height Location	7	8	8	8	7	8
17	Bathymetry	8	7	7	8	7	7
18	Sea Wave Heights	7	8	7	7	8	7
19	Wind Velocity	6	7	7	6	6	7
20	Tide Water	8	8	8	7	7	8
21	Sedimentation Rate	6	7	7	7	8	7
C	Economic Aspects						
22	Development Cost	7	7	8	7	8	8
23	Advanced Operations Cost	8	7	8	8	7	7

b.Diagraming

The results of the assessment or preference rating for each alternative based on qualitative criteria.

No	Qualitative Criteria	Naval Harbor	E1	E2	E3	E4	E5	E6
1	Region Vulnerability	NB1	8	7	9	8	8	7
		NB2	8	8	8	8	9	7
		NB3	7	5	7	7	7	6
		NB4	9	9	8	9	9	8
2	Society Conflict	NB1	6	5	7	8	5	8
		NB2	6	7	6	7	6	7
		NB3	8	7	9	8	8	8
		NB4	7	6	7	7	6	6
3	Sea Crime	NB1	6	5	6	6	7	6
		NB2	6	6	7	6	6	7
		NB3	9	9	10	9	9	9
		NB4	5	5	5	5	5	5
4	Borders Violation	NB1	7	6	6	7	8	7
		NB2	8	7	8	9	7	9
		NB3	7	7	7	8	7	7
		NB4	7	8	8	7	8	8
5	Foreign Countries Threats	NB1	6	7	7	6	8	7
		NB2	8	7	8	6	8	9
		NB3	9	8	7	9	8	7
		NB4	8	8	6	7	6	9
6	Rock Soil Conditions	NB1	7	6	8	6	5	7
		NB2	7	8	6	8	7	9
		NB3	8	8	8	8	8	9
		NB4	7	6	7	6	7	6
7	Climate Weather Conditions	NB1	6	6	5	7	6	8
		NB2	7	7	6	8	9	7
		NB3	8	9	8	9	8	8
		NB4	7	6	7	5	8	8
8	Environmental Conditions	NB1	6	7	8	9	5	7
		NB2	7	7	7	7	6	6
		NB3	8	7	8	7	8	8
		NB4	6	7	6	8	5	9
9	Hinterland Conditions	NB1	7	8	7	7	8	9
		NB2	5	7	5	8	6	7
		NB3	7	8	7	8	9	9
		NB4	7	7	8	7	5	8
10	Maintenance Facilities	NB1	6	8	8	7	8	8
		NB2	8	9	7	8	8	9
		NB3	9	9	10	10	9	9
		NB4	8	8	7	8	9	8
11	Logistics Facilities	NB1	8	6	5	7	6	7
		NB2	8	7	8	6	8	7
		NB3	8	7	8	8	7	6
		NB4	9	9	8	9	9	8
12	Recreational Facilities	NB1	7	8	6	7	8	5
		NB2	8	7	8	8	7	6
		NB3	7	8	6	7	8	5
		NB4	8	7	8	8	7	6
13	Healthy Facilities	NB1	7	6	8	8	5	8
		NB2	7	6	7	6	7	6
		NB3	8	8	8	8	8	9
		NB4	8	8	8	9	9	8

c. Determining

The mean fuzzy numbers, by adding the value that appears in each level scale linguistic and then dividing the sum by the number of criteria that value into the inside of the linguistic assessment level. The mathematical notation is as follows:

$$a_t = \frac{\sum_{i=1}^{k} \sum_j T_{ij}}{\sum_{i=1}^{k} n_{ij}}$$

a_t= median fuzzy numbers to levels

T= the level of assessment is very low, low, medium, high and very high.

n= number of scale linguistic scale factor for an alternative to T-1 of the i-th factor

T_{ij} =numerical value of the scale for an alternative to linguistic T-1 of the j-th factor.

d. Determining

The value of the lower limit and upper limit value fuzzy numbers, where the lower limit value (ct = b (i - 1)) is equal to the mean level down, while the upper limit value (bt = b (i - 1)) is the same as the mean level on it.

e. Determining

The aggregate weight of each qualitative criteria, as used in this study linguistic assessment form that has had the definition of triangular fuzzy numbers, then the aggregation process is done by searching for the aggregate value of the respective lower limit value (c), the mean (a) and the upper limit value (b), which can be modeled as follows:

$$c_t = \frac{\sum_{j=1}^{n} c_{tj}}{n} \qquad a_t = \frac{\sum_{j=1}^{n} a_{tj}}{n} \qquad b_t = \frac{\sum_{j=1}^{n} b_{tj}}{n}$$

c_{tj} = lower limit value of qualitative criteria to-t by decision makers to-j

a_{tj} = median qualitative criteria to-t by decision makers to-j

b_{tj} = the value of the upper limit to the qualitative criteria-t by decision makers to-j

n = number of assessors (decision maker)

Aggregate value is $N = (c_j, a_j, b_j)$, Nt = Value aggregation weights for qualitative criteria to-t

f. Calculating

the value of the preference of each alternative Harbors on qualitative criteria. In calculating the aggregate weight each alternative for each criterion may look fuzzy aggregate value with the following models:

$$q_t = \frac{\sum_{j=1}^{n} q_{tj}}{n} \qquad o_t = \frac{\sum_{j=1}^{n} o_{tj}}{n} \qquad p_t = \frac{\sum_{j=1}^{n} p_{tj}}{n}$$

q_{itj} = lower limit value alternative to qualitative criteria by the manufacturer to kep tj.

o_{it} = value alternative to middle-t qualitative criteria by decision makers to j.

o_{itj} = upper limit value alternative to qualitative criteria by the manufacturer to kep tj.

N = number of assessors (decision maker).

Aggregate value is $M_{itj} = (q_{it}, o_{it}, p_{it})$, M_{itj}= weighted aggregation value for the i-th alternative to qualitative criteria to-t.

g. Calculating

the value of the fuzzy index of each alternative assessment results for the qualitative criteria which are denoted by Gi. First obtained value Mit and Nt, to get a fuzzy match index value for each Gi subjective criteria. Here Gi is not triangular fuzzy numbers, but fuzzy numbers.

$$G_i = (Y_i, Q_i, Z_i, H_{i1}, T_{i1}, H_{i2}, U_{i1}), \qquad i = 1,2,...m$$

h. Calculating the value of the utility of each alternative to qualitative criteria.

$$U_t(G_t) = \frac{1}{2}\left[H_{i2} - \left({H_{i2}}^2 + \frac{X_R - Z_i}{U_{i1}}\right)^{\frac{1}{2}} + 1 + H_{i1} - \left({H_{i1}}^2 + \frac{X_L - Y_i}{T_{i1}}\right)^{\frac{1}{2}}\right]$$

$$X_R = \frac{1}{2}\left\{2x_1 + 2H_{i2}(x_2 - x_1) + \frac{(x_2 - x_1)^2}{U_{i1}} - (x_2 - x_1)\left[\langle 2H_{i2} + \frac{(x_2 - x_1)^2}{U_{i1}} + 4\frac{x_1 - z_1}{U_{i1}}\rangle\right]^{\frac{1}{2}}\right\}$$

$$X_L = \frac{1}{2}\left\{2x_2 + 2H_{i1}(x_2 - x_1) + \frac{(x_2 - x_1)^2}{T_{i1}} - (x_2 - x_1)\left[\langle 2H_{i2} + \frac{(x_2 - x_1)^2}{T_{i1}} + 4\frac{x_1 - z_1}{T_{i1}}\rangle\right]^{\frac{1}{2}}\right\}$$

The first step to do is by looking for the criteria and preferences of defuzzification value alternative to the criteria, which the used defuzzification method used is the centroid method. The formula of defuzzification criteria is as follows:

$$\text{Defuzzification } N_{it} = \frac{\left[\left[\int_{c_t}^{a_t} \frac{(x-c_t)}{(a_t-c_t)} x dx + \int_{a_t}^{b_t} \frac{(x-b_t)}{(a_t-b_t)} x dx\right]\right]}{\left[\left[\int_{c_t}^{a_t} \frac{(x-c_t)}{(a_t-c_t)} dx + \int_{a_t}^{b_t} \frac{(x-b_t)}{(a_t-b_t)} dx\right]\right]}$$

t = criteria 1,2,3...n

While the formula for determining the value defuzzification alternative preference for qualitative criteria is as follows:

$$\text{Defuzzification } M_{it} = \frac{\left[\left[\int_{q_{it}}^{o_{it}} \frac{(x-q_{it})}{(o_{it}-q_{it})} x dx + \int_{o_{it}}^{p_{it}} \frac{(x-p_{it})}{(a_t-p_{it})} x dx\right]\right]}{\left[\left[\int_{q_{it}}^{o_{it}} \frac{(x-q_{it})}{(o_{it}-q_{it})} dx + \int_{o_{it}}^{p_{it}} \frac{(x-p_{it})}{(a_t-p_{it})} dx\right]\right]}$$

i = alternative 1,2,3,..m

I. Calculating the value of the ranking of each alternative Harbors on qualitative criteria by using the following formula:

$$ST_i = \frac{U_T(G_i)}{\sum_{i=1}^{m} U_T(G_i)}$$

ST_i= the value of the i-th rank alternatives Harbors on qualitative criteria.

j. Calculating the value of the ranking of each alternative Harbors on quantitative criteria by using the following formula:

$$OT_i = \frac{\sum_{j=1}^{p}\left[T_{ij} l\left(\sum_{i=1}^{m} T_{ij}\right)\right]}{p}$$

T_{ij} = value (score) of the i-th alternative to quantitative criteria to-j

M = number of alternative P = number of quantitative criteria

OT_i= the value of the i-th rank alternatives Harbors on quantitative criteria

k. Calculating total value ranking each alternative to qualitative criteria and quantitative criteria by using the following formula:

$$FT_i = \frac{ST_i + OT_i}{\sum Vk}, 0 \leq x \leq 1$$

Σ Vk = number of variables

FT_i = rank total value for the alt to-i

Selecting the best alternative Harbors on the value of the highest rank.

TOTAL RANKING		
NAVAL BASE	Fti	RANKING
NB1	0,242	III
NB2	0,248	II
NB3	0,242	III
NB4	0,268	I

3. RESULT AND DISCUSSION

The methods in the paper is a development of the theory of covering naval harbor concept and the development of the concept of Fuzzy MCDM. Fuzzy MCDM theory was introduced by Liang and Wang (1994) [11] in the paper about selecting a hub location for global shipping carrier. The set covering methodology was introduced by Daskin (1995) [2], Heragu (1997) [5], and followed up by Manfaat (1998) [7] in paper about computer-based approach to the effective utilization of spatial layout design experience and and the next done by Suharyo (2017) [9] developed a set covering theory as part of the navy fleet placement. In general, studies about site priority development research has a lot to do. Methods for site selection have also been widely applied and developed. Some researchers who have done: Borah et al (2013) [1] conducted a wind turbine site selection optimization with fuzzy logic and GIS system uses three parameters that are qualitative environmental conditions, location and the physical condition of the human factor. Tierno et al (2013) [8] conducted a study on the retail site location using GIS and the Analytical Hierarchy Process (AHP). Eylem Koc (2015) [3] did an application of Analytical Hierarchy Process (AHP) in a real world of store location to get a priority development of store location. And then Farahani and Asgari (2006) [4] did a combination of MCDM and covering technique in optimize model for facility location.

The creativity and the development of the methods in this research are:

a. The additional program in the form of a zero-one matrix of decision variable in the theoretical concept set covering technique of naval harbor placement. Zero-one matrix is the decision-making variables that have a price value of 0 (zero) or 1 (one). 0 (zero) means that the Naval Harbor is not elected, and 1 (one) means the Naval Harbor was selected to provide cover in the operating sectors with the aim of minimizing the hub-port harbor to cover more harbors. Decision 0 or 1 is an integer instead of a fractional decision since the selection of the Naval Harbor is the selection of unity variables intact as a single Harbor unit.

b. Integration of Zero One Matrix Decision Variable (ZOMDV) with Fuzzy MCDM concept is one form of creativity development methods in this paper. One thing that becomes a critical point in site selection issue is suitability method applied to the condition of the real problems in the field. This is the main reason for the integration of these two concepts above. Because in choosing Naval Harbor locations, initial selection should be done is to minimize the number of Harbors in a single sector of operation, wherein the Harbor is selected to represent the Harbor more to cover the area of sector operations with a variable of cruising ship distance, the distance between the harbor and within the Harbor to the operation sector. The basic exact method is the development of a set covering technique of naval harbor placement methods. The next step is done by analyzing qualitative variables of the political, technical and economic aspects can be solved by the algorithm of Fuzzy MCDM with the results of the weighting and ranking the Naval Harbor candidates. Figure 4 below shows the data processing result by Fuzzy MCDM methods.

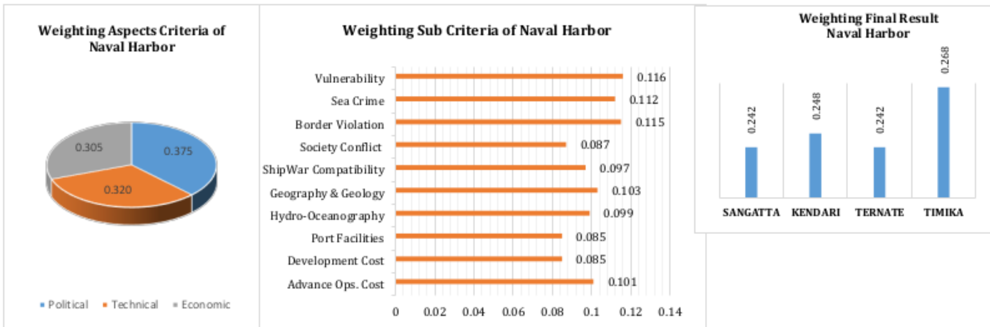

Figure 4.Naval Harbor Weighting Results

4. CONCLUSION

In this paper, a case study about establishing the locations of some naval Harbors with the minimum number of naval Harbors locations was investigated. The main problem in this paper is how to determine the location of appropriate Naval Harbor to be developed into a larger Naval Harbor. The Naval Harbor selected must be able to cover the other Naval Harbors based on the distance of cruising ship, the distance between Naval Harbors, the distance Harbor to operation sector, and by weighting on the political, technical and economic aspect. Variables in the Political, Technical and Economic aspects are: region vulnerability, sea crime, borders violation, society conflict, warship compatibility, geography, geology, hydro-oceanography, port facilities, advanced development cost, operations cost were assessed.

In this paper, we presented the two-step procedures or methods that in each stage regarding the situation we used different tools and models. The two-step procedures are Zero-One Matrix Decision Variable including set covering naval harbor, and Fuzzy MCDM methods. The benefits of integrating two methods in this study are indeed a simplification of solving problems in the field because the development of naval Harbor is a unique and complex problem. Various variables are very influential both on quantitative and qualitative in decision-making. Integration of ZOMDV and Fuzzy MCDM models is able to solve these problems simply and systematically.

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