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A Model of Marine Security Synergy at Chokepoint Lombok Strait With AHP-SWOT Identification Method

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Abstract

Lombok Strait is one of the gateway entrance of international shipping line that gets priority maritime security and maritime safety. Also, the Chief of Indonesian Navy wants the Naval Base in Lombok Strait to carry out its duties and functions optimally amid the limited facilities owned. So, it is necessary to study the synergistic between Naval Base, Maritime Stakeholders and Local Government to support Indonesian maritime diplomacy policy. This research was made to create a model of marine security synergy with AHP-SWOT identification method. The results of the assessment to understand the area in the Lombok strait as well as by improving the ability of security facilities at Naval Base. The result of this work also mention about the strategic location factor of strait Lombok becomes determinant to make a policy. Overall of this synergistic strategy proof that the important of the Lombok strait marine security in the Indonesia and support the improvement of regional economies.

Keywords: Naval base; Maritime security; Synergistic; AHP-SWOT

Introduction

One of the strategic aspects of a maritime country because Indonesia has 4 sea traffic points international "Chokepoints" that are Malacca Strait, Sunda Strait, Lombok Strait and Ombai-Wetar Strait [1]. To manage maritime resources, Indonesia needs to use the power and ability of the Indonesian Navy to become the main power of diplomacy strategy [2]. Through the sea toll road development program, deep sea port development increased logistics support, and shipping industry, as well as marine tourism development especially in maritime development in eastern Indonesia, is expected to be part of the nation's diplomacy strategy in maritime [3]. Lombok Strait is one of the gateway entrance of International shipping line from Chokepoint and ALKI II. The Lombok Strait is also part of the main trade route between the Asia-Australia continent [4]. One of the maritime diplomacy strategies developed by the Indonesian government in the Lombok Strait is to ensure maritime security including maritime safety [5].

Indonesia's maritime security and safety responsibilities belong to the Indonesian Navy, Maritime Stakeholders (Bakamla, Polairud, Dishubla, KKP) and Local Government. All maritime institutions control and minimize various forms of maritime threats [6]. The maritime threats that can occur in the Lombok Strait include illegal activities in the sea (such as smuggling of wood, fuel oil and sand and fish theft), maritime security disturbances (such as collision accidents, ship hijacking, sabotage and surveillance of Indonesian territory) and disturbances in border areas (such as smuggling of goods, weapons, narcotics and humans and acts of terrorism/separatism) [7].

As part of the Integrated Fleet Weapon System (SSAT), Naval Base is to provide support both administrative support and logistical support to warships (KRI), aircraft, troops (Marines) who served in their working areas [8]. While the function of the Naval Base can be grouped into 5R which includes: (1) Base as a place of Replenishment; (2) Bases for repair and maintenance; (3) Base as a rest area; (4) Base for Refreshing; and (5) Base as a refueling point [9]. Indonesian Navy places two Naval Bases (NB) that have an important role in overseeing and handling maritime security issues in the Lombok Strait. The bases are Denpasar Naval Base (DPS-NB) and Mataram Naval Base (MTR-NB) [10,11] (Figure 1).

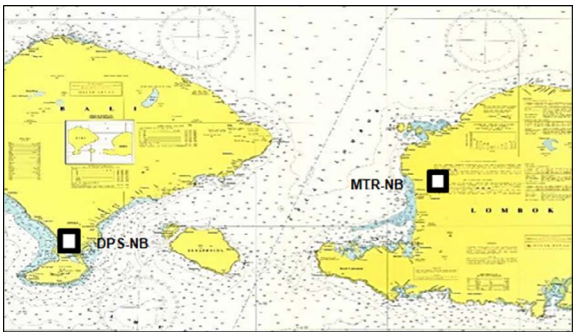

Figure 1: Map of Lombok strait.

However, these two NB have problems in carrying out supervision and handling of maritime security and safety in the region. The main constraint is due to limited port facilities, communication facilities, ship maintenance and repair facilities and security facilities. With this limitation, both of NB can't perform the task optimally. The cooperation of all maritime institutions and stakeholders is required to support the tasks and functions of NB [12]. This synergy is influenced by internal factors including all the strengths and abilities of the NB, as well as technical capabilities. The influence of external factors on the carrying capacity of the region as well as economic and political support from national and local government policy [13]. The head of both of NB in the Lombok Strait also has a major task to synergize the functions of the NB in the future. So, it is necessary to study the synergy of duty and function of NB which is expected to support Maritime security operation in Lombok Strait.

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Some of the studies have been conducted and support this research: The existence of the Naval Base reflects the conditions and effects on the security of the region [14]; Establishment of safety and security information system of shipping by utilizing altimetry satellite data [15] and The Naval Base based on sustainability model [13]. The first thing to do in this research is iidentifying the factors that affect the Maritime security system. By identifying the system will form a conceptual synergistic and become the basic strategy of this research.

This research will synergize the tasks and functions of the NB in the Lombok Strait from the security, technical and economic aspects [16]. Also carried out jointly with various maritime institutions that exist in the Lombok Strait region. This is because these aspects are the main pillar of the existence of NB that supports marine security operations in creating maritime development in the provinces of Bali and West of Nusa Tenggara.

The research question of this research is how to identify the influencing factors of synergistic and how to make a strategy of synergistic duty and function of NB in Lombok Strait in the future? The objective goal of this research is maritime stability with indicators of declining numbers of illegal activities at sea, marine security disturbances, and disruptions in border areas. Also increasing economy of maritime community with income indicator on society around Lombok strait become more prosperous. At the end of the introduction in Section 2 of this paper laid out the research methodology. The results are discussed in Section 3. Section 4 provides a general discussion of the results, while the conclusion of the study can be found in Section 5.

Research Methodology

Chokepoint Lombok strait

The chokepoint Lombok strait which lies between Bali Island and Lombok Island is an important part of international shipping as it provides a support channel for cross-continental trade and shipping (Australia and Asia) as well as connecting from the Indian Ocean to The Pacific Ocean [17]. Lombok Strait geographically, which has a length of 60 kilometres with a width of 18-30 kilometres and a depth of more than 1000 meters are not many of hindered by the island and suitable for large ships to pass away [18]. The countries that depend on utilizing the cruise through the Lombok Strait are Australia, China, Singapore, India and Japan [19]. Lombok Strait can be a cornerstone of maritime tourism-based economic development as well as part of the national food support distribution channels. Lombok Strait is also much traversed by freight vessels and human transport vessels so that the potential of various maritime service industries can develop around the Lombok Strait [20]. But maritime threats can occur such as threats of territorial violations, the danger of navigation, illegal exploitation of resources, and other illegal action. In addition, illegal smuggling of goods and trafficking in persons, as well as terrorism may affect the economy of the people in the tourism sector [21].

Maritime security system

The research variables are sourced from internal factors in the form of data of strength condition and capability possessed by Naval Base, whereas variable from an external factor of Navy is in the whole environment that exist in the Maritime security system [22]. The input of this system is the condition of the ability of DPS-NB and MTR-NB in terms of security, economic and technical aspects. In the process is done by conducting maritime security operations together using all the conditions that exist today [23]. As a result, the implementation of Maritime security operations optimally with the boundary implementation of administrative and logistical support necessary to carry out Maritime security operations [24] (Figure 2).

Naval exercise

Military training with Multilateral Naval Exercise Komodo (MNEK) 2018 became the right means for the Navy to train together with the navies of friendly countries in preparation for dealing with natural disasters and humanitarian problems in Lombok Strait. It is a joint exercise with navies of friendly countries in non-war military operations that had a purpose of this activity is to increase cooperation in tackling disasters and humanitarian problems in an area that needs to get the attention of all countries. This MNEK is followed by 37 countries which is centred on the Lembar Port and takes the theme of 'Cooperation to Respond to Disaster and Humanitarian Issues' in accordance with the conditions of Indonesia's geological location [25]. Lombok straits is very prone to disasters because it is located on a ring of fire that has the potential to cause earthquakes, volcanic eruptions, tsunamis and landslides. And this exercise was very useful when Lombok was hit by the recent earthquake [26]. Indonesian Navy send a ship with medical aid, supplies and logistics support in joint humanitarian operations.

AHP-SWOT analysis

Analysis with SWOT matrix can be used not only for management but also can be used in analyzing an activity for the decision-making process [27]. SWOT analysis can also be used as a decision support tool and used as a tool to analyze the internal condition of the organization and environmental conditions around the organization. So that the various internal and external information of the organization can already be represented systematically in the SWOT matrix [28]. The added value of the SWOT analysis can be achieved by performing pairwise comparisons between the SWOT factors and analyzing them by the technique of determining the eigenvalue as applied in the AHP method [29]. The relative importance weight of the SWOT variable and its sub-variables obtained by the AHP approach and used to rank the strategies based on the identification of the experts [30] (Figure 3).

Stages of AHP

To use qualitative analysis, the conventional SWOT method can be explained by using AHP method to determine the quantitative value and the accuracy of its value [31]. The SWOT-AHP process seeks to

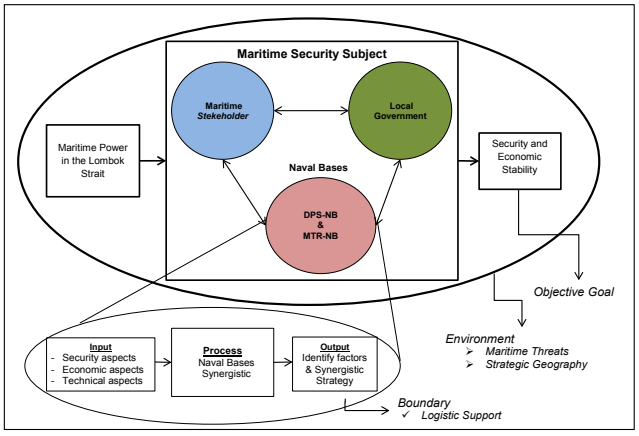

Figure 2: Conceptual synergy system on naval base in Lombok strait.

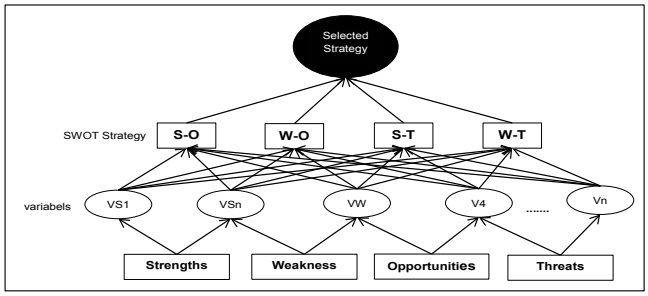

Figure 3: AHP approach on SWOT analysis.

accommodate multiple viewpoints. In this way, the SWOT-AHP will find the consensus value point of a view [32]. To carry out quantitative calculations with AHP comparisons is done AHP-SWOT calculation steps [33,34]. Stages of AHP are as follows:

Step 1: SWOT analysis.

Step 2: Comparisons in pairs between SWOT factors were conducted within each SWOT group.

Step 3: Comparisons in pairs between four SWOT groups.

Step 4: Using results in the formulation of strategies and the evaluation process.

Relative importance weights of the SWOT factors and sub-factors were obtained by the Analytic Hierarchy Process (AHP) model, as well as the ranking of identified strategies. It was performed by several experts [30]. The stages of decision-making with the AHP method are as follows:

- Define problems and determine solutions.
- Creating a hierarchical structure
- Pairwise comparison matrix formed by choice or judgment of the decision maker to assess the level of importance of an element than any other element.
- Normalize the data
- Calculating eigenvalues vector and tested for consistency
- Repeat steps 3, 4, and 5 for all levels of hierarchy.
- Calculating eigenvector of each pairwise comparison matrix.
- Test the consistency of the hierarchy in the form of relationship priorities as eigen vector against consistency.

If that assessment is perfect in any comparison, then $aij.\ ajk = aik$ for all, and A matrix is called consistent [35].

$$A = \begin{pmatrix} 1 & a_{12} & \cdots & a_{1n} \\ \frac{1}{a_{12}} & 1 & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \frac{1}{a_{1n}} & \frac{1}{a_{2n}} & \cdots & 1 \end{pmatrix}$$

The values of the comparison matrix A [36] can be expressed into the following forms:

$$a_{ij} = \frac{w_i}{w_j};\quad (\mathrm{i,j} = 1,2,3,.....,\mathrm{n}) \qquad (1) \tag{1}$$

$$a_{ij}.\left(\frac{w_i}{w_j}\right) = 1;\quad (\mathrm{i,j} = 1,2,3,.....,\mathrm{n}) \tag{2}$$

Consequences:

$$\sum_{j=1}^{\bar{n}} a_{ij}.w_j.\left(\frac{1}{w_i}\right) = 1;(i = 1,2,3,.....,n) \tag{3}$$

$$\sum_{j=1}^{n} a_{ij}.w_j = nw_i;(i = 1,2,3,.....,n) \tag{4}$$

Equation (4) in the form of a matrix becomes:

$$A.w = n.w \tag{5}$$

If Z_1, Z_2, Z_3, ..., Zn are numbers that is in accordance with equation A. w = Z. w

(Z is Eigenvalue of the A matrix, and if $aii = 1$ to i) then an equation becomes:

$$\sum_{i=1}^{n} Z_i = n \tag{6}$$

if A is a pairwise comparison matrix, to obtain the priority should be sought w vector satisfying the equation:

$$Aw = Z_{maks}.w \tag{7}$$

Indicators of consistency measured using Consistency Index (CI) were formulated.

$$CI = \frac{Z_{maks} - n}{n-1} \tag{8}$$

And for measuring the consistency of assessment is used Consistency Ratio (CR).

$$CR = \frac{CI}{RI} \tag{9}$$

A certain level of consistency is required in determining the priority to obtain valid results. CR value should not be more than 10% or 0.10. If not, then need to be revised.

Analysis and Results

Identifying analysis

Identifying the factors that influence the research is done by collecting the SWOT factor data sourced from the primary data. The results primary and data collection is done by interviewing maritime expertise competence: Officer of Indonesian NB facilities services, hydro-oceanographic, Indonesian 2nd Fleet Command, Commander of KRI, Commander of DPS-NB and MTR-NB, and from the leader of Maritime and Local Government. All data were processed by Excel program and Software Expert Choice into data criteria and weighting according to the design of numerical calculation (Figure 4).

Design and numerical calculation result

The design of numerical calculation is based on the process of giving a weight of each level starting from the aspect of research, criteria, and variables which the calculation is according to interview result and questionnaire to 12 experts (Table 1).

Research subjects assessment

Assessment of all variables that affect the research done by scoring the current condition that is supported by the primary data and real data in the field. The weight of the SWOT score is the same which means each variable has the same strong influence (Table 2).

From the results of the assessment with the AHP-SWOT method above the overall score on a scale of 1 to 4, identified in the evaluation

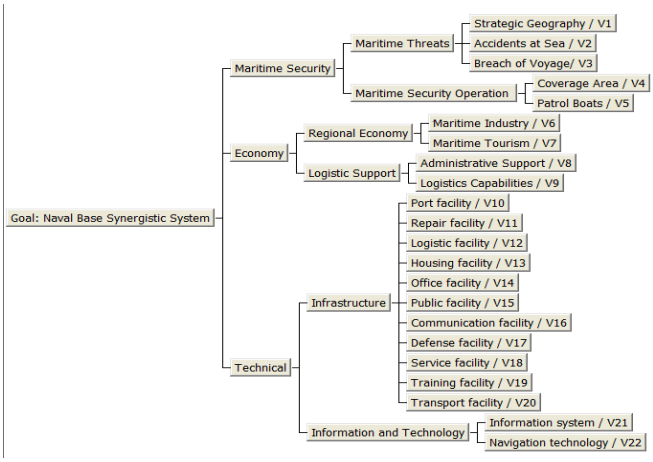

Figure 4: Identifying naval base synergistic system in Lombok strait.

Research Aspects	Weight Level 1	Research Criteria	Weight Level 2	Variable Code	Weight Level 3
Maritime Security	0.380	Maritime Threats	0.155	V1	0.061
				V2	0.034
				V3	0.041
		Maritime Security Operation	0.173	V4	0.053
				V5	0.049
Economy	0.289	Regional Economy	0.167	V6	0.043
				V7	0.053
		Logistic Support	0.167	V8	0.044
				V9	0.050
Technical	0.331	Infrastructure	0.167	V10	0.048
				V11	0.043
				V12	0.043
				V13	0.038
				V14	0.050
				V15	0.042
				V16	0.046
				V17	0.049
				V18	0.043
				V19	0.036
				V20	0.038
		Information and Technology	0.173	V21	0.054
				V22	0.042

Table 1: Weighting calculation result.

SWOT Score	Variable Code	Relative Weight (N)	Assessment Result (J)	Rating (R) (N) × (J)	Score (S) (R) × (N)	SWOT Ranking
Strengths (S)	V4	0.053	95	5.038	0.267	1
	V14	0.050	90	4.486	0.224	2
	V5	0.049	89	4.379	0.215	3
	V10	0.048	83	3.978	0.191	5
1.503	V13	0.038	80	3.067	0.118	8
	V9	0.050	79	3.937	0.196	4
	V11	0.043	78	3.339	0.143	7
	V8	0.044	77	3.395	0.150	6
Weaknesses (W)	V18	0.043	76	3.302	0.14	3
	V17	0.049	76	3.739	0.184	1
	V16	0.046	76	3.496	0.161	2
	V12	0.043	75	3.259	0.142	4
0.958	V15	0.042	74	3.073	0.128	5
	V19	0.036	74	2.695	0.098	7
	V20	0.038	72	2.714	0.102	6
Opportunities (O)	V7	0.053	81	4.296	0.228	2
0.634	V1	0.061	78	4.735	0.2874	1
	V6	0.043	65	2.783	0.1191	3
Threats (T)	V3	0.041	62	2.535	0.1037	2
	V21	0.054	56	3.006	0.1613	1
0.420	V22	0.042	55	2.319	0.0978	3
	V2	0.034	50	1.693	0.0573	4

Table 2: SWOT scoring result.

Total Internal Factors (S + W)		2.461
Selected Strategy Priorities		
Strengths (S)	Covered Area (V4)	0.267
Weaknesses (W)	Defense facility (V17)	0.184

Table 3: Internal Factors Evaluation (IFE).

Total External Factors (O + T)		1.055
Selected Strategy Priorities		
Opportunities (O)	Strategic Geography (V1)	0.287
Threats (T)	Information system (V21)	0.161

Table 4: External Factors Evaluation (EFE).

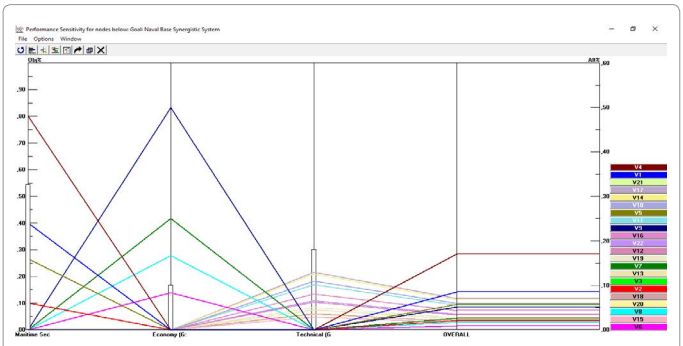

Figure 5: Performance and synthesize sensitivity.

of internal factors reached the score of 2.461 with the highest variable priority is to cover the area in the Lombok strait as well as by improving the ability of security facilities at Naval Base (Table 3).

While on the evaluation of external factors reached a score of 1.055

Internal Factors	Strengths (S)	Weaknesses (W)
External Factors	(1) V4, (2) V14, (3) V5, (4) V10, (5) V13, (6) V9, (7) V11, (8) V8	(1) V18, (2) V17, (3) V16, (4) V12, (5) V15, (6) V19, (7) V20
Opportunities (O)	**S-O Strategy**	**W-O Strategy**
(1) V7, (2) V1, (3) V6	1. Strengthening covered areas at sea 2. Utilizing the strategic value of the location for the voyage	1. Improve the function of defense facilities and maritime communications 2. Enhance maritime tourism
	(S1) (S2) (S3) (O2) (O1)	(W2) (W3) (O1) (O3)
Threats (T)	**S-T Strategy**	**W-T Strategy**
(1) V3, (2) V21, (3) V22, (4) V2	1. Development of headquarters capability 2. Maximize port information center	1. Using a shared communications network 2. Preventing crossing ship violations
	(S2) (S3) (T2) (T1)	(W3) (W4) (T1) (T3)

Table 5: SWOT matrix research.

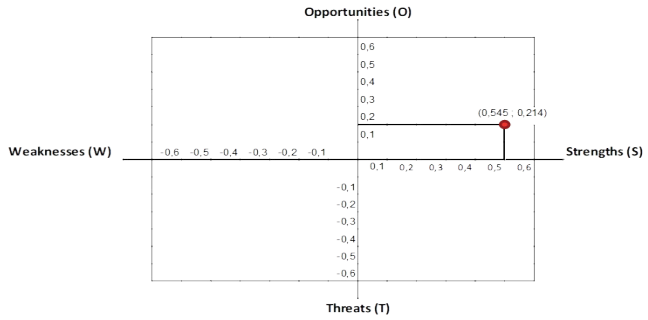

Figure 6: SWOT evaluation strategy priorities.

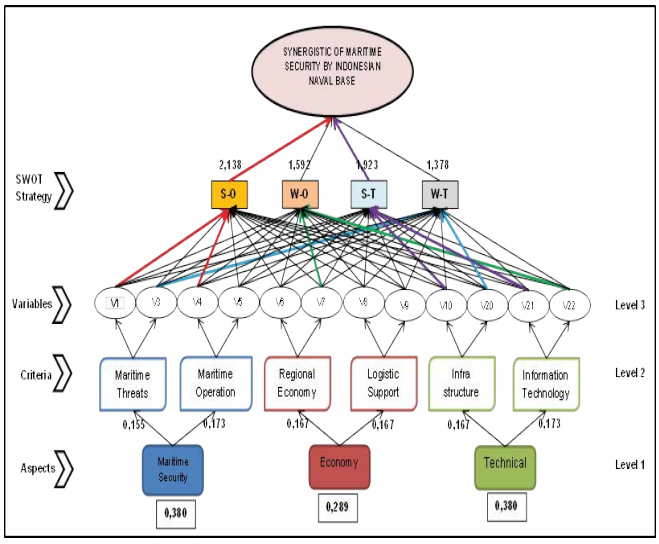

Figure 7: SWOT hierarchy of the priority strategies.

with the highest variable priority is to utilize the strategic geo-strategic strait of Lombok as the gateway of shipping and international trade by utilizing the management of information systems from the port of Benoa and Lembar (Table 4).

Sensitivity analysis

AHP sensitivity analysis can combine strategic variables so that it can determine the priority order of the best strategy. Sensitivity analysis is shown in the Dynamic Sensitivity Software Expert Choice Chart (Figure 5).

Discussion

Formulation of strategy priorities

The result of EFI matrix (Evaluation Internal Factor) and EFE matrix (External Factor Evaluation) then the intersection of four lines of Strength, Weakness, Opportunity and Threat factors are as follows:

Strength Score - Weakness score = 1.503 - 0.958 = 0.545

Opportunity Score - Threat Score = 0.634 - 0.420 = 0.214

Then the intersection of comparing strength lies in Quadrant I which is supporting the Aggressive Strategy. NB can take maximum advantage of the strategic conditions of Lombok Strait together with maritime stakeholders and local government (Figure 6).

SWOT Matrix analysis priority based on AHP

Assessment of SWOT strategy with AHP analysis is an activity of translating strategy formula into activities that must be implemented in each column. Then the column of strategy can identify the variables that greatly affect the success of achieving the goals of this synergy (Table 5 and Figure 7).

Conclusion

Creating a common strategy in managing the Strait of Lombok is the main point of this research. Synergy resulted in this research indicates that strategic location factor of strait Lombok becomes determinant to make a policy. Utilizing existing opportunities from external Naval Bases such as cooperating in managing shipping information. So that information can be reused by DPS-NB or MTR-NB as part of joint Maritime security operations. The S-O or S-T strategy becomes the priority of the Navy leadership in establishing synergy in maintaining maritime security in the Lombok Strait. This paper may serve as a useful reference for elsewhere in the world for strategic study. After this research is further expected future research can create a model of synergy that can describe the dynamics of the system that may occur from any use of strategy. So, by dynamic system we can visualize the changes as well as the values that can be obtained based on the time change.

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