

Policy Management Of Natural Resources In Border State Using AHP Approach

Sampe L. Purba¹, Purnomo Yusgiantoro², Yanif Dwi Kuntjoro³, Rachmat Sudibyo⁴, Herlina J.R. Saragih⁵

^{1,2,3,4,5}Indonesian Defense University, Jakarta, Indonesia

Abstract

This paper reports the results of a study of oil and gas management as natural resources in state border area, using the AHP approach. Modification of AHP in the research designed by grouping the five main elements of Ideology, Politics, Economy, Social Culture, Defense and Security, into two main criteria, namely Non Defense Security which consists of elements of ideology, politics, economy, socio-culture, and elements of defense and security. The five elements is widely known as pancagatra.

As a novelty of contribution to the AHP method, the AHP approach in this study offers two new things. The first is the merging of the five elements into only two, but it is still remarkably possible to trace the priority level of importance to each element. The second is that the respondent has a dual role as the object of research, but at the same time becomes the subject of research. The background variability of respondents is expected to provide a complete and unbiased picture related to the subject matter studied. At the same time, the inputs and views of each respondent are of paramount for their interests as subjects who will get benefit from the formulation and implementation of Government policies in the field of oil and gas management at the border state regions in the perspective of national defense.

Keywords: oil and gas management, politics, economy, social culture, defense and security, public policy

Introduction

AHP (analytical hierarchy process) was introduced by Prof. Thomas L. Saaty. AHP is a method of determining the choice simplified hierarchically into more than one attribute. Between attributes, the pair wise comparisons are made regarding the degree of importance. Then at the next level there are various alternatives. Between alternatives, pairwise comparisons were carried out. Likewise with respect to alternatives in relation to the attributes above them. The weights for each choice and level are based on the subjective value of the importance of one element relative to other elements by each

selected respondent, which are tested for consistency. The element or variable that gets the highest score is the selected priority.

Saaty (2001) identified seven pillars of AHP, comprising of (i) ratio scales on reciprocal paired comparisons, (ii) psychophysical origin of the fundamental scale, (iii) sensitivity of the eigenvectors, (iv) homogeneity and clustering the scale, (v) synthesis of the priority, (vi) rank preservation, and (vii) construction group decision compatible with the individual preferences.

The hierarchical structure of AHP varies, both in terms of the number of variables and the number of levels. The simplest structure is with one main goal, then at the next level at least three main criteria attributes, and at the next level at least three alternative choices. The minimum number of limitation is at place because for each stage, it is necessary to calculate a consistency index. The measure of the consistency index is the comparison between the consistency index and the random index. By Saaty (1990), the random indices determined on various alternatives or attributes are as follows

:

n	1	2	3	4	5	6	7	8	9	10
random index	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

The table above indicates that at least there must be more than two alternatives, which are evaluated to obtain a priority ranking.

Selected previous study model of AHP

In building the model on this AHP, the researcher first examined several models that were previously relevant for discussion. Among them is the model developed by Marsono (2009). The Marsono model is a very simple basic model, however it is very conceptual to understand how AHP works. Marsono (2009) concludes simply, the three basic axioms that must exist in AHP are reciprocity, homogeneity and dependency. His hierarchy structure chart is very simple, consisting of three layers, namely goals, criteria and alternatives. He builds his model by setting five criteria for three alternatives.

The second model studied is the Fuzzy AHP conducted by Vinodh S and Vimal KEK (2018) in the paper under the title of a decision support for prioritizing process sustainability tools using FAHP. The model consists of four layers, namely objective, dimension, criteria and alternatives. There are distinctive things to observe where the sub elements in each dimensions are vary in numbers. Sub elements in the dimension which consists of three. Each dimension has different criteria. In the environmental dimension there are five criteria, in the economy dimension there are two criteria, and in the society dimension there are three criteria. Then in the last layer, each criterion in the three dimensions is measured by a pairway comparison matrix of alternatives to the fivepre set alternatives.

The third model is the simplified fuzzy AHP proposed by Kuntjoro(2009). His modeling is a combination of quantitative and qualitative research. AHP is designed on a different layer for quantitative and for qualitative. The qualitative aspect has five layers, while the quantitative aspect has four layers. Quantitative aspects and qualitative aspects were analyzed to obtain alternative priority options for respondents.

The approach and result of this modified AHP

In this AHP approach, the researcher offers several new things. This research data collection was carried out online through the google form media by accompanying the researcher's information as a respondent's reference if there were questions related to the distributed questionnaires. The purpose of the research being conducted is to obtain the views of the respondents, in relation to the Oil and Gas Management Policy Instrument in Border Areas in general, and specifically in the Province of Aceh, the border province of Indonesia in west side. The research is merely for academic purposes.

Below are AHP's modified approach in measuring the priority of developing oil and gas resources at the border.

i). The AHP tree design. Research entitled AHP in oil and gas management policies in State border region.

The main criterion is the element of Pancagatra¹. Pancagatra are aspects of national life which involve the life and association of human life in society and the state with certain ties, rules and norms in Indonesia. Pancagatra is a standard term in the doctrine of insight into the Indonesian archipelago namely Wawasan Nusantara. In it there are five elements, namely ideology, politics, economy, socio-culture and defense and security. In the proposition, the Pancagatra aspect is simplified into two main criteria. The first is the Non-defense and security aspect and the second is the defense and security criteria.

The goal of modifying the 5 elements of the main criteria into 2 areas of the Defense and Security and Non-Defense groups as main criteria is to focus the total priorities of the study. Calculating the Total Priority of Sub-Criterion 1 against the main criteria is conducted by synthesizing the weights of each sub-criterion 1, namely Defense and Security and Non-Defense. For non-defense, the weight used is the average weight of the eigenvectors in the Ideological, Political, Economic and Socio-Cultural aspects of each element of sub-criteria 1) with the main criteria weight by classifying the weights of defense and security and non-defense. (For non-defense the weight used is the average sum of the weights on the aspects of ideology, politics, economy and socio-culture). Modification of the AHP using eigenvectors was carried out with the aim of obtaining a focus on the field of Defense and Security and Non-Defense without changing the scale of the respondents. The priority result was kept maintained at a value of total weight 1.

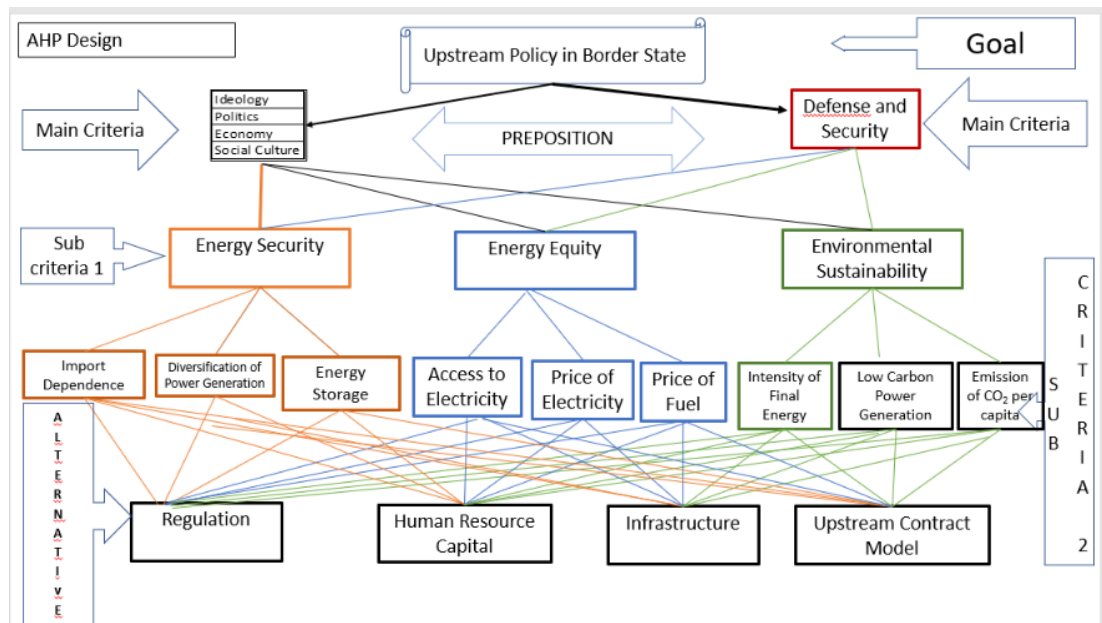
The AHP tree consists of five layers. All design layers and attributes in each layer are based on existing theories and concepts. The main criteria are based on the concept of

¹For detail of the doctrine of Pancagatra, readers are pleased to visit <http://www.lemhannas.go.id/>

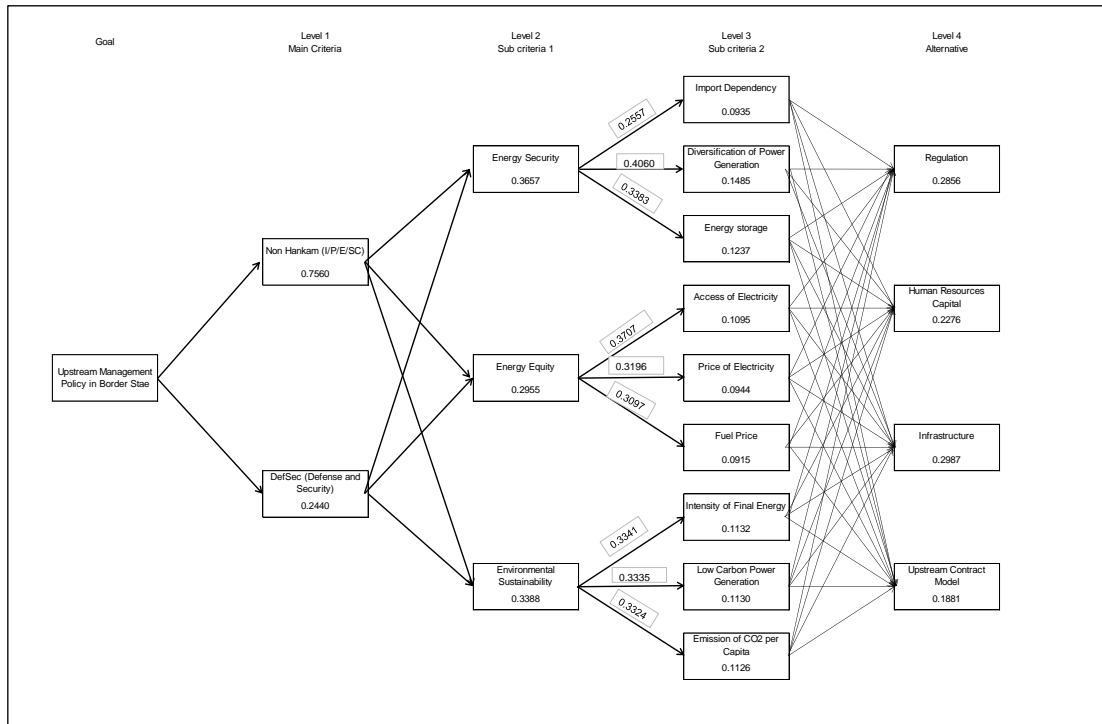
Pancagatra. Layers sub-criteria 1 consists of three elements, namely energy security, energy equity and environmental sustainability. These elements are concepts used by the World Energy Council, which publishes the World Energy Trilemma Index each year. The elements in each sub-criteria 1 are put in detail to sub-criteria 2, according to the distribution of elements in the World Energy Trilemma Index.

The last layer is alternatives, which is measured by AHP steps. The four alternatives listed consist of regulation, human resource capital, infrastructure and upstream model contracts. The determination of these four alternatives is based on the author's professional judgment, which is based on experience, literature studies and observations in the field.

The visualization of AHP tree description is as follows:



Based on the calculation from 60 selected respondents and following the AHP steps, the results are as follows:



ii. Respondent selection

Respondents were carefully selected, representing various views, positions and professions. There are 60 respondents, which can be categorized as follows:

Based on profession, they are classified into six categories, namely (i) energy policy makers and corporate top management, (ii) upstream professionals, (iii) Entrepreneurs related to oil and gas value chain business, (iv) public policy authorities, (v) Public policy researchers and (vi) Scholars and lecturers. These categories are considered to have captured the diversity of respondents. Their backgrounds are also diverse, which can be categorized into three major categories, namely military and policemen, government civilian officers, and practitioners of business in corporations and private sectors. Meanwhile, from the perspective of role and authority level, the respondents categorized into three groups, namely (i) Military and Policemen Generals/ Top Managements and Commissioners, (ii) middle operational management, and middle rank officers, and (iii) professionals. .

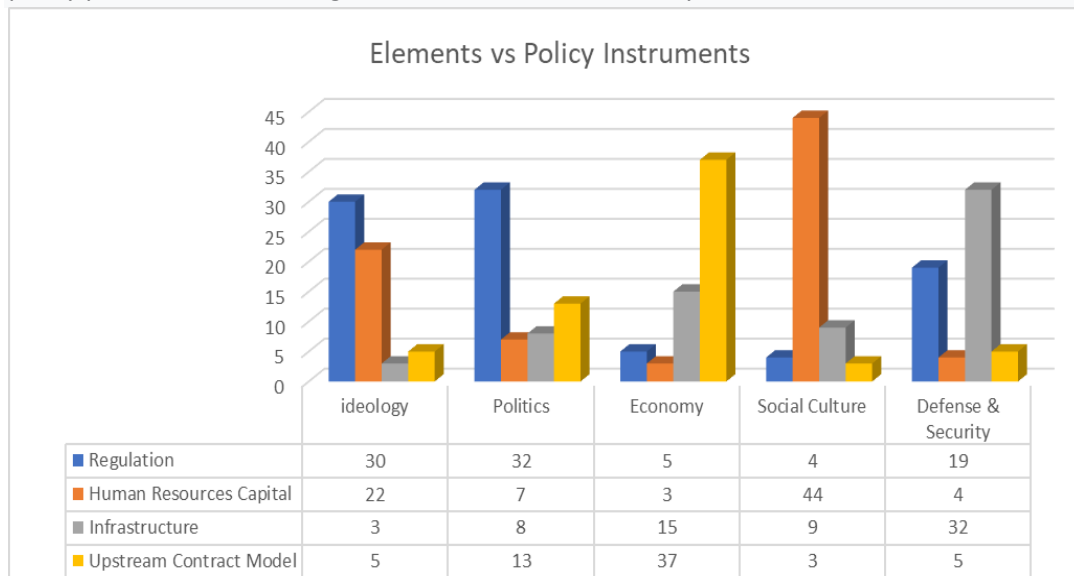
The background of respondents is important, because the purpose of AHP is not only to get the most preferred choice. But we have to extract them from a really experts and knowledgeable in the matters under study. One other thing that is no less important is what policy preferences are in accordance with the views, perspectives and backgrounds of the respondents. By mapping this well, from the result of the research, the Government as the holder of the public policy authority will be able to choose and sort things that are priority, things that are important but not urgent, or things that are urgent but not too important.

Below is the summary table of the respondents :

	Respondent	Amount	Military and Policemen	Govt Civilian Officers	Corporation & Private	Generals/ Top Management/ Commissioner	Middle Operational Management/ Middle Rank Officers	Professional
Category	Profession	Numbers	Background			Role and Authority Level		
i	Energy Policy Maker/ Management	14	13	1		9	5	
ii	Upstream Professional	8		1	7	3	1	4
iii	Entrepreneur	7	3		4	7		
iv	Public Policy Authority	16	11	5		8	7	1
v	Public Policy Researchers	7			7			7
vi	Scholars and Lecturers	8	3	3	2	5	1	2
	Total	60	17	22	21	32	14	14

iii. Triangulation

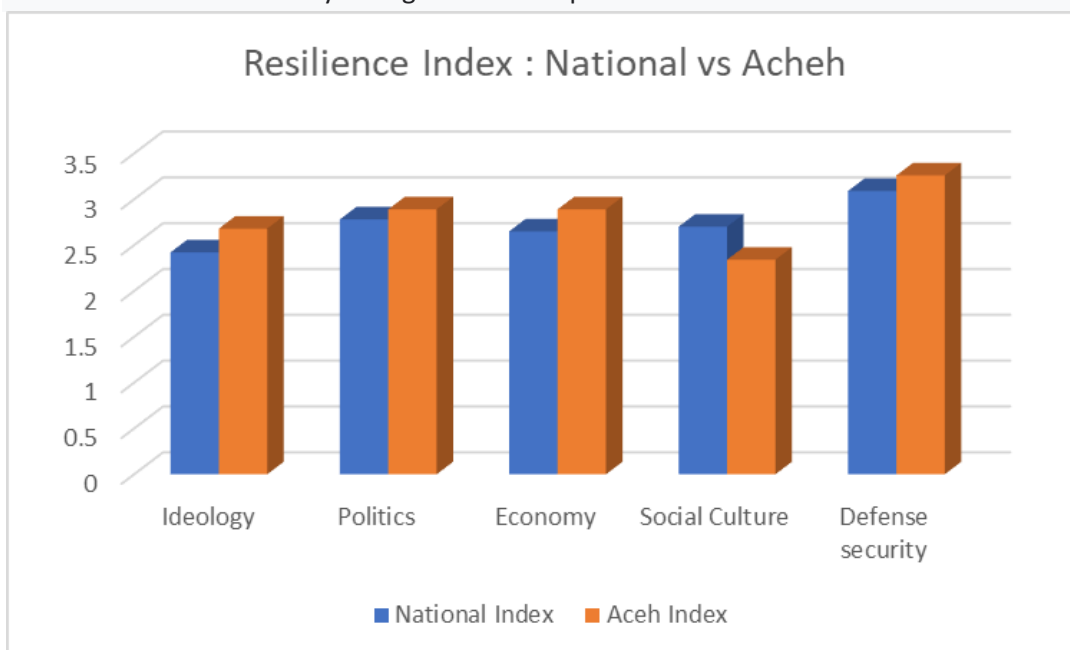
Triangulation of the AHP is carried out in two ways. The first is by conducting initial questions to the respondents before the AHP questionnaire model stage. The main component elements are directly asked in relation to alternative choices which are public policy priorities to achieve goals. The results of the survey are as follows:



The second method is to compare the overall measurement of the national resilience index carried out by Lemhannas RI² against the five elements measured in this

²Lemhannas (Lembaga Ketahanan Nasional - National Resilience Institution) of Republic of Indonesia is an Indonesian Non-Ministerial Government Institution tasked with carrying out government duties in the field of

survey, in Aceh Province. Aceh Province is one of the provinces in Indonesia which has specific characteristics in relation to and within the State of Indonesia in the western border region of Indonesia. This special relationship is related to historical aspects in the past, including the existence of aspirations for independence, separatism and armed rebellion³. Aceh province has large oil and gas resources. This is one of the considerations that this research was carried out by taking the locus or place in Aceh Province.



This second approach basically only compares the level and degree of index of each aspect studied against the national index. One thing that is interesting from this graph is that in general the index in Province of Aceh is higher than those of other parts of Indonesia, with the exception to the social culture index.

The summary of the AHP with the results based on alternative priority rank along with the number of respondents and their choices are as follows:

Rank of Alternative priority as per AHP

Alternative Priority Ranks			
Infrastructure	Regulation	Human Resource Capital	Upstream Contract Model
1	2	3	4
0.2989	0.2854	0.2276	0.1822

Proportion based on tally of respondents

education for national leaders, strategic assessment of national resilience and strengthening of national values.

³For further note, among other things one may refer to <https://reliefweb.int/report/indonesia/political-history-aceh>

Based on Tally of Respondents			
Regulation	Human Resource Capital	Infrastructure	Upstream Contract Model
14	7	37	2
23.33%	11.67%	61.67%	3.33%

This result convey some interpretations meaning :

The weighting of alternative priorities and respondents' choices, shows the same priority order, but with different weights/proportions

This indicates that the weight given by each respondent is not the same for each element in the Main Criterion – Sub Criterion 1 – Sub Criterion 2, which is reflected in the alternative choices. This two result is the very heart of this research, to allow the Government as the Public authority holders to set up policy based on degree of urgency, priority and the necessary public policy instruments required.

Conclusion

This modified AHP approach has offered new things both in terms of substance and method, namely:

Modeling modification of the five elements into two main criteria, while maintaining the pairway comparison of the respective criteria in the priority synthesis. Modification of AHP using eigenvectors is carried out with the aim of obtaining a focus on the field of Defense and Security and Non Defense without changing the scalechoice of the respondents

Recognizing and acknowledging each respondent's choice, on each public policy alternative offer a more wide and comprehensive pictures to the public authority holders.

The pre and post triangulation method is also enrich and add to completeness of the research result. Internal triangulation of respondents in the survey as a pre AHP questionnaire which was carried out simultaneously in the same questionnaire. External triangulation by comparing data from survey results and processing by external institutions against the same elements.

Epilog

To give a complete picture of the steps for working on the modified AHP, below is the example of the AHPresult data processing from one of the respondents (denoting as respondent K-17) as follows:

Research Title : Oil and Gas Management Policy in Border Areas

Media : Google Form <https://forms.gle/YFzBqkVzTfYpGEBQ7>

Topic : Oil and Gas Management Policy in Border Areas from the perspective of National Defense

Respondent K-17

Name :not to disclose

Profession : General Manager Production Sharing Contract

AHP steps with respect to :

1. Level 1 (Main criteria)

No	Element	abbreviation
1	Ideology	Ideo
2	Politics	Pol
3	economy	Eco
4	Social culture	SocCul
5	Defense and Security	DefSec

a. Make a pairwise comparison (PwC) matrix between the main criteria (there are 5 elements in the main criteria which will later be compressed and focused on 2 areas namely Defense and Security (DefSec) and Non Defense and Security (Non-Defense) without changing the results of the comparison of respondents.

Pairwise Comparison Level 1

	Ideo	Pol	Eco	SocCul	DefSec
Ideo	1	3	1/2	4	1
Pol	1/3	1	1/8	1/4	1/8
Eco	2	8	1	8	1
SocCul	1/4	4	1/8	1	1/5
DefSec	1	8	1	5	1

b. Calculating the Priority criteria to obtain the eigenvectors

➤ Squaring a matrix in decimal form

	Ideo	Pol	Eco	SocCul	DefSec							
Ideo	1.0000	3.0000	0.5000	4.0000	1.0000	x	Ideo	1.0000	3.0000	0.5000	4.0000	1.0000
Pol	0.3333	1.0000	0.1250	0.2500	0.1250		Pol	0.3333	1.0000	0.1250	0.2500	0.1250
Eco	2.0000	8.0000	1.0000	8.0000	1.0000		Eco	2.0000	8.0000	1.0000	8.0000	1.0000
SocCul	0.2500	4.0000	0.1250	1.0000	0.2000		SocCul	0.2500	4.0000	0.1250	1.0000	0.2000
DefSec	1.0000	8.0000	1.0000	5.0000	1.0000		DefSec	1.0000	8.0000	1.0000	5.0000	1.0000

➤ Calculating the Priority criteria by determining eigenvectors

Normalization of the matrix by adding up each row in the matrix resulting from squaring (in total), then determining the eigenvectors by adding up the normalized matrix and dividing each row of the matrix in the normalization to the total value in the normalized matrix.

	Ideo	Pol	Eco	SocCul	DefSec	Total	Eigen Vector
Ideo	5.0000	34.0000	2.8750	17.7500	3.6750	63.3000	0.2128
Pol	1.1042	5.0000	0.5729	3.4583	0.7583	10.8938	0.0366
Eco	9.6667	62.0000	5.0000	31.0000	6.6000	114.2667	0.3841
SocCul	2.2833	11.3500	1.0750	5.0000	1.2750	20.9833	0.0705
DefSec	7.9167	47.0000	4.1250	24.0000	5.0000	88.0417	0.2960
Total						297.4854	1.0000

c. Calculation of the priority of the criteria is based on the order of the eigenvector quantities.

Pairwise Comparison Level 1

	Ideo	Pol	Eco	SocCul	DefSec	Priority Vector
Ideo	1	3	1/2	4	1	0.2128
Pol	1/3	1	1/8	1/4	1/8	0.0366
Eco	2	8	1	8	1	0.3841
SocCul	1/4	4	1/8	1	1/5	0.0705
DefSec	1	8	1	5	1	0.2960

According to respondent K-17, the Economic Criteria have the first most important priority, while the Political criteria are the last most important priority compared to other criteria, Defense, Security, Ideology and Socio-culture.

d. Test the consistency index and the consistency ratio.

	Ideo	Pol	Eco	SocCul	DefSec		Eigen Vector		
Ideo	1.0000	3.0000	0.5000	4.0000	1.0000	x	0.2128	=	1.0928
Pol	0.3333	1.0000	0.1250	0.2500	0.1250		0.0366		0.2102
Eco	2.0000	8.0000	1.0000	8.0000	1.0000		0.3841		1.9629
SocCul	0.2500	4.0000	0.1250	1.0000	0.2000		0.0705		0.3774
DefSec	1.0000	8.0000	1.0000	5.0000	1.0000		0.2960		1.5385

$$t = \frac{1}{5} \left[\frac{1.098}{0.2128} + \frac{0.2102}{0.0366} + \frac{1.9629}{0.3841} + \frac{0.3774}{0.0705} + \frac{1.5385}{0.2960} \right] = 5.3070$$

$$CI = \frac{t-n}{n-1} = \frac{5.3070-5}{5-1} = 0.0767$$

$$CR = \frac{CI}{RI} = \frac{0.0767}{1.12} = 0.069$$

Because $CR < 0.1$ means that the respondent's answer is consistent.

Pairwise Comparison Level 1

	Ideo	Pol	Eco	SocCul	DefSec	Priority Vector	CI	CR
Ideo	1	3	1/2	4	1	0.2128	0.0767	0.069
Pol	1/3	1	1/8	1/4	1/8	0.0366		
Eco	2	8	1	8	1	0.3841		
SocCul	1/4	4	1/8	1	1/5	0.0705	consistent	
DefSec	1	8	1	5	1	0.2960		

2. Level 2 (Sub criteria 1)

a. Prioritize sub-criteria 1 in relation to the main criteria (same as steps 1-4 Level 1)

- with respect to Aspects of Ideology
- with respect to Political Aspect
- with respect to the Economic Aspect
- with respect to Socio-Cultural Aspects
- with respect to Defense and Security Aspects

Pairwise Comparison Level 2

Field		ES	EE	EvS	Priority vector	CI	CR	
N o n D e f e n s e c	Ideology						0.0681	0.1174
	ES	1	3	1	0.4639			
	EE	1/3	1	1	0.2165	consistent		
	EvS	1	1	1	0.3196			
	Politics						0.0681	0.1174
	ES	1	3	1	0.4639			
	EE	1/3	1	1	0.2165	consistent		
	EvS	1	1	1	0.3196			
	Economy						0.0681	0.1174
	ES	1	3	1	0.4639			
	EE	1/3	1	1	0.2165	consistent		
	EvS	1	1	1	0.3196			
	Social Culture						-	-
	ES	1	1	1	0.3333			
	EE	1	1	1	0.3333	consistent		
	EvS	1	1	1	0.3333			
DefSec	Defense Security						0.0408	0.07
	ES	1	7	1	0.5156			
	EE	1/7	1	1/3	0.0938	consistent		
	EvS	1	3	1	0.3905			

b. Design a total priority by modifying the 5 elements of the main criteria into 2 areas of the Defense and Security and Non-Defense groups (Ideological, Political, Economic and Socio-Cultural Aspects). The goal is to focus priorities based on defense and security factors. Calculating the Total Priority of Sub-Criterion 1 against the main criteria is conducted by synthesizing the weights of each sub-criterion 1, namely Defense and Security and Non-Defense (for non-defense, the weight used is the average weight of the eigenvectors in the Ideological, Political, Economic and Socio-Cultural aspects of each - each element of sub-criteria 1) with the main criteria weighting namely classifying the weights of defense and security and non-defense (for non-defense the weight used is the sum of the weights on the aspects of ideology, politics, economy and socio-culture). Modification of the AHP using

eigenvectors was carried out with the aim of obtaining a focus on the field of Defense and Security and Non-Defense without changing the scale of the respondents but the priority result was maintained at a value of 1.

The weight of Subcriteria 1

Total Priority Sub criteria 1 towards Main Criteria

	Ideo	Pol	Eco	SocCul	DefSec		Non DefSec	DefSec
ES	0.4639	0.4639	0.4639	0.3333	0.5156	ES	0.4313	0.5156
EE	0.2165	0.2165	0.2165	0.3333	0.0938	EE	0.2457	0.0938
EvS	0.3196	0.3196	0.3196	0.3333	0.3905	EvS	0.3230	0.3905

Weight of the main criteria

	Priority Vector	EV Criteria
Ideo	0.2128	
Pol	0.0366	
Eco	0.3841	
SocCul	0.0705	
DefSec	0.2960	0.2960

Synthesis 1 (criteria and sub criteria 1)

Synthesis 1 (criteria dan Sub criteria 1)

	Non DefSec	DefSec	Total Priority
	0.7040	0.2960	
ES	0.4313	0.5156	0.4562
EE	0.2457	0.0938	0.2008
EvS	0.3230	0.3905	0.3430

3. Level 3 (Sub criteria 2)

a. Prioritize between sub-criteria 2 in relation to sub-criteria 1 (same as steps 1-4 Level 1)

- with respect to Energy Security
- with respect to Energy Equity
- with respect to Environmental Sustainability

Pairwise Comparison Level 3

				Priority Vector	CI	CR
Energy Security					0.0268	0.0463
	ID	DPG	Est			
ID	1	1	1	0.3276	consistent	
DPG	1	1	2	0.4138		
Est	1	1/2	1	0.2586		
Energy Equity					0.0558	0.0963
	AE	PE	PP			
AE	1	3	9	0.6554	consistent	
PE	1/3	1	8	0.2962		
PP	1/9	1/8	1	0.0484		
Environmental Sustainability					0.0268	0.05
	IFE	LCPG	Em			
IFE	1	2	1	0.4138	consistent	
LCPG	1/2	1	1	0.2586		
Em	1	1	1	0.3276		

b. Make a total priority from the synthesis of sub-criteria 1 and the main criteria to sub-criteria 2 by way of synthesis.

Synthesis 2 (Synthesis 1 and Sub criteria 2)

	ES	Total Priority
	0.4562	
ID	0.3276	0.1495
DPG	0.4138	0.1888
Est	0.2586	0.1180
	EE	Total Priority
	0.2008	
AE	0.6554	0.1316
PE	0.2962	0.0595
PP	0.0484	0.0097
	EvS	Total Priority
	0.3430	
IFE	0.4138	0.1419
LCPG	0.2586	0.0887
Em	0.3276	0.1124

4. Level 4 (Alternative)

a. Prioritize between alternatives with sub-criteria 2 (same as steps 1-4 Level 1)

- with respect to Import Addiction
- with respect to Power Generation Diversification
- with respect to Energy Storage
- with respect to Access to Electricity
- with respect to Electricity Prices
- with respect to fuel prices
- with respect to Final Energy Intensity
- with respect to Low Carbon Power Generation
- with respect to CO2 Emissions per Capita

Nat. Volatiles & Essent. Oils, 2021; 8(6): 5098-5115

Pairwise Comparison Level 4 (Alternative)

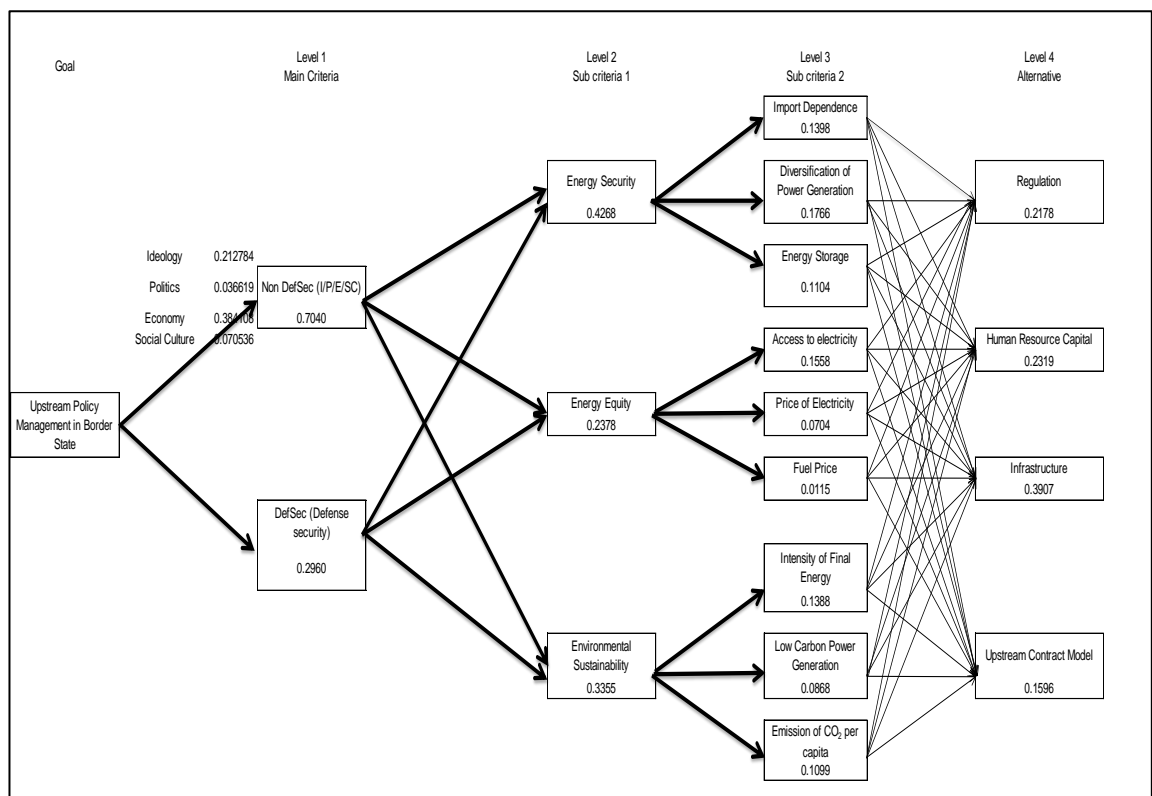
						Priority Vector	CI	CR
Import Dependence (Energy Security)							0.0812	0.0902
	Reg	HRC	Infras	UCM				
Reg	1	2	1/2	1	0.2363			
HRC	1/2	1	1	1	0.2073		consistent	
Infras	2	1	1	3	0.3802			
UCM	1	1	1/3	1	0.1762			
Diversification of Power Generation (Energy Security)							0.0810	0.0900
	Reg	HRC	Infras	UCM				
Reg	1	1	1/2	3	0.2498			
HRC	1	1	1	1	0.2360		consistent	
Infras	2	1	1	4	0.3918			
UCM	1/3	1	1/4	1	0.1224			
Energy Storage (Energy Security)							0.0625	0.0695
	Reg	HRC	Infras	UCM				
Reg	1	1	1/2	1	0.1885			
HRC	1	1	1	1	0.2396		Konsisten	
Infras	2	1	1	4	0.4089			
UCM	1	1	1/4	1	0.1629			
Access to Electricity (Energy Equity)							0.0522	0.0580
	Reg	HRC	Infras	UCM				
Reg	1	1	1/3	1	0.1724			
HRC	1	1	1	1	0.2414		consistent	
Infras	3	1	1	3	0.4138			
UCM	1	1	1/3	1	0.1724			
Price of Electricity (Energy Equity)							0.0812	0.0902
	Reg	HRC	Infras	UCM				
Reg	1	2	1/2	1	0.2363			
HRC	1/2	1	1	1	0.2073		consistent	
Infras	2	1	1	3	0.3802			
UCM	1	1	1/3	1	0.1762			
Price of Fuel (Energy Equity)							0.0696	0.0773
	Reg	HRC	Infras	UCM				
Reg	1	2	1/2	2	0.2737			
HRC	1/2	1	1	1	0.2032		consistent	
Infras	2	1	1	3	0.3789			
UCM	1/2	1	1/3	1	0.1442			
Intensity of Final Energy (Environmental Sustainability)							0.0396	0.0440
	Reg	HRC	Infras	UCM				
Reg	1	1	1/2	1	0.1955			
HRC	1	1	1	1	0.2432		consistent	
Infras	2	1	1	3	0.3818			
UCM	1	1	1/3	1	0.1795			
Low Carbon Power Generation (Environmental Sustainability)							0.0718	0.0798
	Reg	HRC	Infras	UCM				
Reg	1	1	1/2	3	0.2593			
HRC	1	1	1	1	0.2366		consistent	
Infras	2	1	1	3	0.3704			
UCM	1/3	1	1/3	1	0.1337			
Emission of CO ₂ per Capita (Environmental Sustainability)							0.0723	0.0804
	Reg	HRC	Infras	UCM				
Reg	1	1	1/3	2	0.2146			
HRC	1	1	1	5113	0.2361		consistent	
Infras	3	1	1	2	0.3863			
UCM	1/2	1	1/2	1	0.1631			

b. Create a Global Priority by multiplying the weight of each alternative by the weight of the synthesis result 2.

Global Priority

	ID	DPG	Est	AE	PE	PP	IFE	LCPG	Em	GP
	0.1495	0.1888	0.1180	0.1316	0.0595	0.0097	0.1419	0.0887	0.1124	
Reg	0.2363	0.2498	0.1885	0.1724	0.2363	0.2737	0.1955	0.2593	0.2146	0.2190
HRC	0.2073	0.2360	0.2396	0.2414	0.2073	0.2032	0.2432	0.2366	0.2361	0.2319
Infras	0.3802	0.3918	0.4089	0.4138	0.3802	0.3789	0.3818	0.3704	0.3863	0.3902
UCM	0.1762	0.1224	0.1629	0.1724	0.1762	0.1442	0.1795	0.1337	0.1631	0.1589

c. Write the results of global priorities on the AHP tree to determine the decision making of Oil and Gas Management Policy in Border Areas.



Bibliography

Bachtiar S. Bachri, Meyakinkanvaliditas data melaluitriangulasi pada penelitiankualitatif(ensure the validity of data through triangulation in qualitative research

– free English translation) –Jurnal Teknologi Pendidikan, Vol.10 No. 1, April 2010 (pp 46 – 62)

Profil Ketahanan Nasional Indonesia (National Resilience Index Profile) LEMHANNAS RI, 2020

Marsono, Penggunaan Metode Analytical Hierarchy Process dalam Penelitian (Using Analytical Hierarchy Process in research – free English translation), Bogor, Indonesia, 2019

Thomas L. Saaty, Luis G. Vargas, Models, Methods, Concepts & Applications of the Analytic Hierarchy Process, Second edition, Springer, 2012

Thomas L. Saaty, The Seven Pillars of the Analytic Hierarchy Process, in Multiple Criteria Decision Making in the New Millennium, pp 15 – 77. Volume 507, 2001

Vinodh S and Vimal K, A decision support for prioritizing process sustainability tools using FAHP, in Fuzzy Analytic Hierarchy Process, ed. Ali Emrouznejad and William Ho, CRC Press, 2018

Yanif Dwi Kuntjoro, Pemilihan Konsep dengan penyederhanaan metode FAHP (Concept selection using simplified FAHP – a case study on warship maintenance), Dissertation, ITS, Surabaya, 2009

World Energy Council, World Energy Trilemma Index, United Kingdom, 2019