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SIMPLE ADDITIVE WEIGHTING IN SELECTION OF CITIES PERFORMANCE OF NON SMOKING AREA AND TOBACCO ADVERTISEMENTS, PROMOTIONS AND SPONSORS BAN

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Abstract
Previous researches have implemented a decision support system (DSS) in various industries, such as the clinical industry, human resources, and others. The prevalence of smoking in adolescents between the ages of 10-18 years old continues to increase, namely at a percentage of 9.1% in 2018 from 7.2% in 2013. Furthermore, according to Riskesdas in 2018 and Sirkesnas in 2016, tobacco consumption in the population aged 15 years and over also experienced an increase, namely 33.8% from 32.8%. To control active smokers, regional governments are supported by the central government issuing regional regulations about Non- Smoking Area and Tobacco Advertising, Promotion and Sponsoring (TAPS). However, evaluation of the implementation level of the regulations does not exist. Thus, we then stated the research problem is how to model the measurement of the evaluation above using simple additive weighting (SAW). After doing literature review, SAW is more appropriate to cope various variables that exist. Survey has been made, citizens from 3 city/district (Lombok, Bogor District, and Padang) have answered several questions that relate to indicators of non-smoking areas and TAPS ban. The results of the survey are calculated using SAW, it shows that alternative A1 (Lombok city) is in first position, A2 (Bogor district) is second, and A3 (Padang city) is third.

1.0 INTRODUCTION

Decision support system is growing and getting a lot of attention from researchers and practitioners to help evaluate and rank several industrial sectors. Previous research has implemented decision support systems in clinical, retail and academic industries. This is proven by more than 100 papers in a 20-year period that discusses the Multi-Criteria Decision Support System [1]. The Decision Support System is usually built to support solutions to a problem or for an opportunity, the application of a decision support system (DSS) is applied in decision making. The application of a DSS using CBIS (Computer Based Information System) that is

flexible, interactive, and can be adapted, which is developed to support solutions to specific unstructured management problems [2].

Decision support systems have been pursued in various academic sectors, namely the decision support system can be applied to lecturer performance evaluation using the ELECTRE method [3]. The DSS method with the Analytical Hierarchy Process (AHP) has also been applied in the retail industry, namely IT stores in Jakarta, AHP can help determine the best employees [4]. AHP also used to determine the priority of medical equipment maintenance, the criticality scores are obtained based on the assessment of criteria, sub-criteria, and grade. The devices with higher critical weight take higher priority for maintenance than devices with lower critical weight [5]. In transportation sector, it is reasonable to use the AHP to solve the Cargo stowage of vehicle problem. Accordance with the requirements of vehicle loading characteristics, the corresponding hierarchy model is set up. Then construct the judgment matrix and complete the hierarchical order sorting, validate judgment matrix by consistency check, finally obtain the weight of each object hierarchy. Multiplied the weight by the corresponding score, vehicle's total score is obtained [6]. DSS with combination of k-means and k-NN method produced better results than using both correlation method and using the k-means method only to classify the traffic condition in neighboring roads [7]. In the government sector, the decision support system uses Simple Additive Weighting (SAW) analysis method to rank good governance [8]. In addition, SAW analysis method has also been developed in the clinical sector, to determine dengue endemic areas at Tanggamus [9].

In particular, SAW method is the most well-known and most widely used method in dealing with Multiple Attribute Decision Making (MADM) situations. MADM itself is a method used to find optimal alternatives from a number of alternatives with certain criteria. The advantage of the SAW method compared to the other decision support system methods lies in its ability to make judgments more precisely because it is based on the criteria value and the level of importance needed. In this method, it can also select the best alternative from a number of alternatives, then a ranking process is carried out in which the sum of the weighted values of all criteria is added after determining the weight values of each criterion [10].

To control active smokers, the government issued a Non-Smoking Area and Tobacco Advertisements, Promotions, and Sponsors (TAPS) regulations. Non-Smoking Area is a room or area that is declared prohibited for smoking activities or activities to produce, sell, advertise, and/promote tobacco products [11]. Cigarettes are products that are subject to excise, meaning that cigarettes are products whose consumption needs to be controlled and monitored [12]. In 2018, the prevalence of smoking in adolescents (10-18 years) continues to increase, namely 9.1% (2018) from 7.2% (2013) [13]. This shows that the local regulations supported by the government have not had a significant impact on reducing smokers in Indonesia. Regulations for non-smoking area and TAPS have been made and implemented in Indonesia, however there is no measurement about the level of implementation of these regulations has been implemented and understood by the public. Efforts to solve the problems is making a formula which can be used to process public opinions regarding the realization of Non-Smoking Area and TAPS Regulation. To get the appropriate SAW analysis method calculation formula, this paper focuses on data samples in the areas of Lombok City, Bogor District, and Padang City.

This paper seeks to obtain a formula that is in accordance with the rules of the Decision Support System with the SAW analysis method. The indicators set by the government are indicators that can be assessed and weighted to be a conclusion whether or not a region comply the Non-Smoking Area and TAPS regulations

2.0 THEORETICAL

2.1. Non-Smoking Areas and TAPS Ban

Non-smoking area is a room or area that is declared prohibited for smoking or producing, selling, advertising and / or promoting tobacco products. The application of KTR is an effort to protect the community against the risk of threats to health problems because the environment is polluted by cigarette smoke. In addition, through the application of KTR, smoking behavior is expected to be controlled, and smoking habits can be gradually reduced or lost. Thus the health of smokers for the better [11].

Tobacco Product Ad Control is carried out on print media, broadcast media, information technology media, and / or outdoor media. For control outside the IPS Cigarette control room

contained in article 27, namely: not placed in the No Smoking Area and not placed on the main road or protocol [12].

2.2. Integrated Survey Simple Additive Weighting

Integrated Survey is that all parts of the survey process are coherently integrated, the results of one part of the process automatically provide information to the next part of the process [14]. The basic concept of Simple Additive Weighting (SAW) Method is to find a weighted sum of performance ratings on each alternative on all attributes. The SAW method requires the process of normalizing the decision matrix (X) to a scale that can be compared with all available alternative ratings. SAW analysis method is the most well-known and most widely used method in dealing with Multiple Attribute Decision Making (MADM) situations. MADM itself is a method used to find optimal alternatives from a number of alternatives with certain criteria [10]. The formulas for normalizing are as follows:

$r_{ij} = \frac{x_{ij}}{Max\, x_{ij}}$ if j is benefit attribute (1)

$r_{ij} = \frac{Min\, x_y}{x_{ij}}$ if j is cost attribute (2)

Rij statement is a normalized performance rating from alternative Ai on the criteria / attributes Cj, i = 1,2,3 ..., m and j = 1,2,3 ..., n.
Information
Max Xij: The biggest value of each criterion.
Min Xij: The smallest value of each criterion.
Xij: The attribute value of each attribute.
Benefit: If the biggest value is the best value.
Cost: If the smallest value is the best value.

$V_i = \sum_{j=1}^{n} w_j r_{ij}$ (3)

The prefix for each alternative (Vi) is given the following formula:
Information
Vi: Rank for each alternative.
Wj: the weight value of each criterion.
rij: normalized performance rating value.
A greater value of V indicates that the alternative Ai is more chosen [2].

3.0 METHODOLOGY

In conducting this research, a framework is needed that serves as a guide, shown at figure 1. The case to be investigated is to see and determine whether the city / regency has realized the regulations of non-smoking and TAPS properly by taking surveys from the community

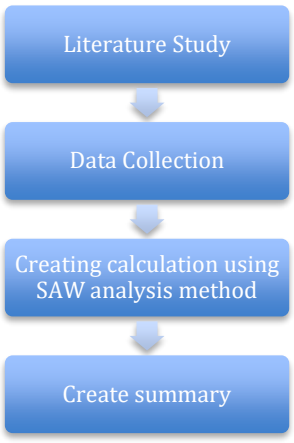

Figure 1. Research method flowchart

In determining the method to be carried out in this study, literature studies were carried out in the form of books, journals, regional regulations, research reports, and information related to this research. After conducting literature studies, data collection is carried out with the following activities; the team of authors in collaboration with one of the Non-governmental organizations (NGOs), formulated assessment indicators in accordance with government and regional regulations. After the indicator is determined, the indicator will be given a weight determinant for the assessment. Furthermore, the indicator survey can be tested in the city of Padang, Lombok city, and Bogor region.

The sample data obtained, then were assessed and a calculation is made using the SAW analysis method. The simulation calculation is to rank the city/region that has implemented the Non-Smoking Area and TAPS regulations. After that the calculation conclusions and results will be generated after going through these stages.

4.0 RESULANTS AND DISCUSSION

NGOs which engages tobacco control, has aspiration for Indonesia namely IDOLA 2030 (Indonesia Layak Anak 2030), Indonesia that is free of cigarettes smoke and tobacco advertisements, promotions and sponsors. Several government regulations have been made to control tobacco. Survey questions are based on areas designated as non-smoking areas and TAPS Ban. That is determined by several regulations, according to central government. Table 1 shows several places as indicators which have been determined by government regulations, so to assess the realization of Non-Smoking Area and TAPS.

Table 1. Places as indicators of implementation non-smoking area and TAPS

Non-smoking area	
No	Government Regulation no. 109 year 2012
1	Health service
2	Education places
3	Child-friendly indoor and outdoor
4	Worship places
5	Public transportation
6	Office spaces
7	Public places and other determined places.

TAPS	
No	Government Regulation no109 year 2012
1	Health service
2	Education places
3	Child-friendly indoor and outdoor
4	Worship places
5	Public transportation
6	Office spaces
7	Public places and other determined places.
8	Major Arterial Road

Survey was made in 3 cities; Lombok City, Bogor District, and Padang City. See table 2 for the result of survey from 3 city/region. Indicator 1, whether the cities have a local regulations about non-smoking areas and TAPS Ban, the cities will have full score if they have one. Indicator 2, is how the cities implement TAPS Ban; whether the cities implement half or full prohibition to TAPS on all areas, whether any TAPS at major arterial roads, outside school (education places), hospital/ health service, and worship places. Indicator 3 to 9 are education places, hospitals/health services, playground/kindergarten/child friendly areas, public transportations, public places, office spaces, public spaces. Every sub-indicators 3 to 9 assess whether citizens see of non-smoking area sign, people smoke, smoking butt, TAPS, and officer that comply to regulations. Each sub indicators assessed by points of all the answers, then the indicator have averaged score by sub indicators.

Table 2. Average score for each indicator

No	Question	Lombok City		Bogor District		Padang City	
		Score	Average	Score	Average	Score	Average
1	**Regional Regulation about Non-smoking area and TAPS**	100	100	100	100	100	100
2	**TAPS**		49.5		45.5		43.5
2.1	TAPS Ban	50		52.5		72.5	
2.2	Major Arterial Roads	45		40		35	
2.3	Outside the school/university/education places	60		55		10	
2.4	Outside hospital or health service	67.5		65		70	
2.5	Outside worship place	25		15		30	
3	**Education Places**		36.5		43		46
3.1	Sign "No-Smoking Area"	30		70		85	
3.2	Smoking People	5		20		5	
3.3	Smoking Butt	17.5		30		30	
3.4	Compliance Officer	65		50		65	
3.5	TAPS	65		45		45	
4	**Hospital/ Health service**		63		53		60
4.1	Sign "No-Smoking Area"	85		70		100	
4.2	Smoking People	42.5		50		45	
4.3	Smoking Butt	37.5		40		50	
4.4	Compliance Officer	57.5		35		30	
4.5	TAPS	92.5		70		75	
5	**Playgroup/Kindergarten/Child friendly outdoor space**		60		53		42
5.1	Sign "No-Smoking Area"	57.5		60		45	
5.2	Smoking People	27.5		40		30	
5.3	Smoking Butt	67.5		60		25	
5.4	Compliance Officer	72.5		55		55	
5.5	TAPS	75		50		55	
6	**Worship Places**		54.5		51		48
6.1	Sign "No-Smoking Area"	72.5		40		50	
6.2	Smoking People	45		40		30	
6.3	Smoking Butt	42.5		50		20	
6.4	Compliance Officer	32.5		45		70	
6.5	TAPS	80		80		70	
7	**Public Transportation**		57.5		60		40
7.1	Sign "No-Smoking Area"	25		45		30	
7.2	Smoking People	65		75		10	
7.3	Smoking Butt	60		55		30	
7.4	Compliance Officer	85		80		75	
7.5	TAPS	52.5		45		55	
8	**Office Spaces**		43.5		50		48
8.1	Sign "No-Smoking Area"	60		60		80	
8.2	Smoking People	25		50		30	
8.3	Smoking Butt	10		30		10	
8.4	Compliance Officer	60		60		60	
8.5	TAPS	62.5		50		60	
9	**Public Places**		31.5		44		44
9.1	Sign "No-Smoking Area"	35		65		70	
9.2	Smoking People	7.5		35		25	
9.3	Smoking Butt	10		35		35	
9.4	Compliance Officer	87.5		65		55	
9.5	TAPS	17.5		20		35	

Table 3. List of indicators

C	Indicators	**Weight**
C1	Regional regulation about Non-Smoking Area and TAPS	**10**
C2	TAPS Ban	**10**
C3	Education Places	**15**
C4	Hospital/ Health service	**15**
C5	Playgroup/Kindergarten/Child friendly outdoor space	**10**
C6	Worship Places	**10**
C7	Public Transportation	**10**
C8	Office Space	**10**
C9	Public Places	**10**

Indicators that explained before are listed in table 3 as C1 to C9. Each indicator is rated 10 weights, with 2 special indicators given 15 weights. Because education places and hospital/health services are places that must be smoke-free, and TAPS ban.

Table 4. List of Alternatives

A	Alternatives
A1	Lombok City
A2	Bogor District
A3	Padang City

The cities which are Lombok city, Bogor district, and Padang city are set as alternatives (A) shown at table 4. Alternatives are object that wish to rank or assess.

Table 5. Weight Indicator

SCORE	DESCRIPTION	WEIGHT
91 - 100	VERY GOOD	4
61 - 90	GOOD	3
51 - 60	FAIR	2
0 - 50	POOR	1

Table 6. Match rating of each alternative to the indicator

ALTERNATIVES	INDICATOR								
	C1	C2	C3	C4	C5	C6	C7	C8	C9
A1	4	1	2	3	2	2	2	1	1
A2	4	1	1	2	2	2	2	1	1
A3	4	1	1	2	1	1	1	1	1

The result of survey of each alternative that shown in table 4, matched up with weight indicator shown in table 5. Match rating of each alternative to the indicator shown in table 6, then it is calculated to being normalized.

$$\begin{bmatrix} 4 & 1 & 2 & 3 & 2 & 2 & 2 & 1 & 1 \\ 4 & 1 & 1 & 2 & 2 & 2 & 2 & 1 & 1 \\ 4 & 1 & 1 & 2 & 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

C1

$$A1 = \frac{4}{MAX\ (4,4,4)} = \frac{4}{4} = 1$$

$$A2 = \frac{4}{MAX\ (4,4,4)} = \frac{4}{4} = 1$$

C2

$$A1 = \frac{1}{MAX\ (1,1,1)} = \frac{1}{1} = 1$$

$$A2 = \frac{1}{MAX\ (1,1,1)} = \frac{1}{1} = 1$$

$$A3 = \frac{4}{MAX\ (4,4,4)} = \frac{4}{4} = 1$$

$$A3 = \frac{1}{MAX\ (1,1,1)} = \frac{1}{1} = 1$$

C3

$$A1 = \frac{2}{MAX\ (2,1,1)} = \frac{2}{2} = 1$$

$$A2 = \frac{1}{MAX\ (2,1,1)} = \frac{1}{2} = 0{,}5$$

$$A3 = \frac{1}{MAX\ (2,1,1)} = \frac{1}{2} = 0{,}5$$

C4

$$A1 = \frac{3}{MAX\ (3,2,2)} = \frac{3}{3} = 1$$

$$A2 = \frac{1}{MAX\ (3,2,2)} = \frac{1}{3} = 0{,}6$$

$$A3 = \frac{1}{MAX\ (3,2,2)} = \frac{1}{3} = 0{,}6$$

C5

$$A1 = \frac{2}{MAX\ (2,2,1)} = \frac{2}{2} = 1$$

$$A2 = \frac{2}{MAX\ (2,2,1)} = \frac{2}{2} = 1$$

$$A3 = \frac{1}{MAX\ (2,2,1)} = \frac{1}{2} = 0{,}5$$

C6

$$A1 = \frac{2}{MAX\ (2,2,1)} = \frac{2}{2} = 1$$

$$A2 = \frac{2}{MAX\ (2,2,1)} = \frac{2}{2} = 1$$

$$A3 = \frac{1}{MAX\ (2,2,1)} = \frac{1}{2} = 0{,}5$$

C7

$$A1 = \frac{2}{MAX\ (2,2,1)} = \frac{2}{2} = 1$$

$$A2 = \frac{2}{MAX\ (2,2,1)} = \frac{2}{2} = 1$$

$$A3 = \frac{1}{MAX\ (2,2,1)} = \frac{1}{2} = 0{,}5$$

C8

$$A1 = \frac{1}{MAX\ (1,1,1)} = \frac{1}{1} = 1$$

$$A2 = \frac{1}{MAX\ (1,1,1)} = \frac{1}{1} = 1$$

$$A3 = \frac{1}{MAX\ (1,1,1)} = \frac{1}{1} = 1$$

C9

$$A1 = \frac{1}{MAX\ (1,1,1)} = \frac{1}{1} = 1$$

$$A2 = \frac{1}{MAX\ (1,1,1)} = \frac{1}{1} = 1$$

$$A3 = \frac{1}{MAX\ (1,1,1)} = \frac{1}{1} = 1$$

$$Matrix\ A = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 0.5 & 0.6 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 0.5 & 0.6 & 0.5 & 0.5 & 0.5 & 1 & 1 \end{bmatrix}$$

After generate the matrix A (alternatives), we have table 7 which filled with matrix A, that shown A1 which is Lombok city has perfect score of each indicators. While A2 shown each indicator C3 and C4 with value of 0.5 and 0.6. The last alternative A3 has various value of C3, C4, C5, C6 and C7 in sequence of 0.5, 0,6, 0.5, 0.5 and 0.5.

Table 7. Normalized Matrix A

ALTERNATIVE	INDICATOR								
	C1	C2	C3	C4	C5	C6	C7	C8	C9
A1	1	1	1	1	1	1	1	1	1
A2	1	1	0.5	0.6	1	1	1	1	1
A3	1	1	0.5	0.6	0.5	0.5	0.5	1	1

The formula will calculate the value V to rank the city after each score of indicator (C1 to C9) calculated with each weight of indicator. Table 8 shown the V value of each city, normalized result describes that alternative of V1 has value of 100, A2 has 88.5 and V3 has 73.5. That makes the alternative of A1 have the highest score.

Table 8. Normalized Result V

ALTERNATIVE	INDICATOR									RESULT
	C1	C2	C3	C4	C5	C6	C7	C8	C9	
V1	10	15	15	10	10	10	10	10	10	100
V2	10	15	7.5	6	10	10	10	10	10	88.5
V3	10	15	7.5	6	5	5	5	10	10	73.5

5.0 CONCLUSION

Measurement level calculated, showing that non-smoking area and Tobacco, advertisements, promotional, and sponsors ban using SAW Analysis to weight all the indicators that apply, shows ranked value. Data collected from 3 cities, those are Lombok, Bogor district and Padang City. The measurement indicators are the existence of local policy, and implementation of the policy applied at non-smoking areas (education places, hospitals/health services, kids friendly public outdoor, public transportation, worship places, office places, and public places). Cities has gained ranked value after normalized step, stated V1 which is Lombok city has the highest score, compare to other alternatives/cities value of Bogor district with 88.5 value at second and Padang City at third. The result of this measurement could be a model to measures all cities or districts that are also implementing the regional regulation of non-smoking area and Tobacco, advertisements, promotional, and sponsors ban, thus gives a recommendation for policy maker or cities/districts government to enhance the regulation. Nonetheless, further measurement using certain analysis or methods can also be done to improve the result.

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