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APPLICATION OF HOUSEHOLD INDUSTRIAL CERTIFICATE LICENSE USING WEIGHT PRODUCT METHOD

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ABSTRACT

The process of granting home industry food certificates to the City of Tanjungbalai Health Office does not yet have a decision support system that can assist in making decisions quickly and accurately both in terms of the licensor (Dinas Kesehatan) and the certificate applicant (producer), this is because the assessment process is still being carried out manually and do not yet have an integrated system that can facilitate decision making in granting home industry food certificate permits. The adoption of a Decision Support System using the web-based Weight Product (WP) method can assist the Health Office in determining producers who qualify for a food certificate permit under established criteria. This Weight Product (WP) method can give weight to each criterion so that the Health Office has a benchmark in determining which producers meet the requirements for a home industry food certificate. This system also makes it easy for producers to apply for a permit because the system provides information to the permit applicant about the terms, conditions, alternatives, and criteria for obtaining a home industry food certificate permit online.

INTRODUCTION

A good way of producing food is one of the important factors to meet quality standards or food safety requirements set for food. This is very useful for the survival of the food industry, whether small, medium, or large scale. By producing quality food that is safe for consumption, people's trust will inevitably increase, and the food industry in question will develop more rapidly.

Tanjungbalai City Health Office is located at Jl. Gereja No. 2B, Karya Sub-District, South Tanjungbalai District, Tanjungbalai City aims to create a healthy community with a high quality of life, independently based on cooperation by increasing the promotion and preventive role by empowering the potential of the community in implementing health-oriented development. The City of Tanjungbalai Health Service also provides or issues home industry food certificates for or for anyone who wants to open a business and market their products to be accepted in the community and be able to survive in facing competition in the market on the condition that they must meet the provisions in force in the Laws Invite The implementation of

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the granting of a home industry food permit at the Tanjungbalai Health Office does not yet have a decision support system that can assist in the decision so that it can result in an objective and slow process of granting a certificate permit and the absence of specific criteria as benchmarks resulting in an ineffective decision-making process and not efficient.

METHOD

Decision support systems or more simply called SPK are built to support solutions to a problem or are also used to evaluate an opportunity that exists[1], [2]. The Weight Product (WP) method is one of the Multi-Criteria Decision Making (MCDM) methods used to solve the Multi-Attribute Decision Making (MADM) problem that will evaluate several alternatives for a set of attributes or criteria[3]. The Weight Product method is similar to the Meighted Sum (WS) method, but the WP method contains multiplication in mathematical calculations[4]. The Weight Product (WP) method uses multiplication to link attribute ratings, where the rating of each attribute must be raised first with the corresponding attribute weights, the process is the same as normalization. The Weight Product method can help in making decisions but calculations using the Weight Product method only produce the greatest value that will be selected as the best alternative. The calculation will be under this method if the chosen alternative meets the specified criteria.

The steps to solve a problem using multi-criteria are as follows[5] :

1. Determine the criteria to be used as a reference in decision making.
2. Determine the suitability rating of each alternative on each criterion.
3. Determine the preference weights for each criterion.

$$W_j = \frac{w_j}{\Sigma w_j} \qquad (1)$$

4. Duplicate all attributes for alternatives with weights as positive ratings for earnings attributes and negative weights for cost attributes.
   The formula for calculating preference values for alternative Ai is given as follows[6]:

$$S_i = \prod_{j=1}^{n} X_{ij}^{w_j} \qquad (2)$$

Where :
S: represents an alternative preference analogous to the vector S
x: states the value of the criterion
w: state the criteria weights
i: another alternative
A: state the criteria
n: states the number of criteria

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5. The multiplication results are added together to produce a vector V value for each alternative. The vector V value can be calculated using the formula:

$$Vi = \frac{\prod_{j=1}^{n} X_{ij} W_j}{\prod_{j=1}^{n} (X_j) W_j} \qquad (3)$$

Where :
V: states that alternative preferences are analogous to vector V
X: Criteria value
W: Weight of criteria / sub-criteria
i: Alternative
A: Criteria
n: Number of criteria
*: The number of criteria that have been assessed in the vector S

6. Finding alternative values by doing the same steps as in step one, only using the highest value for each highest attribute for each benefit attribute and the lowest value for the cost attribute.
7. Divide the value of V for each alternative with a standard value.
8. Looking for an ideal alternative value by ranking V Value V while making conclusions as to the final stage.

In this study, 10 foods will be used as alternatives, namely P01 = Dumplings, P02 = Potato Chips, P03 = Wet Cake, P04 = Serundeng Shellfish, P05 = Bandrek Powder, P06 = Cheese Corn Chips, P07 = Onion Cake, P08 = Pork Cake Sesame, P09 = Terasi, P10 = Terasi.
5 criteria will be used as a reference in making decisions:
C1 = Method of Production
C2 = Type of Food
C3 = Product Packaging
C4 = Security Education
C5 = Completeness of File

The compatibility ranking of each alternative on each criterion is assessed with 1 to 5, namely:
1 = Very Less
2 = Less
3 = Enough
4 = Good
5 = Very Good

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Following is the system analysis and calculation of the Weight Product method:

1. Determine the types of criteria for granting a home industry food certificate.

Table 1. Criteria Data

Code	Name Criteria	Weight
C1	Method of Production	5
C2	Food Types	4
C3	Product Packaging	3
C4	Security counseling	4
C5	The completeness of the file	4

Then do the weighting of values on each criterion. Can be seen in the following table:

Table 2. Weighting Criteria for Production Methods

Criteria	Scale	Weight
Method of Production	Manual	5
	Semi-Automatic	4

Table 3. Weighting Criteria for Food Types

Criteria	Scale	Weight
Food Types	Natural	5
	Food coloring	4
	Preservatives	3

Table 4. The Weighting of Product Packaging Criteria

Criteria	Scale	Weight
Product Packaging	Glass	5
	Plastic	1
	Paperboard	4
	Cans	2
	Aluminum Foil	3

Table 5. The Weighting of Security Counseling Criteria

Criteria	Scale	Weight
Security Counseling	Pass	5
	Not pass	2

Table 6. Weighting Criteria for Completeness of Files

Criteria	Scale	Weight
Complete File	KTP, KK, Production Identity	5
	KTP, KK	4
	Production Identity	3

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Tabel 7. Kode Alternatif

Code	Alternative Name
P01	Pangsit
P02	Keripik Kentang
P03	Kue Basah
P04	Serundeng Kerang
P05	Bandrek Bubuk
P06	Keripik Jagung Keju
P07	Kue Bawang
P08	Kue Wijen
P09	Terasi 1
P10	Terasi 2

2. In this case, ten alternative data will be used for the granting of home industry food certificates. Can be seen in the following table:

Table 8. Alternative Data

Alternative	Criteria				
	C1	C2	C3	C4	C5
P01	Manual	Natural	Carton / paper	Pass	KTP, KK, Production Identity
P02	Semi-Automatic	Food coloring	Plastic	Not Pass	KTP, KK
P03	Manual	Food coloring	Carton / paper	Pass	Production Identity
P04	Semi-Automatic	Preservatives	Cans	Pass	KTP, KK, Production Identity
P05	Semi-Automatic	Food coloring	Aluminum Foil	Pass	KTP, KK
P06	Manual	Food coloring	Plastic	Not Pass	KTP, KK
P07	Semi-Automatic	Preservatives	Plastic	Not Pass	Production Identity
P08	Manual	Natural	Plastic	Pass	KTP, KK, Production Identity
P09	Manual	Food coloring	Plastic	Pass	Production Identity
P10	Manual	Natural	Carton / paper	Pass	KTP, KK

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3. After knowing the alternative data, then give weight criteria for each alternative data. Following is Table 9 the criteria weights for each alternative:

Table 9. Criteria Weights for Each Alternative

Alternative	**Criteria**				
	C1	C2	C3	C4	C5
P01	2	3	4	5	2
P02	2	4	3	3	3
P03	5	2	3	2	2
P04	4	2	3	4	5
P05	1	4	2	5	3
P06	4	3	2	1	2
P07	3	3	4	2	1
P08	2	2	3	4	4
P09	4	3	3	2	2
P10	1	2	3	4	5

4. Next, weights will be improved first. The initial weight W = (5,4,3,4,4) will be corrected so that the total weight $\sum W_j = 1$, with W is the weight of each entered criteria. The calculation of the repair criteria is as follows:

$$W1(C1) = \frac{5}{5+4+3+4+4} = 0{,}25$$

$$W2(C2) = \frac{4}{5+4+3+4+4} = 0{,}2$$

$$W3(C3) = \frac{3}{5+4+3+4+4} = 0{,}15$$

$$W4(C4) = \frac{4}{5+4+3+4+4} = 0{,}2$$

$$W5(C5) = \frac{4}{5+4+3+4+4} = 0{,}2$$

Table 10. Results of Criteria Weights

Preference	**Value Weight**
W1 (C1)	0,25
W2 (C2)	0,2
W3 (C3)	0,15
W4 (C4)	0,2
W5 (C5)	0,2

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$$\sum W_j = 1$$

5. Then the next step is to calculate the vector S, S is the value of each alternative. This calculation is done by multiplying all attributes (criteria) for all alternatives with W (weight) as positive rank for-profit attributes and negative rank weights for cost attributes. In the case of the granting of a home industry food certificate permit W (weight) is a positive rank because there are no-cost attributes (attributes whose value is increasingly detrimental). How to calculate the S vector is as follows:

$$S1(P01) = (2^{0,25}) \times (3^{0,2}) \times (4^{0,15}) \times (5^{0,2}) \times (2^{0,2})$$
$$S1(P01) = 1,1892 \times 1,2457 \times 1,2311 \times 1,3797 \times 1,1486$$
$$S1(P01) = 2,8901$$

$$S2(P02) = (2^{0,25}) \times (4^{0,2}) \times (3^{0,15}) \times (3^{0,2}) \times (3^{0,2})$$
$$S2(P02) = 1,1892 \times 1,3195 \times 1,1791 \times 1,2457 \times 1,2457$$
$$S2(P02) = 2,8710$$

$$S3(P03) = (5^{0,25}) \times (2^{0,2}) \times (3^{0,15}) \times (2^{0,2}) \times (2^{0,2})$$
$$S3(P03) = 1,4953 \times 1,1486 \times 1,1791 \times 1,1486 \times 1,1486$$
$$S3(P03) = 2,6716$$

$$S4(P04) = (4^{0,25}) \times (2^{0,2}) \times (3^{0,15}) \times (4^{0,2}) \times (5^{0,2})$$
$$S4(P04) = 1,4142 \times 1,1486 \times 1,1791 \times 1,3195 \times 1,3797$$
$$S4(P04) = 3,4867$$

$$S5(P05) = (1^{0,25}) \times (4^{0,2}) \times (2^{0,15}) \times (5^{0,2}) \times (3^{0,2})$$
$$S5(P05) = 1,0000 \times 1,3195 \times 1,1095 \times 1,3797 \times 1,2457$$
$$S5(P05) = 2,5161$$

$$S6(P06) = (4^{0,25}) \times (3^{0,2}) \times (2^{0,15}) \times (1^{0,2}) \times (2^{0,2})$$
$$S6(P06) = 1,4142 \times 1,2457 \times 1,1095 \times 1,0000 \times 1,1486$$
$$S6(P06) = 2,2450S7$$

$$S7(P07) = (3^{0,25}) \times (3^{0,2}) \times (4^{0,15}) \times (2^{0,2}) \times (1^{0,2})$$
$$S7(P07) = 1,3160 \times 1,2457 \times 1,2311 \times 1,1486 \times 1,0000$$
$$S7(P07) = 2,3160$$

$$S8(P08) = (2^{0,25}) \times (2^{0,2}) \times (3^{0,15}) \times (4^{0,2}) \times (4^{0,2})$$
$$S8(P08) = 1,1892 \times 1,1486 \times 1,1791 \times 1,3195 \times 1,3195$$
$$S8(P08) = 2,8040$$

$$S9(P09) = (4^{0,25}) \times (3^{0,2}) \times (3^{0,15}) \times (2^{0,2}) \times (2^{0,2})$$

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$$S9(P09) = 1{,}4142 \times 1{,}2457 \times 1{,}1791 \times 1{,}1486 \times 1{,}1486$$
$$S9(P09) = 2{,}7403$$

$$S10(P10) = (1^{0{,}25}) \times (2^{0{,}2}) \times (3^{0{,}15}) \times (4^{0{,}2}) \times (5^{0{,}2})$$
$$S10(P10) = 1{,}0000 \times 1{,}1486 \times 1{,}1791 \times 1{,}3195 \times 1{,}3797$$
$$S10(P10) = 2{,}4655$$

Table 11. Looking for Value Results

Vector S	S_i
S1 (P01)	2,8901
S2 (P02)	2,8710
S3 (P03)	2,6716
S4 (P04)	3,4867
S5 (P05)	2,5161
S6 (P06)	2,2450
S7 (P07)	2,3180
S8 (P08)	2,8040
S9 (P09)	2,7403
S10 (P10)	2,4655
$\sum S_i =$	27,0083

6. After obtaining the vector S value, then determine alternative ranking by dividing the value of V (the value of the vector used for ranking) for each alternative with the total value of all alternative values (Vector S). The following is a ranking calculation:

$$V1(P01) = \frac{2{,}8901}{27{,}0083}$$
$$V1(P01) = 0{,}1070$$
$$V2(P02) = \frac{2{,}8710}{27{,}0083}$$
$$V2(P02) = 0{,}1063$$
$$V3(P03) = \frac{2{,}6716}{27{,}0083}$$
$$V3(P03) = 0{,}0989$$
$$V4(P04) = \frac{3{,}4867}{27{,}0083}$$
$$V4(P04) = 0{,}1290$$
$$V5(P05) = \frac{2{,}5161}{27{,}0083}$$
$$V5(P05) = 0{,}0931$$
$$V6(P06) = \frac{2{,}2450}{27{,}0083}$$
$$V6(P06) = 0{,}0831$$
$$V7(P07) = \frac{2{,}3180}{27{,}0083}$$
$$V7(P07) = 0{,}0858$$
$$V8(P08) = \frac{2{,}8040}{27{,}0083}$$
$$V8(P08) = 0{,}1038$$
$$V9(P09) = \frac{2{,}8901}{27{,}0083}$$
$$V9(P09) = 0{,}1014$$
$$V10(P10) = \frac{2{,}4655}{27{,}0083}$$
$$V10(P10) = 0{,}0912$$

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From the alternative calculation results above, it can be concluded that the highest value is 0.1290, namely P4 (Serundeng Kerang) followed by other alternatives which can be seen in Table 12 above.

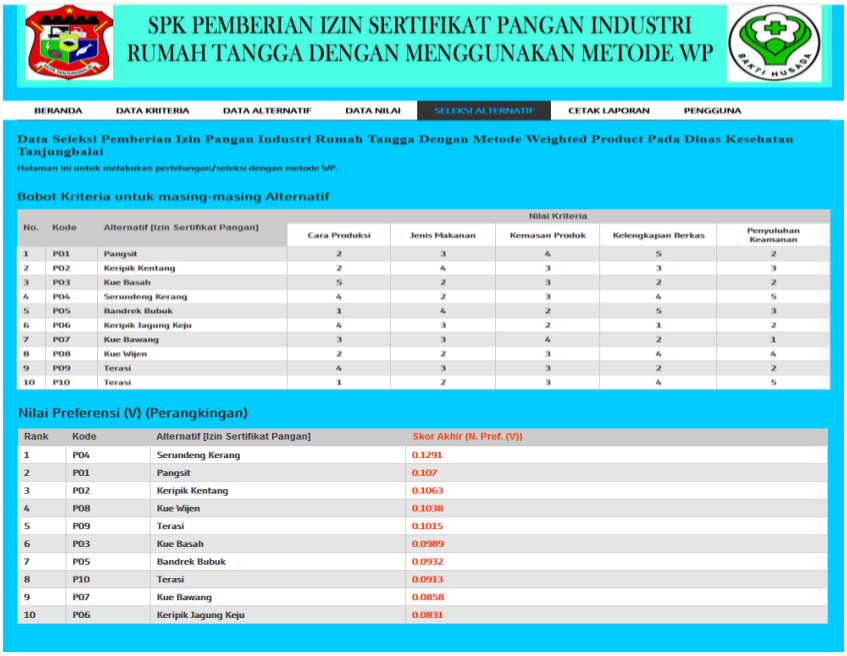
Table 12. Finding Results Preference Values (Vi)

Alternative	Preference (Vi)	Rank
P01	0,1070	2
P02	0,1063	3
P03	0,0989	6
P04	0,1290	1
P05	0,0931	7
P06	0,0831	10
P07	0,0858	9
P08	0,1038	4
P09	0,1014	5
P10	0,0912	8

RESULT AND DISCUSSION

Implementation of Calculations

Implementation of the calculation is the main page admin displays the results of the calculation after performing the Weight Product method steps. The following is the calculation page.



No.	Kode	Alternatif [Izin Sertifikat Pangan]	Nilai Kriteria				
			Cara Produksi	Jenis Makanan	Kemasan Produk	Kelengkapan Berkas	Penyuluhan Keamanan
1	P01	Pangsit	2	3	4	5	2
2	P02	Keripik Kentang	2	4	3	3	3
3	P03	Kue Basah	5	2	3	2	2
4	P04	Serundeng Kerang	4	2	3	4	5
5	P05	Bandrek Bubuk	1	4	2	5	3
6	P06	Keripik Jagung Keju	4	3	2	1	2
7	P07	Kue Bawang	3	3	4	2	1
8	P08	Kue Wijen	2	2	3	4	4
9	P09	Terasi	4	3	3	2	2
10	P10	Terasi	1	2	3	4	5

Rank	Kode	Alternatif [Izin Sertifikat Pangan]	Skor Akhir (N. Pref. (V))
1	P04	Serundeng Kerang	0.1291
2	P01	Pangsit	0.107
3	P02	Keripik Kentang	0.1063
4	P08	Kue Wijen	0.1038
5	P09	Terasi	0.1015
6	P03	Kue Basah	0.0989
7	P05	Bandrek Bubuk	0.0932
8	P10	Terasi	0.0913
9	P07	Kue Bawang	0.0858
10	P06	Keripik Jagung Keju	0.0831

Image 1. Implementation of Calculations

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CONCLUSION

The conclusions that can be drawn from research conducted at the Tanjungbalai City Health Office include:

1. The decision support system for the granting of home industry food permits in the City of Tanjungbalai Health Service was developed using a web-based heavy method, which will facilitate the administrative process both in terms of certificate issuer/permit manager and permit manager because it can be done online so that it can provide information whenever needed.
2. The granting of a home industry food certificate permit is adjusted to the criteria specified in the Tanjungbalai City Health Office
3. In solving multi-criteria problems, the Heavy Product Method is not the only decision-making method used, this method can be combined or compared using other methods such as Method: AHP, TOPSIS, SAW, and several other methods to support more informed decisions effective and efficient.

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