Article

The Weighted Product Implementation In Selection of Superior Jersey Materials in Gorich Industry and Production

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Abstract:

The success of a convection business is determined by the materials used. The more the need for orders at GORICH Industry and production convection, the business owner must be competent in producing and selecting superior materials so that customers feel satisfied with the products purchased. The number of materials and the various criteria for these materials requires a decision support system as a solution for selecting the best materials, which is used as a recommendation for material selection to prospective buyers. This method was chosen for this study using the Weighted Product method because it can determine the weight value for each attribute; in this case, it can be followed by ranking, which will be able to select each quality from the best alternative from several existing choices. From the results of the analysis, it was also found that the jersey material alternative recommended at Gorich Industry and Production fell on the A8 option, namely Emboss material.

Keywords: Convection, Decision Support System, Weighted Product, business, industry

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1. INTRODUCTION

The rapid development of science allows practitioners to continue to make good decisions. Decision-making must be carried out quickly, thoroughly, and on target and can be accounted for to be the key to successful decision-making in the future. The amount of data that has been collected cannot guarantee that the decisions that have been made look accurate. Before the decision-making process is carried out, it must determine what criteria are needed. Each standard must be able to solve the problem at hand. One of the problems faced by the GORICH Industry and production convection business is determining the superior jersey material. Sometimes many customers are confused about selecting the materials needed; choosing the wrong fabric or not according to the customer's wishes will negatively impact the assessment of the convection business itself.

GORICH Industry and production is a home-based business engaged in convection in Plana Neighbourhood head/Head of Hamlets number 03/04, Somagede Banyumas. One of the most frequently produced products is the jersey. The more the need for orders at GORICH Industry and production Convection, the business owner must be more competent in making and selecting superior materials so that the customer feels satisfied with the jersey purchased. The convection business itself determines the success of a convection business in

running a business properly. The utilization of decision-support systems by applying decision-support methods to produce the best alternative is beneficial for decision-makers.

This designed system uses the Weighted Product (WP) method, which is quantitative in decision-making. The Weighted Product method uses multiplication to connect attribute values (criteria), where the value of each attribute (criteria) must be raised to the first power of the attribute (criteria) in question. Best of a number of alternatives. In this case, the alternative in question is the best quality jersey material based on the criteria determined by the steps of the Weighted Product method, which are simple, easy to understand, effective, and efficient. With the existence of this decision support system, it is hoped that it can help prospective customers to be able to choose the jersey material to be purchased according to the desired criteria and provide appropriate alternatives according to the needs and abilities of prospective customers.

Based on the background that has been described, the problem to be solved can be formulated, and how to determine superior jersey materials to be recommended to potential customers based on predetermined weights and criteria so that they can assist in deciding the best jersey material.

The research results are purposeful and valuable for Gorich Industry and production in helping determine the best jersey material so that it is more objective, does not take long and is accurate in recommending materials to potential customers.

2. LITERATURE REVIEW

A. Decision Support System

The decision Support System is intended to support managerial decision makers in semi-structured decision-making. The DSS is designed to be a tool for decision-makers to expand their capabilities, not to replace their judgment (Septilia, 2020).

B. Weighted Product

Weighted Product (WP) is a popular multi-criteria decision analysis and is multi-criteria decision-making method. The Weighted Product (WP) method is a finite set of decision alternatives described in terms of several decision criteria. The Weighted Product (WP) method uses a multiplication of attribute ratings in the name of each attribute rating it must be raised to the first rank with the weight of the attribute in question (Aldo, 2019).

C. Weighted Product (WP) Algorithm

The Weighted Product method algorithm briefly (Hafiz, 2018):

1. Normalize the weights to produce values Where j = 1,2,...,n are many alternatives.
2. Determine the category of each criterion, whether it is included in the profit or cost criteria.
3. Determine the value of the vector S by multiplying all the criteria for an alternative with the weight as a positive exponent for the benefit criterion and the weight functioning as a negative exponent for the cost criterion.
4. Determine the value of the vector V for ranking.
5. Compare the final values of vector V.
6. Finding the best alternative sequence which will later become a decision.

D. Previous Research

1. Research conducted by Idham Ramadhana and Umar (2019) entitled METHOD COMPARISON ANALYSIS SIMPLE ADDITIVE WEIGHTING (SAW) WITH WEIGHTED PRODUCT (WP) METHOD IN SUPPORTING THE DECISION TO ACCEPT NEW EMPLOYEES". Previous research was carried out with the aim of comparing the accuracy value of the SAW method is higher than the accuracy value of the WP method.
2. Suci Ramadhani et al. (2018) with the title "Decision Support System for Determining Thesis Supervisor using A Weighted Product (WP) Method". Previous research used WP to assist and facilitate the English Department of Tadulako University in selecting accurate and fast thesis supervisors with system mathematical calculations so that the resulting recommendations are more accountable.
3. Mohamad Irfan et al. (2020) with the title "Decision Support System for Employee Recruitment Using El Chinix Traduisant La Realite (Electre) and Weighted Product (WP)." In previous research, namely using the ELECTRE method to determine prospective employees who pass the initial selection, data on prospective employees need to be taken from the registration stage carried out by prospective employees. And the WP method.
4. Raman Kumar (2020) with the title "Selection of portable hard disk drives based upon weighted aggregated sum product assessment method: A case of the Indian market." Previous studies using WP, namely for multi-criteria decision-making, are used to assess various portable hard disk drive alternatives according to the wishes of buyers/retailers/wholesalers, taking into account various attributes. This approach benefits users/vendors/traders, or even website designers/comparison sites. That is, differentiating different products and goods.

5. Roni Kurniawan with the title "Analysis of the Weight Product (WP) Algorithm on the best Go Car Driver Recommendation at PT. Maranatha Princess Brothers." Previous research to rank the best Go Car Drivers. Problems arise due to inaccuracy in giving value to the driver, resulting in wrong decisions being made. Hence, the assessment tends to be subjective, which results in a recommended alternative as the best go-car driver.
6. Anna Sergeenko (2021) with the title "Convergence Analysis of Weighted SPSA-based Consensus Algorithm in Distributed Parameter Estimation Problem." The goal of the sensor is to find a global estimate of the unknown minimizing parameter, which minimizes some aggregate cost functions. Each sensor can communicate with several "neighbors." Then the communication channel has a limited capacity with the results of a weighted SPSA-based consensus algorithm and convergence analysis of this algorithm in the stationary case. Additionally, determine the appropriate step size algorithm based on this analysis. This method is validated through simulation, where parameters are selected based on convergence analysis.
7. Ta-Yin Hu (2014) with the title "Comparison of a Multi-Objective Compromise Weight Model and a Multi-Objective Evolutionary Algorithm in Hazmat Transportation Route Planning." This previous research focused on three objectives: cost, risk, and emergency responsiveness. Then build, two solution algorithms, a compromise weight model and an evolutionary algorithm, to solve the multi-objective problem. The results of these two algorithms are observed and compared. In addition, this research also provides several recommendations for stakeholders, including the hazmat industry, government, and residents.
8. Tung-Kung Liu with the title "Optimal design for transport and logistics of steel mill by-product based on double-layer genetic algorithms." This research was previously to break the bottleneck of traditional decision-making to optimize transportation logistics decision-making through artificial intelligence. In defining the problem, the model of transportation and logistics.
9. Zhenyuan Liu with the title "Different responses of incidence-weighted and abundance-weighted multiple facets of microinverter rate beta diversity to urbanization in a subtropical river system." Previous research Using the WP method examined how urbanization affects various aspects (e.g., taxonomic, functional, and phylogenetic) of beta diversity. The underlying ecological drivers in urban rivers macroinvertebrates obtained taxonomic and phylogenetic beta diversity weighted by incident data primarily driven by replacement of taxa. In contrast, differences in richness contribute more to various aspects of beta diversity based on abundance data.

10. Supriono (2018) with the title "Developing decision support systems using the weighted product method for house selection." This previous study used WP, namely determining the criteria that influence house selection as opposed to house prices and sizes which cannot be resolved using a general linear mathematical formula with the aim of developing a home selection decision-making model to calculate and sort recommendation values, to implement a decision support system to in a web-based environment.
11. Dedi Candro (2021), with the title "APPLICATION OF THE WEIGHTED PRODUCT METHOD FOR THE SELECTION OF CANDIDATES FOR THE NATIONAL SCIENCE OLYMPIAD AT SMK YAPIM BIRU - BIRU" to determine prospective National Science Olympiad participants using the calculation of scores from the criteria for subject scores, academic achievement, OSN experience as a reference for assessment at YAPIM Biru-Biru Vocational School. A computerized Weighted Product decision support system has produced an application to support the selection of OSN participants to make it more effective and efficient in the assessment process conducted on 100 students at SMK YAPIM Biru-Biru.
12. B Ozdemir (2018) with the title "How safe is the use of herbal weight-loss products sold over the Internet?" This previous research was to identify the nature and quantity of certain undeclared hazardous substances and toxic metal contamination of herbal weight loss products marketed over the Internet using the WP method.
13. Supriono (2018) with the title "Determination Feasibility of Poor Household Surgery By Using Weighted Product Method." This previous study required clear parameter criteria to determine the feasibility of operating the house, and the specified parameters were defined as the criteria to determine the eligibility for the operation of the WPM house activities for the selection of houses to be successfully implemented in a web-based environment using a persona.
14. Joseph Y. -T. Leunga et al. (2006), with the title "Scheduling orders for multiple product types to minimize total." This previous research is Order Scheduling, which has many application areas; application areas range from order scheduling in manufacturing environments to maintenance of large aircraft to complete the total weighted calculation. Home operations for low-income families in a fast and precise manner. The accuracy of this method's test results is 100%, so no one is harmed for all the Parties.

3. METHOD

A. Research Stages

The steps taken in solving the problem using the weighted product method are shown in Figure 1. Figure 1 describes the following parameters along with their explanations:

a) *Problem Identification Stage*
   Identification of the problem is carried out, and then a plan is made, the formulation of the problem and its model, as well as the formulation of methods and solutions. In this research problem

b) *Data Collection Stage*
   The data collection method used in this study is as follows. Namely library research, observation, and interviews.

c) *Implementation of Weight Products*
   The weighted product method uses a multiplication technique to connect attribute ratings, where the rating of each attribute must be raised to the first power with the weight of the attribute in question. This process is the same as the normalization process.

Furthermore, The steps for completing the weighted product method are as follows:

1. Determine the choices (Ai) and the criteria for each alternative (Cj) by making a decision matrix
2. Carry out the normalization process on the weights of each alternative
3. Calculating the Si vector, which raises the value of each choice with each corrected weight.
4. Calculate the vector vi, by dividing by the average of the results of each multiplication.

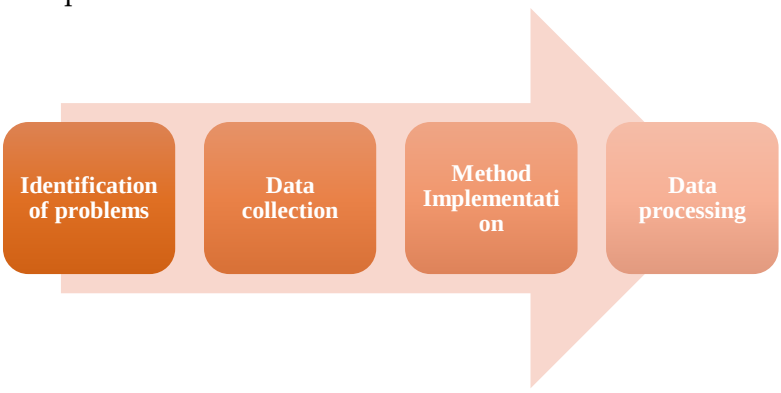

Figure 1. Research Stages

B. Data processing

Data Processing An analysis of the calculation of weights, s vector values, and alternative v vector values was carried out using the weighted product method. The following formula gives this process:

1. Determination of the weight value of S, as equation 1.

$$S_i = \prod_{j=1}^{n} x_{ij}^{w_j} , \quad (1)$$

with i = 1, 2, ..., m

where :

S = expresses an alternative preference,

x = denotes the criterion value,

w = denotes the weight of the criteria,

n = specifies the number of criteria.

Furthermore, Wj is a positive rank for the profit attribute and a negative value for the cost attribute.

2. Determination of V Weight Value, as the equation 2.

$$V_i = \frac{\prod_{j=1}^{n} x_{ij}^{w_j}}{\prod_{j=1}^{n} (X_j)^{w_j}} ; \quad i=1,2,..,m \quad (2)$$

where :

V: Alternative preference,

X: Criteria value,

w: Criteria weight.

4. RESULT AND DISCUSSION

The process of data analysis is the determination of data in the form of criteria used to assess the selection of superior jersey materials in the Gorich Industry and Production. The method used in analyzing this data is to apply the weighted product method to produce information in the form of ranking against the criteria for managed data. The following are the criteria used in this decision support system:

1. Determining Material Assessment Alternatives

Table 1. Alternative Materials

Code	Alternative
A1	Serena
A2	Milano
A3	Benzema
A4	Umbro
A5	Smash
A6	Bintik
A7	Jarum
A8	Embos

2. Define Criteria

Table 2. Assessment Criteria

Code	Criteria	Type	Weight
C1	Quick dry material	Profit	1
C2	Jersey prices	Cost	2
C3	Absorb sweat	Profit	3
C4	Stitches	Profit	4
C5	Fiber thickness	Profit	5
C6	Color sharpness	Profit	6

3. Matrix data for assessing jersey materials to be ranked

Table 3. Jersey Material Assessment Matrix Data

Alternative	Criteria					
	Quick Dry Material	Jersey Price (IDR)	Absorb sweat	Stitches	Fiber Thickness	Color sharpness
R1 = Serena	1	35000	1	1	1	1
R2 = Milano	3	75000	3	2	4	3
R3= Benzema	2	60000	2	3	2	2
R4 = Umbro	2	65000	2	4	3	2
R5 = Smash	4	80000	4	5	5	3
R6 = Bintik	2	65000	2	6	3	2
R7 = Jarum	4	85000	4	7	6	4
R8 = Embos	4	85000	4	8	6	4

4. Perform Criteria Weight Improvement

From the data matrix table 3, normalization or improvement of the weights is carried out first from the preference weight priority chosen based on the priority level, namely = (1,2,3,4,5,6) with a total weight value of 21. The following is the normalization or improvement of the weights carried out on each criterion:

$$\mathrm{Wn} = \frac{\mathrm{Wn}}{\mathrm{w1+w2+w3+w4+w5+w6}} \tag{3}$$

From equation 3, the values of W1, W2, W3, W4, W5, and W6 can be calculated as follows:

$$\mathrm{W1} = \frac{1}{1+2+3+4+5+6} = 0.047$$

$$\mathrm{W2} = \frac{2}{1+2+3+4+5+6} = 0.095$$

$$\mathrm{W3} = \frac{3}{1+2+3+4+5+6} = 0.142$$

$$\mathrm{W4} = \frac{4}{1+2+3+4+5+6} = 0.190$$

$$\mathrm{W5} = \frac{5}{1+2+3+4+5+6} = 0.238$$

$$\mathrm{W6} = \frac{6}{1+2+3+4+5+6} = 0.285$$

5. Compute Vector S_i

Furthermore, to calculate the S_i vector, The S_i vector is obtained by increasing the value of each alternative with each corrected weight.

$$\mathbf{S1} = (\mathbf{1}^{0,047})(\mathbf{35000}^{0,095})(\mathbf{1}^{0,142}) + (\mathbf{1}^{0.190}) + (\mathbf{1}^{0,238}) + (\mathbf{1}^{0,285}) = \mathbf{2.702}$$

$$\mathbf{S2} = (\mathbf{3}^{0,047})(\mathbf{75000}^{0,095})(\mathbf{3}^{0,142}) + (\mathbf{2}^{0.190}) + (\mathbf{4}^{0,238}) + (\mathbf{3}^{0,285}) = \mathbf{7.802}$$

$$\mathbf{S3} = (\mathbf{2}^{0,047})(\mathbf{60000}^{0,095})(\mathbf{2}^{0,142}) + (\mathbf{3}^{0.190}) + (\mathbf{2}^{0,238}) + (\mathbf{2}^{0,285}) = \mathbf{5.629}$$

$$\mathbf{S4} = (\mathbf{2}^{0,047})(\mathbf{65000}^{0,095})(\mathbf{2}^{0,142}) + (\mathbf{4}^{0.190}) + (\mathbf{3}^{0,238}) + (\mathbf{2}^{0,285}) = \mathbf{6.382}$$

$$\mathbf{S5} = (\mathbf{4}^{0,047})(\mathbf{80000}^{0,095})(\mathbf{4}^{0,142}) + (\mathbf{5}^{0.190}) + (\mathbf{5}^{0,238}) + (\mathbf{3}^{0,285}) = \mathbf{10.843}$$

$$\mathbf{S6} = (\mathbf{2}^{0,047})(\mathbf{65000}^{0,095})(\mathbf{2}^{0,142}) + (\mathbf{6}^{0.190}) + (\mathbf{3}^{0,238}) + (\mathbf{2}^{0,285}) = \mathbf{6.760}$$

$$\mathbf{S7} = (\mathbf{4}^{0,047})(\mathbf{85000}^{0,095})(\mathbf{4}^{0,142}) + (\mathbf{7}^{0.190}) + (\mathbf{6}^{0,238}) + (\mathbf{4}^{0,285}) = \mathbf{12.003}$$

$$\mathbf{S8} = (\mathbf{4}^{0,047})(\mathbf{85000}^{0,095})(\mathbf{4}^{0,142}) + (\mathbf{8}^{0.190}) + (\mathbf{6}^{0,238}) + (\mathbf{4}^{0,285}) = \mathbf{12.233}$$

6. Calculating the vector vi

Vector Vi is obtained by dividing by the average of the results of each multiplication.

$$V1 = \frac{2{,}702}{(2{,}702 + 7{,}802 + 5{,}629 + 6{,}382 + 10{,}843 + 6{,}760 + 12{,}003 + 12{,}233)} = 0{,}0419$$

$$V2 = \frac{7{,}802}{(2{,}702 + 7{,}802 + 5{,}629 + 6{,}382 + 10{,}843 + 6{,}760 + 12{,}003 + 12{,}233)} = 0{,}1212$$

$$V3 = \frac{5{,}629}{(2{,}702 + 7{,}802 + 5{,}629 + 6{,}382 + 10{,}843 + 6{,}760 + 12{,}003 + 12{,}233)} = 0{,}0874$$

$$V4 = \frac{6{,}382}{(2{,}702 + 7{,}802 + 5{,}629 + 6{,}382 + 10{,}843 + 6{,}760 + 12{,}003 + 12{,}233)} = 0{,}0991$$

$$V5 = \frac{10{,}843}{(2{,}702 + 7{,}802 + 5{,}629 + 6{,}382 + 10{,}843 + 6{,}760 + 12{,}003 + 12{,}233)} = 0{,}1684$$

$$V6 = \frac{6{,}760}{(2{,}702 + 7{,}802 + 5{,}629 + 6{,}382 + 10{,}843 + 6{,}760 + 12{,}003 + 12{,}233)} = 0{,}1050$$

$$V7 = \frac{12{,}003}{(2{,}702 + 7{,}802 + 5{,}629 + 6{,}382 + 10{,}843 + 6{,}760 + 12{,}003 + 12{,}233)} = 0{,}1865$$

$$V8 = \frac{12{,}233}{(2{,}702 + 7{,}802 + 5{,}629 + 6{,}382 + 10{,}843 + 6{,}760 + 12{,}003 + 12{,}233)} = 0{,}1900$$

Furthermore, it is made based on the order from the highest to the lowest, as in table 4.

Table 4. Ranking based on code and value

Code	Value	Ranking
R8 = Embos	0.1900	1
R7 = Jarum	0.1865	2
R5 = Smash	0.1684	3
R2 = Milano	0.1212	4
R6 = Bintik	0.1050	5
R4 = Umbro	0.0991	6
R3 = Benzema	0.0874	7
R1 = Serena	0.0419	8

5. CONCLUSIONS

Based on the research, it was concluded that ranking the highest vector values would be an alternative for selecting jersey materials that are recommended based on the criteria set according to the interests of the user. The analysis also found that the jersey material alternative recommended at Gorich Industry and Production fell on the A8 alternative, namely Emboss, to help Gorich Industry and Production provide recommendations for quality types of jersey material to potential customers.

AUTHOR CONTRIBUTIONS

Conceptualization; Intan Indri Fitriani [I.I.F], Nur Ngaenun Agustina [N.N.A], Alya Nur Fajariyanti [A.N.F], Imam Tahyudin [I.T], methodology; [I.I.F],[N.N.A],[A.N.F], [I.T], validation; [I.I.F],[N.N.A],[A.N.F], [I.T], formal analysis; [I.I.F],[N.N.A],[A.N.F], [I.T] investigation;[I.I.F],[N.N.A],[A.N.F], [I.T] data curation; [I.I.F],[N.N.A],[A.N.F], [I.T], writing—original draft preparation; [I.I.F],[N.N.A],[A.N.F], [I.T], writing—review and editing; [I.I.F],[N.N.A],[A.N.F], [I.T], visualization; [I.I.F],[N.N.A],[A.N.F], [I.T], supervision; [I.I.F],[N.N.A],[A.N.F], [I.T], project administration; [I.I.F],[N.N.A],[A.N.F], [I.T] funding acquisition; [I.I.F],[N.N.A],[A.N.F], [I.T] have read and agreed to the published version of the manuscript.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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