

Decision Support System for Determining the Best Foreman Using the Simple Additive Weighting (SAW) Method

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ABSTRACT

PT. Universal Gloves is a company engaged in the production of rubber gloves in the city of Medan. The increasing number of foremen working in this company makes the diversity of foremen even more complex so that it is difficult to choose the best foreman. Therefore, it is necessary to develop a decision support system as an alternative solution to increase efficiency and effectiveness in the selection and quality of determining the best foreman. This decision support system uses the SAW (Simple Additive Weighting) method based on predetermined criteria and weights. The criteria used as indicators are Discipline, Initiative, Achievement, Cooperation, Order, Performance, and Social. The SAW method was chosen because it was able to select the best alternative from a number of alternatives. This research was carried out by looking for weights on each attribute, then ranking was carried out to determine the best foreman. The results of this study are in the form of a decision support application that can recommend the best foreman at PT. Universal Gloves.



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INTRODUCTION

PT. Universal Gloves is a manufacturing company engaged in the production of rubber gloves and is located in the city of Medan, North Sumatra. As one of the companies that is highly committed to product quality and customer satisfaction, PT. Universal Gloves continues to make various efforts to improve performance on all lines, including in terms of supervision and coordination of the production process. The company realizes that the role of the foreman is very important in maintaining the efficiency and effectiveness of the production process and ensuring that quality standards are met [1]. Therefore, the foremen at PT. Universal Gloves has a great responsibility to oversee every stage of production to keep it in accordance with the procedures and targets that have been set.

In an effort to further improve the performance of the foremen, PT. Universal Gloves plans to implement an awards program that aims to recognize the best performing foreman. This program is expected to be one of the main motivators for foremen to continue to improve their

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work performance [2]. In addition, this program is also a form of the company's appreciation for the contribution of the foremen in the operational success of PT. Universal Gloves. In determining who is the best foreman who is entitled to receive the award, comprehensive supporting data is required, such as customer satisfaction level, number of units produced, teamwork ability, discipline, and other performance indicators [3]. This data will be processed and analyzed objectively to produce an accurate and fair assessment. To support this decision-making, PT. Universal Gloves considers the use of Decision Support Systems (SPK) as an effective tool in solving the problem of determining the best foreman systematically and optimally [4]. SPK allows companies to make decisions based on comprehensive data and analysis. One of the methods that is often used in SPK is Simple Additive Weighting (SAW). The SAW method was chosen because of its simplicity and ability to produce precise and accurate decisions [5]. This method works by combining various criteria that have been normalized into a decision matrix, then a ranking process is carried out to determine the best alternative [6]. Many previous studies have proven the effectiveness of the SAW method in the context of SPK-based decision-making. For example, research conducted by Setiadi (2018) shows that the SAW method can be used well in determining the best students in an educational institution [7]. Another study by Subawa (2015) also shows that this method is effective in determining the best employees in a company [8]. The results of this study prove that the SAW method is not only practical, but also able to provide satisfactory and reliable results [9]. With this background, the author conducted a similar research at PT. Universal Gloves with a focus on determining the best foreman. This research is expected to make a real contribution to the company in an effort to improve the performance of foremen through an objective and fair award program [10]. In addition, this research also aims to add academic insight into the application of the SAW method in the context of the manufacturing industry, especially in the field of rubber glove production. It is hoped that the results of this study can help PT. Universal Gloves to continue to grow and maintain its position as a leading company in the rubber glove industry in Indonesia [11].

METHODS

1. Decision Support System

A Decision Support System (SPK) is a computer-based information system that supports decision-making in semi-structured or unstructured situations, where there is no clear solution or standard method that can be used directly. SPK is designed to assist managers and decision-makers in analyzing information, identifying problems, and choosing the optimal solution among the various alternatives that exist. Basically, SPK combines human ability in decision-making with computer skills in fast and accurate data processing. SPK provides a more systematic and logical approach to decision-making, so that it is able to reduce uncertainty and improve the quality of decisions taken [12]. This is especially important in an increasingly complex and dynamic business environment, where wrong decisions can have a significant impact on the continuity and success of an organization [13]. The main function of SPK is to provide support in the decision-making process, not to replace decision-makers. SPK provides a variety of analysis tools that allow managers to evaluate various alternatives, consider various criteria, and ultimately choose the best option based on the goals they want to achieve [14]. SPK also allows decision-makers to simulate various scenarios and predict the outcome of the decisions taken, so they can anticipate possible risks and impacts that may occur [15]. The main benefits of SPK include increased efficiency and effectiveness in decision-making, increased consistency and objectivity in assessment, and reduced time and cost required to process information [16]. In addition, SPK can help in faster decision-making, which is especially important in critical situations where time is a decisive factor [17]. The implementation of

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SPK not only helps in better decision-making, but also increases the flexibility and responsiveness of the organization to changes in the market and environment. By utilizing information technology, SPK enables decision-makers to remain competitive and adaptive in facing increasingly complex challenges[18]. Decision Support Systems are a very important tool in modern decision-making, combining computer analysis capabilities with human intuition and experience. With features that support data processing, model analysis, and communication, SPK enables organizations to make better, faster, and more efficient decisions. In the midst of increasingly fast and complex business dynamics, the ability to make the right and timely decisions is a crucial competitive advantage, and this is where the role of SPK becomes very significant.

2. Foreman

Foremen are individuals who hold a crucial role in the production chain, responsible for ensuring that all stages of production run in accordance with the company's standards and targets that have been set. They are the spearhead in coordinating daily activities on the production floor, monitoring the execution of work, and ensuring that all processes are carried out in accordance with the procedures that have been set by the company. The role of the foreman is not only limited to supervision, but also includes solving problems that arise during the production process, managing human resources, as well as arranging logistics and distributing tasks among workers[19]. In the context of the production of rubber gloves at PT. Universal Gloves, the foreman's responsibility includes supervision of the entire manufacturing process, from raw material selection, material mixing, printing, to packing the final product. The foreman must ensure that every stage of production is carefully carried out to meet the quality standards set by the company. Errors in any of these stages can have an impact on the final quality of the product, which in turn can affect the company's reputation and customer satisfaction[20]. Foremen must also have a deep understanding of the machinery and equipment used in production, so that they can immediately handle or report any damage or interference to the production equipment. Speed and precision in handling these technical issues are essential to prevent downtime that can hamper production and cause delays in product delivery[21]. Therefore, foremen often work closely with the maintenance team to ensure that all machines are in good condition and ready for use. In addition, foremen play an important role in motivating and directing workers in the field. They must be able to lead the team effectively, provide clear instructions, and ensure that all workers understand their duties and responsibilities. The foreman is also responsible for monitoring the performance of each worker and providing constructive feedback for improvement. In situations where there are workers who experience difficulties or obstacles in carrying out their duties, the foreman must be able to provide guidance and solutions to help the worker achieve optimal performance[22]. Discipline is another aspect that foremen pay great attention to. They must ensure that all workers comply with the company's rules and regulations, including in terms of attendance, use of personal protective equipment (PPE), and compliance with work safety procedures. This discipline is important to create a safe and productive work environment, as well as to avoid work accidents that can harm both workers and the company[23]. Furthermore, foremen also have a role in managing production efficiency. They must ensure that resources such as raw materials, energy, and time are used optimally, without any waste. Foremen should always look for ways to increase their team's productivity, for example by identifying processes that can be optimized or automated. Thus, foremen play a role not only as supervisors, but also as agents of change that can drive innovation and continuous improvement in the production line[24]. At PT. Universal Gloves, the role of the foreman is becoming increasingly important in facing challenges such as fluctuations in market demand,

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changes in industry regulations, and the development of new production technologies. Foremen must be able to adapt quickly to these changes and ensure that their team is also prepared to take on the challenges at hand. They must always update their knowledge and skills to remain relevant in the face of the ever-evolving dynamics of the industry[25]. The overall responsibility carried by the foreman shows how important their role is in ensuring the smooth operation of production operations at PT. Universal Gloves. They are not only tasked with ensuring that production targets are met, but also to maintain product quality, process efficiency, and the well-being and safety of the production team. Therefore, foremen must have a good combination of technical, leadership, and management skills to be able to carry out their duties effectively and efficiently.

3. Literature Studies

The Simple Additive Weighting (SAW) method, or often known as the weighted addition method, is one of the methods in the Decision Support System (SPK) that is used to determine the best alternative from several options based on certain criteria. The SAW method works by weighting each criterion and then summing up the performance value of each alternative based on that weight. The results of this summation are then used to determine the best alternative. The process of applying the SAW method begins by determining the criteria that will be used as a reference in decision-making. These criteria can be factors that are considered important in the evaluation of alternatives, such as quality, cost, time, or efficiency. Each of these criteria is then given a weight that reflects its level of importance relative to the other criteria. This weight can be obtained through various methods, such as pair comparison techniques or based on subjective judgments from decision-makers. After determining the criteria weight, the next step is to assess the performance of each alternative on each of the criteria. This assessment is carried out by providing a rating or score that reflects how well an alternative meets certain criteria. These ratings can be numerical or scaled values, depending on the type of data available and the need for analysis. However, because each criterion can have different units or scales, the SAW method requires a normalization step of the decision matrix. This normalization aims to equalize the scale of all criteria, so that the performance values of each alternative can be directly compared. Normalization is carried out by changing the original value of each criterion to a value relative to the maximum or minimum value in the criterion. This normalization process results in a normalized decision matrix, which is ready for further analysis. Once the normalized decision matrix is formed, the next step is to calculate the total value for each alternative. This is done by multiplying each normalized value by the corresponding criterion weight, and then summing up the results of that multiplication for each alternative. The end result of this process is the final value (V_i) which represents the total performance of each alternative. The alternative with the highest V_i score is considered the best alternative, because it has the highest performance based on the weight of the criteria that have been determined. The SAW method is very popular because of its simple nature and easy to implement. It does not require complex calculations and can be used with quantitative data. This method is also flexible, as it can be applied in various decision-making contexts, from candidate selection in recruitment, business location selection, to investment project evaluation. Its transparent nature also allows decision-makers to understand and verify the results produced, which makes this method a reliable choice in a variety of decision-making situations. With the SAW method, decision-making becomes more structured and systematic, providing clear guidance in assessing and comparing various alternatives based on relevant criteria. This helps to reduce subjectivity and ensure that the decisions made are the ones that best suit the goals and needs at hand.

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The SAW method or weighted sum method finds the weighted sum of each alternative's performance rating on all attributes. This method requires normalizing the decision matrix (X) to a scale that is comparable to all existing alternative ratings. The steps of the SAW method are:

- 1) Determine the criteria that are used as a reference in decision-making (Cj).
- 2) Provides a weight value for each criterion (W).
- 3) Provides a match rating value for each alternative on each criterion.
- 4) Create a decision matrix based on criteria (Cj), then normalize the matrix based on the equation according to the type of attribute (benefit or cost) so that a normalized matrix R is obtained.

$$R_{ij} = \begin{cases} \frac{X_{ij}}{\max X_{ij}} & \text{if } j \text{ is an advantage attribute (benefit)} \\ \frac{\min X_{ij}}{X_{ij}} & \text{if } j \text{ is a cost attribute (cost)} \end{cases}$$

Description of each criterion:

- R_{ij} : Normalized Performance Rating Value
 - X_{ij} : attribute value
 - $\max X_{ij}$: the greatest value of each criterion
 - $\min X_{ij}$: the smallest value of each criterion
 - Benefit : if the greatest value is the best
 - Cost : if the smallest value is the best
- 5) The final result is obtained from the ranking process, namely the addition and multiplication of the normalized matrix R with the weight vector so that the largest value is obtained which is selected as the best alternative (Ai) as a solution.

$$V_i = \sum_{j=1}^n W_j R_{ij}$$

Information:

- V_i : Final verdict of alternative
- W_j : Predetermined weight
- R_{ij} : Matrix normalization

Greater V_i value identifies the best alternative to the SAW method.

RESULTS AND DISCUSSION

To determine the best foreman at PT. Universal Gloves, companies need to collect data by determining the weight criteria that must be met for the calculation. Initial data on the best foreman candidates are obtained from companies with predetermined criteria. Here is a table of criteria and assessment weights:

Table 1. Weights and scoring criteria

Criterion	Information	kind	weight
C1	Hygiene	Benefit	10%
C2	Initiative	Benefit	10%
C3	Cooperation	Benefit	10%

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C4	Responsibility	Benefit	10%
C5	Number of gloves produced	Benefit	20%
C6	Rework done	Cost	20%
C7	Number of absences	Cost	20%

Explanation of the criteria table:

1. Hygiene : Assessment of cleanliness and neatness at work
2. Initiative : The ability to decide and do the right thing without being told
3. Cooperation : Ability to communicate with the team in solving problems
4. Responsibility : Awareness of completing work or problems in the field
5. Number of gloves produced : Number of gloves completed in a one-month period
6. Rework done : Repetitive work due to customer complaints
7. Number of absences : Unexplained absences

Table 2. Foreman criteria value data

Nama	C1	C2	C3	C4	C5	C6	C7
Arif	Good	Excellent	Good	Pretty good	9800	50	20
Budi	Pretty good	Excellent	Good	Pretty good	8600	60	10
Candra	Not good	Pretty good	Pretty good	Good	8900	70	20
Damar	Good	Good	Good	Good	6900	80	10
Eko	Good	Good	Pretty good	Pretty good	7800	130	30
Faisal	Pretty good	Excellent	Excellent	Good	7700	120	10
Guntur	Good	Pretty good	Good	Pretty good	8700	140	30
Hadi	Good	Good	Pretty good	Good	9000	80	20
Irwan	Good	Pretty good	Good	Good	9600	60	10

Table 3. Normalization of criterion values

Nama	C1	C2	C3	C4	C5	C6	C7
Arif	1.0	1.0	1.0	1.0	1.0	0.833	0.5
Budi	0.8	1.0	1.0	1.0	0.8776	0.694	1.0
Candra	0.6	0.8	0.8	1.0	0.9082	0.595	0.5
Damar	1.0	0.8	1.0	1.0	0.7041	0.521	1.0
Eko	1.0	0.8	0.8	1.0	0.7959	0.321	0.333
Faisal	0.8	1.0	1.0	1.0	0.7857	0.347	1.0
Guntur	1.0	0.8	1.0	1.0	0.8878	0.298	0.333
Hadi	1.0	0.8	0.8	1.0	0.9184	0.521	0.5
Irwan	1.0	0.8	1.0	1.0	0.9796	0.694	1.0

Calculating the final grade (V_i) for each foreman using the formula SAW:

$$V_{Arif} = (0.1 \times 1.0) + (0.1 \times 1.0) + (0.1 \times 1.0) + (0.1 \times 1.0) + (0.2 \times 1.0) + (0.2 \times 0.833) + (0.2 \times 0.5)$$

$$V_{Arif} = 0.1 + 0.1 + 0.1 + 0.1 + 0.2 + 0.1666 + 0.1$$

$$V_{Arif} = 0.8666$$

$$V_{Budi} = (0.1 \times 0.8) + (0.1 \times 1.0) + (0.1 \times 1.0) + (0.1 \times 1.0) + (0.2 \times 0.8776) + (0.2 \times 0.694) + (0.2 \times 1.0)$$

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$$V_{\text{Budi}} = 0.08+0.1+0.1+0.1+0.17552+0.1388+0.2$$

$$V_{\text{Budi}} = 0.89432$$

$$V_{\text{Candra}} = (0.1 \times 0.6) + (0.1 \times 0.8) + (0.1 \times 0.8) + (0.1 \times 1.0) + (0.2 \times 0.9082) + (0.2 \times 0.595) + (0.2 \times 0.5)$$

$$V_{\text{Candra}} = 0.06+0.08+0.08+0.1+0.18164+0.119+0.1$$

$$V_{\text{Candra}} = 0.72064$$

$$V_{\text{Damar}} = (0.1 \times 1.0) + (0.1 \times 0.8) + (0.1 \times 1.0) + (0.1 \times 1.0) + (0.2 \times 0.7041) + (0.2 \times 0.521) + (0.2 \times 1.0)$$

$$V_{\text{Damar}} = 0.1+0.08+0.1+0.1+0.14082+0.1042+0.2V_{\text{Damar}} = 0.1 + 0.08 + 0.1 + 0.1 + 0.14082 +$$

$$V_{\text{Damar}} = 0.82502$$

$$V_{\text{Eko}} = (0.1 \times 1.0) + (0.1 \times 0.8) + (0.1 \times 0.8) + (0.1 \times 1.0) + (0.2 \times 0.7959) + (0.2 \times 0.321) + (0.2 \times 0.333)$$

$$V_{\text{Eko}} = 0.1+0.08+0.08+0.1+0.15918+0.0642+0.0666$$

$$V_{\text{Eko}} = 0.64998$$

$$V_{\text{Faisal}} = (0.1 \times 0.8) + (0.1 \times 1.0) + (0.1 \times 1.0) + (0.1 \times 1.0) + (0.2 \times 0.7857) + (0.2 \times 0.347) + (0.2 \times 1.0)$$

$$V_{\text{Faisal}} = 0.08+0.1+0.1+0.1+0.15714+0.0694+0.2$$

$$V_{\text{Faisal}} = 0.80654$$

$$V_{\text{Guntur}} = (0.1 \times 1.0) + (0.1 \times 0.8) + (0.1 \times 1.0) + (0.1 \times 1.0) + (0.2 \times 0.8878) + (0.2 \times 0.298) + (0.2 \times 0.333)$$

$$V_{\text{Guntur}} = 0.1+0.08+0.1+0.1+0.17756+0.0596+0.0666$$

$$V_{\text{Guntur}} = 0.68376$$

$$V_{\text{Hadi}} = (0.1 \times 1.0) + (0.1 \times 0.8) + (0.1 \times 0.8) + (0.1 \times 1.0) + (0.2 \times 0.9184) + (0.2 \times 0.521) + (0.2 \times 0.5)$$

$$V_{\text{Hadi}} = 0.1+0.08+0.08+0.1+0.18368+0.1042+0.1$$

$$V_{\text{Hadi}} = 0.74788$$

$$V_{\text{Irwan}} = (0.1 \times 1.0) + (0.1 \times 0.8) + (0.1 \times 1.0) + (0.1 \times 1.0) + (0.2 \times 0.9796) + (0.2 \times 0.694) + (0.2 \times 1.0)$$

$$V_{\text{Irwan}} = 0.1+0.08+0.1+0.1+0.19592+0.1388+0.2$$

$$V_{\text{Irwan}} = 0.81472$$

After the normalization process is complete, the final grade (V_i) For each foreman, it is calculated by summing the product from the normalized value and the weight of each criterion. This V_i value describes the overall performance of the foreman based on predetermined criteria, taking into account the relative weight of each criterion. The foreman with the highest V_i score is identified as the foreman with the best performance, because he is considered the most capable of meeting the existing assessment criteria. Here is a table of foreman ratings based on final grades (V_i) calculated using the SAW:

Table 4. Results of the final score calculation (V_i)

Name	Final Score (V_i)	Rank
Budi	0.89432	1
Arif	0.8666	2
Damar	0.82502	3
Irwan	0.81472	4
Faisal	0.80654	5
Hadi	0.74788	6
Candra	0.72064	7
Guntur	0.68376	8
Eko	0.64998	9

From the table, it can be seen that Budi obtained the highest final score of 0.89432. This puts him in the first place in the foreman's performance evaluation. With this excellent score, Budi was declared the best foreman at PT. Universal Gloves. Budi's achievements reflect his ability to meet and exceed the standards set by the company in various aspects of assessment, including customer satisfaction, production efficiency, and discipline. This table not only serves as a basis for decision-making in awarding but also as a tool that assists management in designing better performance development programs and improvement strategies in the future. By identifying the best foremen and understanding the factors that contribute to their success, PT. Universal Gloves can continuously improve the quality and efficiency of its operations in the rubber glove production industry.

CONCLUSION

From the results of this study, it can be concluded that the Simple Additive Weighting (SAW) method has proven to be effective in determining the best foreman at PT. Universal Gloves. The SAW method, with its approach based on weighted summation, successfully integrates various predetermined assessment criteria and weights, to provide accurate and objective evaluation results. This process allows companies to assess the foreman's performance thoroughly, taking into account important aspects such as customer satisfaction, production efficiency, and discipline. By using the SAW method, companies can obtain a transparent and measurable assessment of the performance of each foreman. The results obtained from this method provide a solid basis for determining which foreman deserves to receive the award, based on the agreed criteria and weight. This not only improves fairness in the evaluation process, but also motivates foremen to improve their performance better. The implementation of the SAW method in this study proves its ability as an effective tool in evaluating and determining the best foreman. It provides companies with the tools necessary to fairly appreciate employee achievement, as well as drive performance improvement and sustainable development in the future.

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