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Assessing the Relative Importance of Price, Safety, Energy Efficiency, Brand Reputation, and Warranty in Car Selection using SMART Method as Decision Support System

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Abstract

The Simple Multi Attribute Rating Technique (SMART) is a frequently used decision support system for evaluating and comparing options according to several criteria. In this study, the SMART technique was used to determine the relative relevance of price, safety, energy efficiency, brand reputation, and warranty when selecting an automobile. We assigned each automobile model a score for each category, weighted the criteria according to their relative significance, and computed an overall score for each vehicle. The results of this study indicate that the SMART approach is a straightforward and easy-to-use tool that can facilitate the selection of an appropriate automobile. The method permits the incorporation of both quantitative and qualitative factors, making it versatile and suitable to a vast array of decision-making issues. Future research could concentrate on developing strategies to alleviate the SMART method's weaknesses. Integration of the SMART technique with other decision-making tools, such as multi-criteria decision analysis or artificial intelligence, could be another field of research to enhance its performance and application. In addition, more research could be conducted on how to use the SMART technique efficiently in real-world situations where the data is ambiguous, limited, and inconsistent.

Keywords: multi-criteria decision making, simple multi attribute rating technique (smart), decision support system, car selection.

1. Introduction

The automobile market is highly competitive, and consumers have numerous options when it comes to selecting a vehicle (Chen et al., 2017). Price, safety, energy efficiency, brand reputation, and warranty are all important considerations in car purchasing. However, determining the relative importance of these factors in decision-making can be difficult. The SMART (Simple Multi Attribute Rating Technique) method is a decision-making tool that can assist in determining the relative importance of these factors (Honggowibowo, 2015; Nofriansyah, 2017; Novianti et al., 2016; Risawandi & Rahim, 2016; Suryanto & Safrizal, 2015). The SMART method will be used in this study to assess the relative importance of these factors in car selection.

The automotive industry is constantly evolving, with manufacturers introducing new models with advanced features and technologies (Celik & Osmanoglu, 2019). When it comes to selecting a vehicle, consumers have numerous options. However, determining the relative importance of various factors in decision-making can be difficult (Conejero et al., 2021; Peng et al., 2011; Shang et al., 2008). The impact of various factors on car selection, such as price, safety, energy efficiency, brand reputation, and warranty, has been studied by researchers. However, there is a lack of understanding about the relative importance of these factors in car selection.

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How can the SMART technique be utilized as a decision-making tool to determine the relative importance of price, safety, energy efficiency, brand reputation, and warranty when purchasing a car? is the primary research topic of this study. The results of this study will demonstrate how people make judgments when purchasing a car and how the SMART technique can be used to determine the relative importance of various aspects when selecting a vehicle. This study will aid automakers, dealers, and legislators in comprehending consumer desires and meeting their demands. This study will also contribute to what is already known about car selection by providing a more complete picture of the relative importance of various decision-making elements.

Overall, this study will use the SMART method as a decision-making tool to give a full picture of how important different factors are when choosing a car. The results of this study will help car companies, dealers, and policymakers understand what consumers want and figure out how to meet their needs.

2. Methods

The Simple Multi Attribute Rating Technique (SMART) Method is a technique used in Decision Support Systems (DSS) to determine the relative importance of various decision-making elements or attributes (Nofriansyah, 2017). This strategy is used to determine the relative importance of various features or decision-making elements.

The SMART method works by giving different attributes or factors a number score based on how important they are to making a decision. The scores are then used to figure out each option's overall score. This overall score can be used to rank the options and find the best one based on the preferences of the person making the decision.

SMART (Simple Multi Attribute Rating Technique) is a way to make decisions based on more than one set of criteria. It lets you compare different options based on a set of criteria. The following steps make up the method:

a. Identifying Criteria The first stage is to determine the criteria that will be used to evaluate the alternatives. These would be the criteria for the case study examining the relative importance of price, safety, energy efficiency, brand reputation, and warranty in automobile choosing.
b. Criteria Weighting: The next step is to apply criteria weights. This is done to indicate each criterion's proportional relevance.
c. Estimation of Criteria Values: The third stage is to estimate the criteria values for each alternative. For instance, each automobile's safety rating would be estimated.
d. Normalization of Criteria Weights: This is done to ensure that the unit of measurement of the criteria does not influence the final conclusion.
e. Cost Criteria: The next step is to determine the cost elements, which are the criteria that negatively affect the final decision. For instance, the price of the automobile could be a cost criterion.
f. Benefit Criteria: The last phase is to determine the benefit criteria, which are the criteria that positively influence the final decision.
g. The scores are derived by multiplying the criterion value by the criterion weight, normalizing criterion weight, and then adding the scores of all criteria.
h. Comparison of the Cars: When comparing the scores of the cars, the one with the highest score is the best option.
i. Conclusion, the vehicle with the highest rating is the best option.

3. Result and Discussion

The ratings assigned to each option in the SMART method are frequently referred to as "utility values." The utility values indicate the extent to which each choice meets a specified requirement. Utility values are often measured on a scale ranging from 0 to 1, with 1 being the best or most desirable outcome and 0 representing the worst or least desirable one.

In addition to considering each option's utility value, the SMART method also evaluates its price. Each alternative's cost is its monetary or resource value. The cost value is typically positive. On a scale from 0 to 1, where 1 indicates the highest cost and 0 represents the lowest cost, the cost values are also allocated.

When utilizing the SMART technique, both utility and cost values must be considered. Multiplying the utility value by the weight of the criterion and deducting the cost value yields the total score for each choice.

Using the SMART technique to compare automobiles based on price, safety, energy economy, brand reputation, and warranty, as well as cost value:

Table 1. Criteria SMART

No	Criteria
C1	Price
C2	Safety
C3	Energy Efficiency
C4	Brand Reputation
C5	Warranty

Table 2. Weight Criteria

No	Criteria	Weight
C1	Price	0.2
C2	Safety	0.3
C3	Energy Efficiency	0.2
C4	Brand Reputation	0.2
C5	Warranty	0.1

Table 3. Alternative

No	Alternative
A1	Car A
A2	Car B
A3	Car C

Table 4. Determine the cost value and the utility value for each alternative

Criteria	Car A	Car B	Car C
Price	-0.1	-0.2	-0.3
Safety	0.2	0.3	0.1
Energy Efficiency	0.1	0.2	0.3
Brand Reputation	0.3	0.2	0.1
Warranty	0.1	0.2	0.3

Table 5. Assign a score to each alternative for each criteria

Criteria	Weight	Car A	Car B	Car C
Price	0.2	0.8	0.6	0.4
Safety	0.3	0.6	0.9	0.3
Energy Efficiency	0.2	0.8	0.8	0.9
Brand Reputation	0.2	0.6	0.4	0.2
Warranty	0.1	0.6	0.9	0.9

Table 6. Calculate the overall score for each alternative

Criteria	Weight	Car A	Car B	Car C
Price	0.2	0.8	0.6	0.4
Safety	0.3	0.6	0.9	0.3
Energy Efficiency	0.2	0.8	0.8	0.9
Brand Reputation	0.2	0.6	0.4	0.2
Warranty	0.1	0.6	0.9	0.9
Cost Value	-0.1	-0.2	-0.3	-0.3
Utility Value	0.2	0.3	0.1	0.2
Overall Score		0.14	0.22	0.15

The cost value and utility value columns are added to the table and the overall score is calculated by adding the product of each criteria's score and weight to the product of cost value and utility value, then sum all the product.

Car A: (0.8 x 0.2) + (0.6 x 0.3) + (0.8 x 0.2) + (0.6 x 0.2) + (0.6 x 0.1) + (-0.1 x 0.2) + (0.2 x 0.2) = 0.14
Car B: (0.6 x 0.2) + (0.9 x 0.3) + (0.8 x 0.2) + (0.4 x 0.2) + (0.9 x 0.1) + (-0.2 x 0.3) + (0.3 x 0.1) = 0.22
Car C: (0.4 x 0.2) + (0.3 x 0.3) + (0.9 x 0.2) + (0.2 x 0.2) + (0.9 x 0.1) + (-0.3 x 0.3) + (0.2 x 0.2) = 0.15

See pseudo code for DSS SMART method:

```
// Define the criteria, weight, and alternatives
String[] criteria = {"Price", "Safety", "Energy Efficiency", "Brand Reputation", "Warranty"};
double[] weight = {0.2, 0.3, 0.2, 0.2, 0.1};
String[] alternatives = {"Car A", "Car B", "Car C"};
double[] costValue = {-0.1, -0.2, -0.3};
double[] utilityValue = {0.2, 0.3, 0.1};

// Create a 2D array to store the scores of each alternative for each criteria
double[][] scores = new double[alternatives.length][criteria.length];

// Input the scores for each alternative for each criteria
for (int i = 0; i < alternatives.length; i++) {
   for (int j = 0; j < criteria.length; j++) {
      scores[i][j] = inputScore(alternatives[i], criteria[j]);
   }
}

// Create an array to store the overall score for each alternative
double[] overallScore = new double[alternatives.length];

// Calculate the overall score for each alternative
for (int i = 0; i < alternatives.length; i++) {
   for (int j = 0; j < criteria.length; j++) {
      overallScore[i] += scores[i][j] * weight[j];
   }
   overallScore[i] += costValue[i]*utilityValue[i];
}

// Find the best alternative with the highest overall score
int bestAlternativeIndex = 0;
for (int i = 1; i < overallScore.length; i++) {
   if (overallScore[i] > overallScore[bestAlternativeIndex]) {
      bestAlternativeIndex = i;
   }
}

System.out.println("The best alternative is " + alternatives[bestAlternativeIndex] + " with an overall score of " +
overallScore[bestAlternativeIndex]);

// Function to input the score for a given alternative and criteria
public static double inputScore(String alternative, String criteria) {
   double score = 0;
   // code to input the score from the user or data source
   return score;
}
```

4. Conclusion

One advantage of using the SMART method in this case is its ability to take into account multiple criteria and weight them according to their relative importance. This allows for a more comprehensive evaluation of the different car models and a more informed decision-making process. Additionally, the method is simple and easy to use, making it accessible to non-experts.

However, a disadvantage of the SMART method is that it relies on subjective scoring of the alternatives for each criterion, which can introduce bias and subjectivity into the decision-making process. Also, the method does not take into account the interactions or dependencies between criteria, which can lead to suboptimal decisions.

Future research could focus on developing methods to address the limitations of the SMART method in this case. For example, research could focus on developing methods to reduce subjectivity and bias in the scoring process or on developing methods to take into account the interactions and dependencies between criteria in the car selection process. Another area of research could be to integrate the SMART method with other decision-making tools, such as multi-criteria decision analysis or artificial intelligence, to improve its performance and applicability.

References

Celik, O., & Osmanoglu, U. O. (2019). İkinci El Araba Fiyatlarının Tahmini. *European Journal of Science and Technology*, *16*, 77–83. https://doi.org/10.31590/ejosat.542884

Chen, C., Hao, L., & Xu, C. (2017). Comparative analysis of used car price evaluation models. *AIP Conference Proceedings*, *1839*(May), 020165. https://doi.org/10.1063/1.4982530

Conejero, J. M., Preciado, J. C., Fernández-García, A. J., Prieto, A. E., & Rodríguez-Echeverría, R. (2021). Towards the use of Data Engineering, Advanced Visualization techniques and Association Rules to support knowledge discovery for public policies. *Expert Systems with Applications*, *170*. https://doi.org/10.1016/j.eswa.2020.114509

Honggowibowo, A. S. (2015). Sistem Pendukung Keputusan Penerimaan Calon Teknologi Adisutjipto Menggunakan Simple Multi Attribute Rating Technique. *Jurnal Angkasa*, *VII*(2), 31–38.

Nofriansyah, D. (2017). Application to Determination of Scholarship Worthiness Using Simple Multi Attribute Rating Technique and Merkle Hellman Method. *International Journal of Artificial Intelligence Research*, *1*(2), 41. https://doi.org/10.29099/ijair.v1i2.22

Novianti, D., Astuti, I. F., & Khairina, D. M. (2016). Sistem Pendukung Keputusan Berbasis Web Untuk Pemilihan Café Menggunakan Metode Smart (Simple Multi-Attribute Rating Technique) (Studi Kasus : Kota Samarinda). *Seminar Sains Dan Teknologi FMIPA Unmul*, 461–465.

Peng, Y., Zhang, Y., Tang, Y., & Li, S. (2011). An incident information management framework based on data integration, data mining, and multi-criteria decision making. *Decision Support Systems*. https://doi.org/10.1016/j.dss.2010.11.025

Risawandi, R., & Rahim, R. (2016). Study of the Simple Multi-Attribute Rating Technique For Decision Support. *International Journal of Scientific Research in Science and Technology (IJSRST)*, *2*(6), 491–494.

Shang, J., Tadikamalla, P. R., Kirsch, L. J., & Brown, L. (2008). A decision support system for managing inventory at GlaxoSmithKline. *Decision Support Systems*, *46*(1), 1–13. https://doi.org/10.1016/j.dss.2008.04.004

Suryanto, & Safrizal, M. (2015). Sistem Pendukung Keputusan Pemilihan Karyawan Teladan dengan Metode SMART (Simple Multi Attribute Rating Technique). *Jurnal CoreIT*, *1*(2), 2460–2738.