


# Multi-Attribute Group Decision Making (MAGDM) Using Fuzzy Linguistic Modeling Integrated With the VIKOR Method for Car Purchasing Model

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## ABSTRACT

The change in the trend of transportation, increasing per capita income, expectation of better lifestyle, easy finance, and reduced cost of the automobile are some of the factors that enable a commoner to have his/her own car. Therefore, it is essential to comprise such features in cars that offer qualities enabling the ease of consumer decision-making and comfort to purchase a car individually. Purchasing a car is a complicated multi-criteria decision-making problem as an individual may have different preferences for different criteria attributes. The attributes may be conflicting in nature depending on the need of the individual customer. Generally, it becomes quite difficult to assign ratings to these attributes based on numeric values. Therefore, the decision-making process relies on an idiosyncratic finding of the decision-makers, which is in practice fuzzy with uncertainties. Hence, this article is a case study that deals with a hierarchy MCDM approach in accordance with the fuzzy logic and VIKOR method to solve a car purchasing problem.

## KEYWORDS

Car Selection, Decision-Making, Fuzzy Linguistic, Fuzzy-VIKOR, MAGDM, VIKOR

## INTRODUCTION

Due to huge diversity in purchase capability, car manufacturers (and similarly other product manufacturers) are launching different models to satisfy customer needs. Hence, it is essential to identify the need of the customer. As there are many automobiles manufacturing companies, the customers may have the option to get almost identical features with little variation in the cost. Such situations create ambiguity among the customers in model selection while purchasing a new car and a little variation in the decision will lead to a loss to them. While making a choice, customers will look for safety first. Resale value, fuel economy, maintenance, availability of spares, and service of the dealer are some of the other criteria which are taken into consideration. Most of the customers have a limited budget and even a marginal difference in cost will force them to change their choice. Hence for a manufacturer, it is necessary to give more features at a low cost (Byun, 2001; Islami et al., 2020).

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Raphel & Raphel (1996) figured out that maintaining old customers are much cheaper than developing new ones (almost 5 to 9 times cheaper). A firm can earn 25-85 % more if the loyalty of customers can be raised by just 5 %. Hence, it is important to maintain old customers instead of finding new ones. When a customer is delighted with your product or service, he/she tells others and this is how without spending on marketing manufacturers can increase market share. The same will continue with unsatisfied customers, too. Therefore, maintaining the quality of products and satisfactory service to an existing customer is very important in the current competitive market. Shende (2014) did a detailed study of customer behavior while purchasing a car and found that driving ease, quality-price ratio, and safety are priority measures of a customer; however, the noticed quality by a customer primarily relies on the name of the brand. It was further mentioned that the advertisements on television, web-search, and showroom visit are the leading sources of information from where a customer collects the data about the brand and model of a car. Consideration is always given to such sources of information by marketing people so that the focus of anticipating future consumers can be caught. Yavaş et al. (2014) studied the multi-criteria approach for automobile selection in Turkey and gave a broad view of the factors that influence the car selected by customers and found that due to the unique taxation system in Turkey, customers see the engine volume as important criteria followed by interior design, safety, and fuel type. In this cut-throat competition, the manufacturer needs to satisfy the changing needs of customers. Manufacturers and researchers are collaboratively working for finding innovative ways to attract more customers by providing new attributes, developing innovative manufacturing practices (to reduce cost), lucrative offers, better after-sale services, etc. Shahrودي & Rouydel (2012) studied decision-making in the supply chain for the Iran automobile sector and found that the ANP-TOPSIS methodology used in the supply chain has better results. The mixed ANP-TOPSIS method helps to develop a long-term relationship, consistency in quality, and lower production costs.

Saaty (2008) gave an idea about how is the Analytical Hierarchy Process (AHP) method useful for various sectors including defense, administration, Information technology, and automobile. The application of AHP was explained by giving an example that how Ford Motor Company utilized the AHP technique in deciding significance norms that improved consumer gratification. In another example, IBM used the AHP method in designing mid-range AS-400 computers. These examples conclude that innovative decision-making methods are very helpful to reduce failures of new development projects. Barczak et al. (2009) studied new development projects and found that the rate of success of new development projects remains unchanged from 1990 to 2004 (around 59 %) and because of professionalization of decision making, the same rate was increased up to 69 % during 2005 to 2009. The team reported that the best-performing firms use many conventional practices and methods in research but did not elucidate the positivity of the relationship. Some results of this study say that even the top operating enterprises had a level of error as low as 25%. New development projects may not go as per planning hence what to do in all such uncertainties, is also important. Montealegre & Keil (2000) found that the identification of the deviation of the project from its planning should be done as early as possible. Early detection will lead to saving a considerable amount of money, time, and raw material, and delivery of the product will be possible as per schedule. The deviation can be detected using project management and decision-making tools. In one of the leading automotive manufacturing companies, the study was done for project termination. Russo et al. (2008) studied why and how 'information filters' upset the policy-makers and created a "decision trap" that headed the group to the project discontinuation. The reason behind such instances was shifting the burden forward continually but inadvertently by managers for little-span solutions. Such action led to a delay in the overall project while increasing the cost and time for product delivery. Decision-making is not that one has taken the decision and the same will not be changed in any circumstances throughout the completion of the project but it is all about making calculated changes as the project proceeds ahead. Marmier et al. (2013) studied risks in the new development projects and found that to increase the success rate the decision-makers have to persistently alter their responses to risks. The effect of

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