

DEVELOPMENT IN MULTI-CRITERIA DECISION ANALYSIS RESEARCH

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Abstract – Multi-criteria decision analysis (MCDA) is used to solve complex and even contradictory problems by ranking them according to various quantitative and qualitative criteria. MCDA originated several decades ago but has become particularly popular in recent years and now includes more than 200 methods and combinations thereof. Initial MCDA applications were based on modeling preferences and appropriate decision-making based on several criteria, but over the years, development has moved from theoretical frameworks to widespread application and methodological growth. However, MCDA has also incorporated fuzzy sets, risk and uncertainty modelling and multi-criteria optimization, thereby expanding its applicability and scope. The research focuses on the development of MCDA over the last five years due to the rapid development of artificial intelligence and its tools. As a result, MCDA has evolved from a separate tool to a highly integrated system in its various stages:

- MCDA integration with artificial intelligence (AI) and machine learning (ML) as a filter for large data sets, deals with unstructured data, use real-time data for decision-making, helps to select the most appropriate criteria, learns from previous decision data to automatically archive weighting criteria, combines possible outcomes with possible actions in that case.
- MCDA calculation approach shifts from the most perfect result, which is often impossible, to a solution that is a reference to an existing good and realistic solution, also results can be as interval due to unclear approximate sets.
- Uncertainty in MCDA, as an opportunity for experts to express neutral or abstention assessments and for decision-makers to express dislike or uncertainty in their assessments, creates a broader mathematical space for defining opinions.
- Sensitivity analysis MCDA is also evolving, with new, more comprehensive sensitivity analysis methods that simultaneously consider multiple parameters and show the instability of such multiple criteria interactions, as well as the ability to show decision sensitivity in real time.

Keywords – *Artificial intelligence integration; benchmark; sensitivity analysis; uncertainty of expert opinions*



MCDA newest trends