Development of the RANCOM method towards a more accurate representation of decision-makers' preferences in multi-criteria problems

Research project objectives and hypotheses

The goal of the project is to enhance the Ranking Comparison (RANCOM) method used for subjectively determining criteria weights in multi-criteria decision problems. Currently, the method relies on a three-value dictionary approach, which may not fully capture the complexity of decision-makers' preferences. The project proposes introducing more flexible comparison models that better adapt to various decision-making contexts, such as the number of criteria, weight similarity, or the precision of input data. A key component will be the development of a mechanism that selects the appropriate relationship functions automatically, without hindering the method's usability. The proposed solutions will be tested through computer simulations and validated using real-world decision scenarios.

A key question driving this research is: How does the choice of the criteria relationship function affect the accuracy and robustness of the criteria weight estimation in various decision-making scenarios?

The main goals of the study are:

- Exploration of alternative criteria relationship functions for the subjective representation of decision-makers' preferences
- Analysis of the impact of the relationship function on the accuracy of determining the significance of criteria
- Identification of classes of decision-making problems with proposed applications of relationship functions
- Empirical validation of proposed approaches for determining criteria relevance combined with the RANCOM method in multi-criteria problems

Main hypothesis: The integration of the RANCOM method with selected criteria relationship functions will enable a more accurate derivation of criteria weights, better reflecting decision-makers' subjective preferences depending on the specific decision context.

Expected impact of the proposed project

The proposed project aims to develop the RANCOM method for determining subjective criteria weights in multi-criteria analysis by introducing more flexible and precise ways of capturing decision-makers' preferences. The currently used three-value dictionary will be expanded with adaptive relationship functions that adjust to the number of criteria, similarity of weights, and the level of detail provided by the user. This will enable a more accurate reflection of individual preferences, regardless of the type of decision problem being addressed.

The project is expected to improve the accuracy and practical utility of decision support methods across various fields, from strategic planning and sustainability assessment to public health and social policy. The developed solution will be both robust against judgment errors and easy to use, making it suitable for both experts and non-specialists. The project supports the advancement of modern, context-aware decision tools, enhancing the role and impact of decision-makers' preferences in the decision-making process.