The research proposed in this project aims at developing and characterizing innovative methods of decision support enriching the theory and methodology of operational research and management science. The decision problems being considered concern a set of alternatives (also called objects, actions, solutions, candidates,…), each described by a set of attributes (also called, features, criteria, variables, outcomes,…), in view of choosing the best alternative, or classifying them to pre-defined decision classes, or ranking them from the best to the worst. Because of the vector characteristics of alternatives, these problems are called multi-dimensional or multi-attribute. The multiple dimensions (attributes) may come either from multiple decision-makers (voters), from multiple evaluation criteria, or from various states of the world implying different outcomes (gains or losses). The above three sources of multiple dimensions gave birth to three big subdisciplines of decision science in the mid-20th century: social choice theory, multiple-criteria decision analysis, and decision under risk and uncertainty, respectively. The decision problems considered in these three fields have one thing in common – the only objective information that stems from the problem statements is the dominance relation in the set of alternatives. Since the dominance relation is a partial order, it leaves, in general, many alternatives incomparable which prevents working out a recommendation in terms of the best choice, classification, or ranking. To enrich the dominance relation and make the alternatives more comparable, one needs additional information about the value system of the user (one or multiple decision-makers) – this information, called preference information, is necessary to construct a preference model that aggregates the multiple attributes and induces a preference relation in the set of alternatives. Then, after exploiting this relation in a special way one gets a required type of recommendation. Our project is focused on preference modeling in the above-mentioned decision problems. The notion of preference is relevant across a variety of scientific disciplines, including economics and social sciences, operational research and decision sciences, artificial intelligence, psychology, and philosophy. Preferences provide a means for specifying desires in a declarative and intelligible way, a key element for the effective representation of knowledge and reasoning respecting the value systems of decision-makers. Specifically, we plan to develop interactive methods of explanatory preference modeling where decision-makers are in the loop of interaction. Explanatory decision support based on interpretable models constitutes today the greatest challenge for operational research and artificial intelligence. This challenge is called "explainable analytics of preference data". We take up this challenge by proposing methods involving decision models composed of logical statements called decision rules. They are induced from preference information elicited by decision-makers and structured using the dominance-based rough set approach. The decision rules whose general syntax is "*if a conjunction of elementary conditions on selected attributes is true, then suggested decision is…*" are easily interpretable, and give a clear image of preferences. They identify values that drive users' decisions – each rule is a scenario of a causal relationship between evaluations on a subset of attributes and a comprehensive judgment. Moreover, they are non-compensatory aggregation operators, able to represent the most complex interactions between attributes. New methods of decision support based on explanatory analytics of preference data understood in this way will respond to social demand for recommender systems that inspire trust through understandable communication with the user. We will use the rule preference model in interactive multiobjective optimization, not only in the objective space but also in the space of decision variables, which should improve convergence. Different types of preference information will be considered, like classification of reference alternatives or pairwise comparisons of these alternatives. Reference alternatives will be actively selected to best enrich the preference model. The optimization engine will be an evolutionary algorithm. Various variants of preference-driven interactive methods for searching the most compromise alternative combined with parallel identification of the most preferred part of the Pareto-front will be proposed and tested. Apart from multiobjective optimization, the rule preference model will be used for (i) building non-compensatory composite indicators, (ii) interpretation of black-box decision models obtained using neural nets or utility-driven methods, and (iii) consensus reaching in group decision-making. Rule induction techniques involving fuzzy-rough hybridization of granular approximations, and hierarchical construction of meta-rules will also be developed and characterized. The interdisciplinary nature of the developed methodology is reflected in all project tasks. The planned research will create and strengthen relationships between multiple criteria decision analysis, group decisions and negotiations, decisions under risk and uncertainty, multiobjective optimization, artificial intelligence, and machine learning. It will creatively and significantly enrich operational research and management science, showing the effect of positive synergy of the latest trends in mathematical modeling of decision problems, optimization, and preference data analytics. Although the research will have a fundamental character, the developed methodology will concern the type of decision problems encountered in practice.