

Did anyone go to the TV store and get dizzy when he/she saw the huge number of possible models differing in size, shape, or list of parameters? Probably it happened more than once. Everyone would like to buy the best TV for himself. How to choose it? How to do it? How to compare all these models together? Of course, you can try to look at every single device once and then decide what to choose. However, it turns out that this approach does not work in practice. By looking at the latest model, we have to compare it (usually in mind) with all the previously considered models at one time. It is challenging and impractical. It is much easier for a man to examine at most two things - two alternatives - at one time. This observation underlies the pairwise comparisons method. In this approach, each of the two alternatives is compared to each other, and at the end of the process, the best alternative is determined. The above principle underlies many methods, including the electoral system proposed by the 13th-century philosopher, mathematician, Blessed Ramon Llull, an electoral system proposed in the 18th century by the Marquis de Condorcet, a way of social values evaluation suggested in the first half of the XX century by Louis Thurstone. The pairwise comparisons method is also used in contemporary decision-making methods such as the Analytic Hierarchy Process (AHP) as well as Electre or Promethee. One of the most interesting examples of the use of pairwise comparisons is the process of parametric evaluation of scientific units conducted in 2014 by the Polish Ministry of Science and Higher Education.

In spite of the elaborate mathematical methods using for synthesizing the ranking from the set of paired comparisons, the obtained result is not always satisfactory. It may happen that the expert made the comparisons carelessly or he/she was in a hurry. Perhaps the one who was responsible for making the comparisons was not entirely sure of his/her decision and so on. Can we make a decision based on that information and if so then? Can these situations be detected to avoid making a wrong decision (based on bad quality, unreliable data)?

The questions like these have given rise to the research on the quality of decision data used in the pairwise comparisons method. The current ways of measuring the decisions data quality boil down to computing and analyzing the inconsistency indexes. Numerous scientific publications show, however, that these methods are far from being ideal. There are numerous cases in which these methods fail and may lead to wrong decisions.

The purpose of the project is to propose new ways of describing the quality of decision data supporting the theory of quantitative and qualitative pairwise comparisons techniques. The newly proposed methods will allow the decision maker to assess the quality of data from different perspectives: quantitative, qualitative, expert experience, etc. They should also address the problems identified in the literature as regards the use of inconsistency indexes. To conduct the proposed research, we will implement a computational library (written in Wolfram Language). It will help us carry out a series of numerical experiments during which we will examine the properties of existing and newly proposed methods for determining the quality of decision data. All the results of our work will be summarized on a dedicated website devoted to the pairwise comparisons method.