

# **A Consensual Coherent Priority Vector of Pairwise Comparison Matrices in Group Decision-Making**

David Bartl<sup>1</sup>, Jaroslav Ramík<sup>2</sup>

**Abstract.** The Analytic Hierarchy Process (AHP) is a method proposed to solve complex multi-criteria decision-making problems. Pairwise comparison methods are often used in AHP to derive the priorities of the successors of an element in the hierarchy. In this paper, we are concerned with group decision-making; that is, given  $n$  objects, such as criteria and/or variants, let  $m$  decision makers evaluate the  $n$  objects (pairwise) with respect to a criterion. The task is then to find a consensual priority vector of the  $m$  given  $n \times n$  reciprocal pairwise comparison matrices. Recalling several desirable properties of the priority vector – consistency, intensity, and coherence – we consider the weakest one of the three, i.e. coherence, in the rest of the paper. In other words, given  $m$  coherent priority vectors, each provided by a decision maker of the group, the purpose is to find a single consensual priority vector of the group. To cope with this task, we propose a grade to measure the consensuality of a priority vector. We thus obtain an optimization problem, whose solution yields an optimal consensual ranking of the  $n$  given objects.

**Keywords:** multi-criteria group decision-making, pairwise comparison matrices, consensual priority vector, coherence, Analytic Hierarchy Process (AHP)

---

<sup>1</sup> Silesian University in Opava, School of Business Administration in Karviná, Department of Informatics and Mathematics, Univerzitní náměstí 1934/3, 733 40 Karviná, Czechia, bartl@opf.slu.cz

<sup>2</sup> Silesian University in Opava, School of Business Administration in Karviná, Department of Informatics and Mathematics, Univerzitní náměstí 1934/3, 733 40 Karviná, Czechia, ramik@opf.slu.cz