

## **Three developments of the Analytic Hierarchy Process:**

### **Calibrated Fuzzy AHP, AHPSort and GAHPO**

Analytic Hierarchy Process (AHP) is a popular multi-criteria decision making technique. In this talk, I will present three further developments:

- a) Fuzzy AHP is a hybrid method that combines Fuzzy Set Theory and AHP. It has been developed to take into account uncertainty and imprecision in the evaluations. Fuzzy Set Theory requires the definition of a membership function. At present, there are no indications of how these membership functions can be constructed. In this paper, a way to calibrate the membership functions with comparisons given by the decision-maker on alternatives with known measures is proposed. This new technique is illustrated in a study measuring the most important factors in selecting a student current account.
- b) The analytic hierarchy process (AHP) is a useful and widespread method for solving choice and ranking problems. However, it is not adapted for sorting problems. Moreover, another practical limitation of AHP is that a high number of alternatives implies a large number of comparisons. This paper presents AHPSort, a new variant of AHP, used for the sorting of alternatives into predefined ordered categories. AHPSort requires far less comparisons than AHP, which facilitates decision making within large-scale problems. In this paper, a real case study for supplier selections used to illustrate our approach.
- c) The third development is the Group Analytic Hierarchy Process Ordering (GAHPO) method: a new multi-criteria decision aid (MCDA) method for ordering alternatives in a group decision. The problem is separated in two hierarchies for a cost and a benefit analysis. From these two analyses, a partial ordinal ranking can be deduced, where three relations between alternatives exist: the preference, indifference, and incomparability. A complete cardinal ranking can also be deduced by dividing the score of the benefit analysis by the score of the cost analysis. GAHPO has been developed to solve a real case: a selection of new production facilities with multiple stakeholders.