# BOOK REVIEW: ALESSIO ISHIZAKA AND PHILIPPE NEMERY'S MULTI-CRITERIA DECISION ANALYSIS

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In August 2013 the British office of John Wiley & Sons published Alessio Ishizaka and Philippe Nemery's "Multi-Criteria Decision Analysis: Methods and Software". This book has many similarities to "Multi-Criteria Decision Analysis: State of the Art Surveys" edited by Jose Figueira, Salvatore Greco and Matthias Ehrgott and published in 2005 by Springer. The main similarity is that it discusses concepts and procedures for several multi-criteria decision analysis (MCDA) methods, such as the Analytic Hierarchy Process (AHP), *Elimination Et Choix Traduisant la Realité* (ELECTRE), and the Multi-Attribute Utility Theory (MAUT), to name a few. The greatest difference between these two works lies in the method of authorship. Alessio Ishizaka and Philippe Nemery wrote their whole book (with the exception of the DEA chapter which was written by Jean-Marc Huguenin). Jose Figueira, Salvatore Greco and Mathias Ehrgott simply edited contributions from several coauthors. For example, Jose Figueira, Vincent Mossou and Bernard Roy wrote the chapter on ELECTRE methods, while the chapter on AHP was written by Thomas Saaty. This main difference results in two consequences which are a lack of uniformity, and the fact that some content in the book is simply based on the individual authors' opinion.

The entirety of Ishizaka and Nemery's book hangs together with a uniform thread. From Chapter 2, on AHP, to Chapter 10, on Data Envelopment Analysis (DEA), the chapters have the same main sections: "Essential Concepts", "Software", and "In the Black Box". Therefore, after reading a chapter on one particular method the reader can anticipate what will be found in future chapters about other methods. This setup can be very useful for systematic readers. On the other hand perhaps this style of writing can be boring, or monotonous, for other kinds of readers.

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This uniformity extends to the book's division into the following four parts: Part I, Full Aggregation Approach; Part II, Outranking Approach; Part III, Goal, Aspiration or Reference-level Approach; and, Part IV, Integrated Systems. Part I contains Chapters 2 (AHP), 3 (Analytic Network Process), 4 (MAUT), and 5 (Measuring Attractiveness by a Categorical Based Evaluation Technique). Chapter 1 is the Introduction and does not belong to any part. This review is limited to Chapters 1 to 3, since they are focused on the AHP. Chapters 4, 5, 7 (ELECTRE) and 11 (Multi-method platform) also cite the AHP, but all refer to Chapter 2.

Ishizaka and Nemery's book is a milestone in AHP's literature. On July 2008, Jyrki Wallenius, then the president of International Society of MCDA, published (in INFORM's journal, Management Science) a bibliometric analysis on MCDA using the Institute for Scientific Information's database. That analysis found that the AHP was the MCDA method with the highest number of publications. The more than 400 papers published from 2000 to 2004 on AHP have many authors. Nevertheless, until now, the books on AHP referred to most often have the same main author, Thomas L. Saaty. Future bibliographical sections on AHP's works may now have a new book reference.

Papers usually present more updated information than books, since their publication process is supposed to be faster, and they are reviewed and edited in more detail. However, papers often have page or word limits, and are not able to completely repeat theoretical points since they only refer to original papers or books. Nevertheless, a book reference can repeat, or even rewrite the theory, without space limitations. This is another reason why Ishizaka and Nemery's book is an important addition to the AHP literature.

One shortcoming of the Ishizaka and Nemery's book as an AHP reference is the authors' opinions on MCDA generalizations because it is not clear whose opinions they are. For instance, one of the first lines from Section 2.2 introduces AHP as a "particularly useful method when the decision maker is unable to construct a utility function, otherwise MAUT is recommended". This statement is possibly the personal opinion of Alessio Ishizaka or Philippe Nemery, or perhaps both of them. However, it is written as a matter of fact. The statement induces MCDA users to use AHP only if they cannot "construct a utility function". This is a serious statement to consider because "the aim of the book is to make MCDA methods even more intelligible to novice users such as students" (page 2). If the statement sounds incorrect to AHP's practitioners, it is interesting to point out that even Jim Dyer, an AHP's criticizer, has already proposed the conjoint use of AHP and MAUT (Management Science, 1990).

The incorrect statement that AHP should be used only after MAUT proves inadequate is based on the premise that there is an adequate MCDA method for a type of decision problem. Conversely, some MCDA methods should not be applied to certain types of decision problems. "None of the methods are perfect nor can they be applied to all problems" (page 6). The book cites Bernard Roy's paper (Journal of Operations Operational Research Society, 1981), where four main types of decision problems are identified. They are Choice Problems (selection of one among the alternative solutions for the problem), Sorting Problems (alternatives are grouped in categories), Ranking Problems (alternative are ordered from "best to worst"), and Description Problems (description of alternatives and consequences). There are also problems from MCDA

theory, such as the Design Problem or the Elicitation Problem, but Ishizaka and Nemery's book focused only on those four.

In Ishizaka and Nemery's Table 1.2, AHP is listed as an MCDA method that is only useful for solving Choice Problems or Ranking Problems. "AHPSort" (Section 2.5.4), an extension of AHP, was proposed as a method for solving the Sorting Problems by Alessio Ishizaka, Craig Pearman and Philippe Nemery in an article published in the International Journal of Production Research, in 2012. AHPSort was proposed as "a new variation of AHP"; however, it is nothing more than an unusual way to apply AHP (clustering alternatives first). As a matter of fact, it was already done in AHP's original paper (page 273). Therefore AHPSort is simply a new name for an old thing. Nevertheless, AHP can be applied for all MCDA problems. Description Problems have been previously studied by AHP researchers, with the well-known Benefits-Opportunities-Costs-Risks (BOCR) model researched by Diederik Wijnmalen, William Wedley, Mujgan Ozdemir, Luis Vargas, and Thomas Saaty, himself, to name a few.

Ishizaka and Nemery's Table 1.4, "Required inputs for MCDA ranking or choice method", is also controversial. AHP was inserted in the middle of the "MCDA method" column. This table's rows were sorted by "Effort input" ranging from "Very HIGH" to "Very LOW". One inference from that table is that MAUT is the most difficult MCDA method used to solve a Choice Problem or a Ranking Problem, ANP is the second most difficult, followed by MACBETH, ELECTRE, PROMETHEE, GP, TOPSIS, and DEA in that order. This is simply a matter of opinion. Many people find that DEA applications are harder than AHP applications.

Chapter 2 presents AHP's essential concepts (Section 2.2) including problem structuring, priority calculation, consistency check, and sensitivity analysis. The concepts are presented along with an illustrative example named "Case Study 2.1". MakeItRational, an AHP's software package developed in Poland, is presented because of its "simplicity and the free trial version available". The black box of AHP (Section 2.4) includes an interesting subsection on judgment scales (Section 2.4.2). Finally, the Extensions of AHP are presented in the final section of Chapter 2(Section 2.5)

Chapter 3 starts by discussing the Analytic Network Process's essential concepts (Section 3.2) including inner dependency of alternatives and criteria, outer dependency, and influence matrix. Three illustrative examples (Case Studies 3.1, 3.2 and 3.3; the last two cases are almost the same, with a little variation in the modeling) are presented. Next, Super Decisions, an MCDA software package developed for teaching purposes and downloadable free of charge, is presented, and followed by another example (Case Study 3.4). The black box of Analytic Network Process (Section 3.4) includes concepts for Markov Chains and the Supermatrix. Curiously, this chapter is the one with the fewest bibliographical references which include two books, one on Markov Chains (J. Norris, Cambridge University Press) and another on the Analytic Network Process (Thomas Saaty, RWS).

Taking into account both Chapters 2 and 3, around a quarter of the book was dedicated to the AHP. This prioritization emphasizes the importance of AHP for the MCDA. The book has many merits, such as uniformity, essential conceptualization of different methods, and proper authorship. It does not present any novel concepts rather it will be

used as a reference to learn or review the essentials of AHP or other MCDA methods and software. If the reader is looking for innovation, then it would be better to search Journals or Proceedings about AHP, MCDA, or correlated areas like Operational Research or Management Science.

In summary, Ishizaka and Nemery's "Multi-Criteria Decision Analysis: Methods and Software" is a good reference book on AHP. It should be read and referred to with careful attention, as with any other book. In our opinion, it will be a milestone in the AHP's literature, and is a very interesting read presenting the authors' point of view on essential and practical concepts from the AHP.