

Chapter 12

Analytical Network Process in Decision Making

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ABSTRACT

Analytic Network Process (ANP) is a generalized form of the Analytical Hierarchical Process (AHP). AHP is an objective theory of deriving the decision makings on absolute scale values starting from subjective relative measurements perhaps on tangible or intangible or a mix of both rated by the experts. A consistency measure of the relative ratings is verified with a consistency ratio to assure the ratings of the experts are consistent. The clustering of criteria/sub-criteria with inner and outer dependencies as well as feedback is taken into account in ANP. In ANP rather than a hierarchical process, a network structure is assumed and all nodes in the network are treated equally with interaction between nodes and grouping into clusters. A super-matrix is constructed, then normalized it to get weighted super matrix and raised it to a sufficient power to converge this into a unique eigen vector representing the final weights in limit super-matrix. Step by step iterations of ANP was demonstrated with a selection of car example.

INTRODUCTION TO THE DECISION-MAKING PROCESS

Decision-making is a process of selecting a single alternative from a set of alternatives in a systematic and logical way. The basic underlying step-by-step process involved

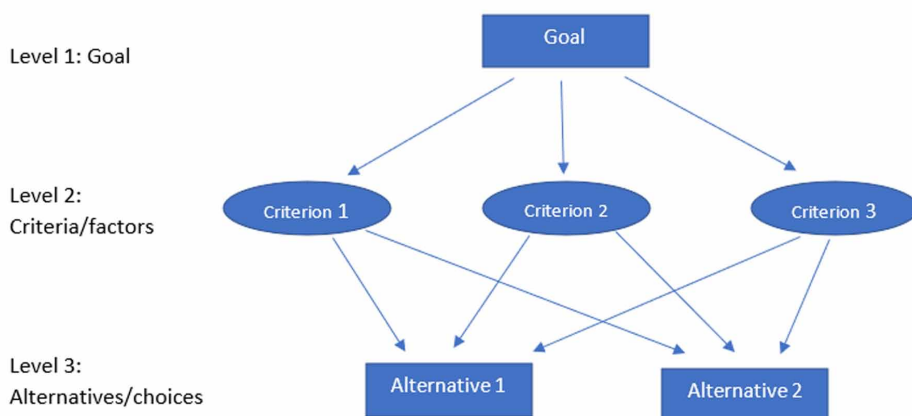
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in decision-making is called a decision-making process. The Decision-making process can also be defined as a reasoning process that identifies and chooses one alternative among many based on the values, preferences, and beliefs of the decision-maker (Simon, 1977)

Decision-making is a criterion-based or criteria-based process and many decision models have been accommodated. However, the generic decision-making process can be explained with the following block diagram.

Figure 1. Generic block diagram of the decision-making process



The block diagram given in Fig. 1 accepts the decision problem as an input and generates the best alternative as an output. However, in certain cases such as shortlisting of alternatives, instead of a single alternative (best alternative) a set of good suitable alternatives are generated.

Hierarchical Structure and Decision-Making Models

In general, people are poor at assimilating large quantities of information on problems and attempt to deal with cognitive overloading through the application of heuristics or meta-heuristics that simplifies the problem or reach a solution without getting into the details of the problem (use of meta-heuristic black-box models such as neural networks). Such a solution lacks analytical aspects and also leads to sub-optimal solutions.

As a remedial strategy and for a better understanding of a problem, the problem breaks down into smaller constituent parts and constructs a hierarchical model. Relevant and enough details are included at the different levels of the hierarchy and

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