

Multicriteria Models for Risk Decision Analysis

Many decision problems have more than one objective that need to be dealt with simultaneously. Risk is a context in which decision problems with multiple objectives have been on the increase in recent years. The importance of having a better structured decision process is essential for the success of any organization. Additionally, decisions on Risk matters may affect the strategic results of any organization, as well as, human life (e.g. safety) and the environment.

Risk influences society and organizations in many ways, since companies and governments must satisfy several expectations related to the everyday lifestyle inherent in modern society, such as safeguarding the safety of their employees, their customers and the community they are part of. Generally, the occurrence of accidents involves critical consequences that require an appropriate and efficient form of risk management, so this requires multidimensional risks to be evaluated in order to meet society's and regulatory bodies' expectations.

Furthermore, Reliability and Maintenance have become more important also, since such expectations are extended to the demands that services are constantly available and that products are of a consistently high quality. Therefore, companies strive to reduce costs and simultaneously improve their performance with regard to meeting their strategic objectives. Hence, these are affected by reliability and maintenance and include implications for risk.

As a result, MCDM/A (Multi-Criteria Decision Making/Aiding) approaches are becoming inevitable when modeling strategic problems that involve the Risk context. The MCDM/A approaches enable more consistent decision-making, taking into account the decision-maker's rationality (compensatory or non-compensatory), decision-maker's behavior regarding risk (prone, neutral or averse) and the uncertainties inherent in the multidimensional risk context.

The steps for building MCDM/A decision models involve identifying hazard scenarios, estimating the set of payoffs, eliciting the MAU function (Multi-attribute utility function), computing the probability function of consequences and estimating multidimensional risk. Loss functions are introduced in the models to calculate the probability distribution functions over the multiple criteria such as impact on humans, and environmental, financial losses, etc. Therefore, Decision Theory concepts are applied to estimate multidimensional risk.