Chapter X

The Nature Of Strategic-Decision-Making Models

Decision with Multiple Criteria and Multiple Scenarios

We will now study more complex problems considering:

Multiple criteria or goals:

- considering earnings or costs, delays, client satisfaction, etc, and

Multiple scenarios:

- where each scenario has a different risk level.

In the multiple goal function problems, there is no optimum solution fully satisfying all goals at the same time. The individual goal’s functions are, in general, conflicting and it is not possible to have an optimization method to solve...
the problem. There is usually a consensus solution satisfying minimal criteria of optimum values for each individual goal function. This consensus is based on the Pareto’s principle presented in chapter nine. The optimal decision making in problems with multiple goals will be analyzed at the end of this chapter (Goicoechea et al., 1982; Keeney & Raiffa, 1976; Dyson, 1990; Saaty, 1980, 1994; Bonabeau, 2003; Charan, 2001; Choo, 1998; Day et al., 1997).

In considering restrictions across several scenarios, the problem solution becomes more difficult due to the high number of possible combinations of goal functions and scenarios to be considered.

Using classical mathematical programming notation, the optimization problem with \( k \) goals and \( w \) scenarios could be formulated as follows:

\[
\text{Maximize (or Minimize)} \quad F(x) = (f_1(x), f_2(x), \ldots, f_k(x))
\]

With restrictions:

\[
\text{Scenario 1:} \quad g_{ij}(x) \leq 0, \quad (j=1,2,\ldots, m_j) \quad \text{and} \quad x \in \mathbb{R}^n; \\
\quad \ldots \\
\text{Scenario w:} \quad g_{wj}(x) \leq 0, \quad (j=1,2,\ldots, m_w) \quad \text{and} \quad x \in \mathbb{R}^n;
\]

An efficient algorithm for this kind of problem has not yet been presented, unless using some kind of heuristic techniques. It should be noted that the mathematical programming problem formulated above does not consider the event of uncertainty or risk, which, in this case, would involve stochastic or probabilistic mathematical programming.

Thus, the decision-making process is one of the methodologies indicated to resolve these problems, since it does not depend on complex mathematics involving scenario restrictions and multiple goals’ functions (Warfield, 1978, 1994).

**Example 10.1.**

A strategic decision with multiple goals and different scenarios (Presented in Chapter VIII, as Example 8.3. Illustration of a political model of decision.)
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