Design of An Optimal Scheduling Model for Effective Management of Multi-R&D Project Execution

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Abstract

Ever since the development of critical path methods in the 1950s, many different models have been proposed on resource-constrained multi-project scheduling to deal with production scheduling problems. The weakness of these models are that they are not suited for scheduling R&D(research and development) projects. This is partly due to their inadequacy to consider complexity and uncertainty that are inherent to R&D. However, multi-R&D project scheduling is still a crucial decision problem in many research organizations.

This research aims at developing a systematic way for solving resource-constrained multi-R&D project scheduling problems which have multiple objectives.

The major achievements in this study can be summarized as follows :

(1) Though many scheduling models provide optimal solutions, their major shortcomings are inability to incorporate multiple objectives into the model. In this research, multi-R&D project scheduling problems are considered as decision making problems involving multiple conflicting objectives at each key-milestones, where these objectives have to be achieved simultaneously. Linear goal programming is proposed as an excellent tool to deal with resource-constrained multi-objective scheduling problems. Moreover, the priority structure of objective function, which represents preemptive and/or nonpreemptive concept, makes multi-R&D project scheduling more effective.

(2) The three-stage hierarchical decomposition procedure was used to address multi-R&D project scheduling. In the first stage, for each of the jobs which have probabilistic nature in technical feasibility, one or more job alternatives are selected using "project tree" decision model. In the second stage, for each of the jobs which are deterministic in nature, exactly one job mode is selected. After the job modes are selected in the preceding two stages, we perform the scheduling of the entire multi-R&D projects. In each of these stages, we used resource-constrained multi-objective linear goal programming to select alternatives and to set up the projects scheduling.