Chapter 3

Critical Path Stability Region: A Single-Time Estimate Approach

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ABSTRACT

Models transform the managerial inputs into useful information for managerial decision. The Project Evaluation and Review Technique (PERT) is the most widely used model for project management. However, it requires three estimates for the duration of each activity as its input. This uncertainty in the input requirement makes the Critical Path (CP) unstable, causing major difficulties for the manager. A linear programming formulation of the project network is proposed in this chapter for determining a CP based on making one estimate for the duration of each activity. Upon finding the CP, Sensitivity Analysis (SA) of Data Perturbation (DP) is performed using the constraints of the dual problem. This largest DP set of uncertainties provides the manager with a tool to deal with the simultaneous, independent, or dependent changes of the input estimates that preserves the current CP. The application of DP results to enhance the traditional approach to PERT is presented. The proposed procedure is easy to understand, easy to implement, and provides useful information for the manager. A numerical example illustrates the process.

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1. INTRODUCTION

Project management is one of the fastest growing career fields in business education today. Most of the growth in this field is in the business sectors, where there are widespread reports about most projects being late, many over budget, and all too often do not satisfy design specifications. This paper is about business project management, although the principles apply to projects in any field. When proposing a new business system, the project manager will be confronted with many questions from top management, in particular “How much will it cost? And “When will it be done?” As many project managers know, these two questions are difficult to answer correctly.

A project involves getting a new, complex activity accomplished. Generally projects designed to accomplish something for the company undertaking them. Because projects involve new activities, they typically involve high levels of uncertainty and risk. It is very difficult to predict what problems are going to occur in business system development.

Projects are systems consisting of interrelated parts working together to accomplish project objectives. There are a number of important roles within business systems projects. Project managers have to balance technical understanding with the ability to motivate diverse groups of people (the project team) brought together on a temporary basis. Projects are collections of activities. If one activity is late, other activities are delayed. If an activity is ahead of schedule, workers tend to slow down to meet the original completion date. Business systems projects have many similarities to generic projects. They consist of activities, each with durations, predecessor relationships, and resource requirements. They involve high levels of uncertainty and often suffer from time and cost overruns, while rarely experiencing time and cost underruns. However, business systems projects are different from generic projects in some aspects. While each project is unique, there are usually numerous replications of business systems project types. Most are served by a standard methodology, with the need to identify user requirements, followed by design of a system, production of the system, testing of the system, training and implementation, and, ultimately, maintenance of the system. These steps are not always in serial; there are often many loops back to prior stages.

Defining project success in itself is difficult. There are many views of what makes a project successful. Successful implementation has been found to require mastery of the technical aspects of systems, along with understanding key organizational and behavioral dynamics. There has been a great deal of research into business systems project failure. Failure can occur when design objectives are not met. The difference between successful and failed business systems projects often lies in planning and implementation. A great deal of research has been performed to identify factors that lead to project success. These factors include planning, user involvement, and good communication. Additional factors that are reported as important in business systems project success repeatedly include top management support and clear statement of project objectives.

Business systems project management can involve a wide variety of tasks. Typical business systems project types include maintenance work, conversion projects, and new systems implementation. Maintenance projects are by far the most common type of business systems project. They can arise from need to fix errors or to add enhancements to some system, or to involve major enhancements. Conversion projects involve changing an existing system. New systems development involves different management characteristics by type of system.