

## CSC.09

## Total Project Cost Success Factors

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Today's managers typically use different project control systems and techniques (earned value and variance calculations) to measure the health of project performance and to ensure project success. However, project performance evaluation and analysis are mostly done in an ad-hoc manner (shotgun fashion). Even when post-project reviews are employed they are after the fact and the results are usually does not lead to full understanding of projects poor performance and how they could be avoided on future projects. Also needed is a systematic approach to capture the causes of project's poor performance in a timely manner. This will help us in establishing a set of action guidelines to provide cost management direction at all phases of a project, for a variety of projects types, using Pareto analysis of completed project cost control data. These action guidelines can be called critical project success factors (CPSF).

## INTRODUCTION

Today's managers are responsible for their projects overall success, which includes meeting project performance goals (cost, schedule, quality, and safety) to satisfy the client's expectations and generate repeated contracts. To help achieve these goals, they commonly use standard project control techniques and systems (earned value and variance calculations) to compare actual to estimates values to measure their project's health. When actual performance differs from what is expected, a target based on predetermined thresholds, managers need to be alerted to take timely corrective actions in order to stay the course and ensure their projects success.

Currently, evaluation and analysis of project performance are mostly done in an ad-hoc manner (shotgun fashion) without a full understanding of the causes of poor performance and how these could be avoided on future projects. This is mainly due to the ways current projects performance data are captured and presented to the project managers. While mostly presented in a useable format, it still requires a great deal of manipulation and translation from the mangers to make sense of the different data presented. As a result, current and historical poor project performance causes are not readily visible in a usable format. In

addition, once project managers start a new project, they are always busy putting fires on daily basis and they seem to forget about fully using valid historical data (past experiences) on their current and future projects.

What is needed is a systematic approach to capture the causes of poor project performance. This will help us in establishing a set of action guidelines to provide cost management direction at all phases of a project for a variety of types of projects. These action guidelines can be called critical project success factors (CPSF).

This article introduces a methodology to allow cost engineers to derive total project cost success factors for projects of any type, subtype, or size, based upon a Pareto analysis. It suggests that in most cases, certain CPSFs are distributed in a way such that a vital few CPSFs make up the largest portion of the overall. In addition, the Pareto analysis will also provide a measure of the importance of each factor (by project type, subtype, and size).

## LITERATURE REVIEW

Researchers conducted numerous studies since the early 1970s to define and study projects success criteria. In 1982, Rockart first used the term *critical success factors* in the context of projects and management of projects. Parfitt [15] proposed key factors for success in building project delivery as a result of committee work by the Consortium for the Advancement of Building Sciences (CABS) at Pennsylvania State University. Sanvido [18] developed a model that he named the *integrated building process* for determining the factors (critical project success factors (CPSFs)) necessary for construction project success. Parfitt [15] presented a checklist that can be used by building professionals as a guideline in predicting the success of a project. The Chua [4] study was to distinguish CSF according to the project objectives of budget, schedule, and quality. Baccarini [1] introduced the logical framework method (LFM) for defining project success. It purposes that project success consists of two components, product success and project management success. Project management success focuses upon the project process, and in particular, the successful accomplishment of cost, time, and quality objectives. It also considers the manner in which the project

management process was conducted. Product success deals with the effects of the project's final product.

There were other studies conducted on specific aspects of construction projects. These included project partnering, [11]; the influence of management and labor on construction productivity, [12]; the success of the traditional building process, [14]; construction contracting methods, [7]; as well as contract disputes, [5]. There also was other work on project management success instead of success of the project as a whole by Might and Fisher [13] and Pinto and Slevin [16].

Previous researchers employed various methodologies ranging from unstructured interviews (respondents were asked to identify a list of factors that they thought were critical and then to indicate their subjective importance of these factors) [16] to structured interviews (respondents were given a list of factors and asked to assess the influence of these factors based on a scale determined by Chan and Kumaraswamy [3]). These methodologies are referred to as post-project postmortems reviews.

Post-projects reviews are often curtailed, sometimes fall into complete disuse and even when they are enthusiastically conducted, their outcomes are poorly disseminated [2]. Collecting data on already completed projects is challenging for the following reasons:

1. past project records typically are not in a useable format;
2. knowledgeable personnel are already assigned to other projects;

3. Not all data are collected on each project; and
4. interpretation errors.

In conclusion, researchers have determined the existence of set of critical project success factors. Also, it is known that certain factors are more critical to project success than others. They also uncovered new questions in the process of providing answers to previously asked questions. Sanvido [18] gives examples of issues not yet adequately resolved.

1. What CPSFs are valid for building construction? In previous research the focus was not building construction, and in fact building construction formed a minor of the projects studied.
2. Are the same or different factors important different types of buildings, e.g., hospitals versus office buildings?
3. In reports that included successful-unsuccessful project pair studies, the judgment whether the project was successful or unsuccessful was based on the views of the participant only. It seems unlikely that other project participants would necessarily have the same judgment of the project.
4. All of the previous studies based their hypothesized CPSFs on experiential and anecdotal evidence. Are there no theories available that could form the basis more rigorous approach to the CPSF problem?

Russell [17] also suggested the need for the development of predictive models at several phases of the project (e.g., 10 percent, 20 percent etc.).

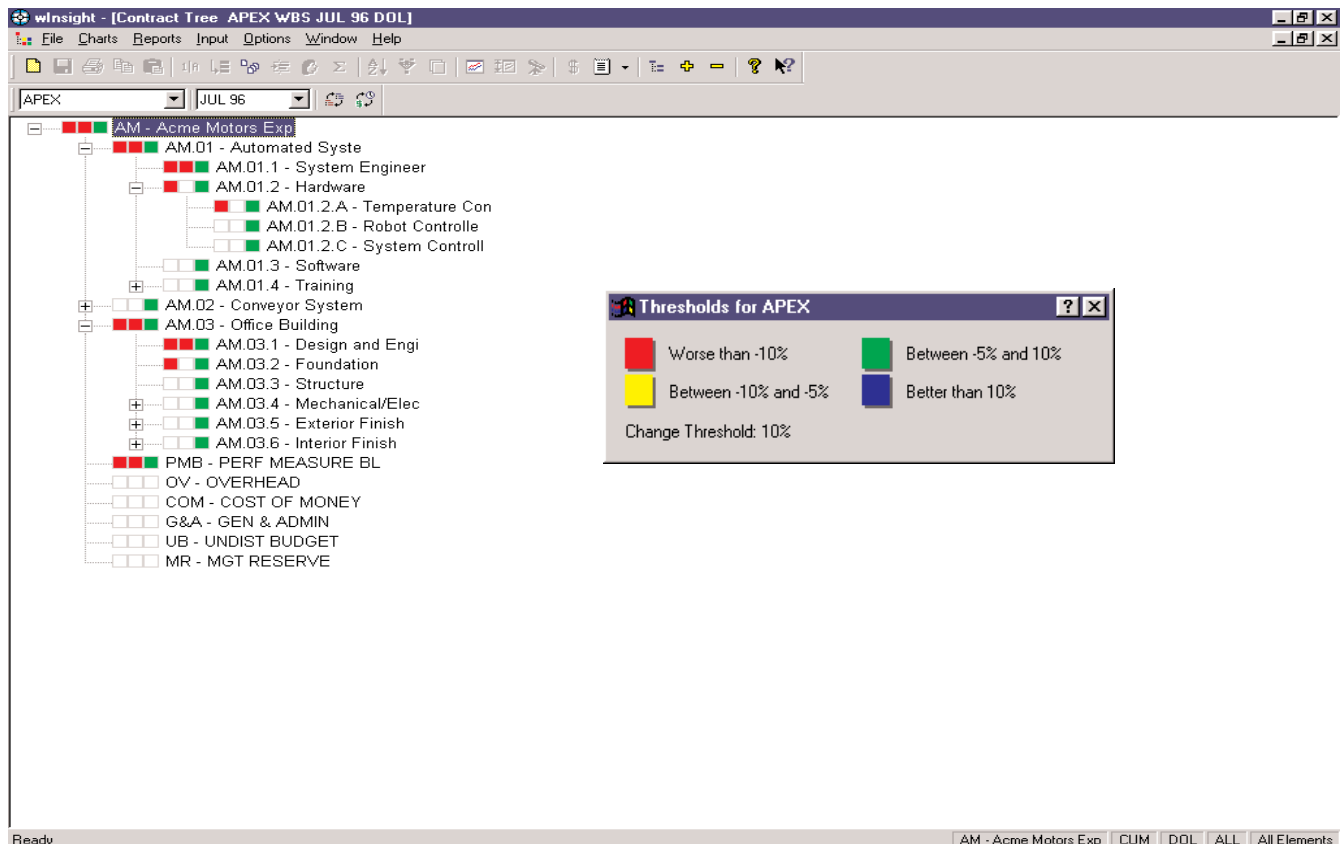


Figure 1—Work Breakdown Structure and Thresholds Definitions

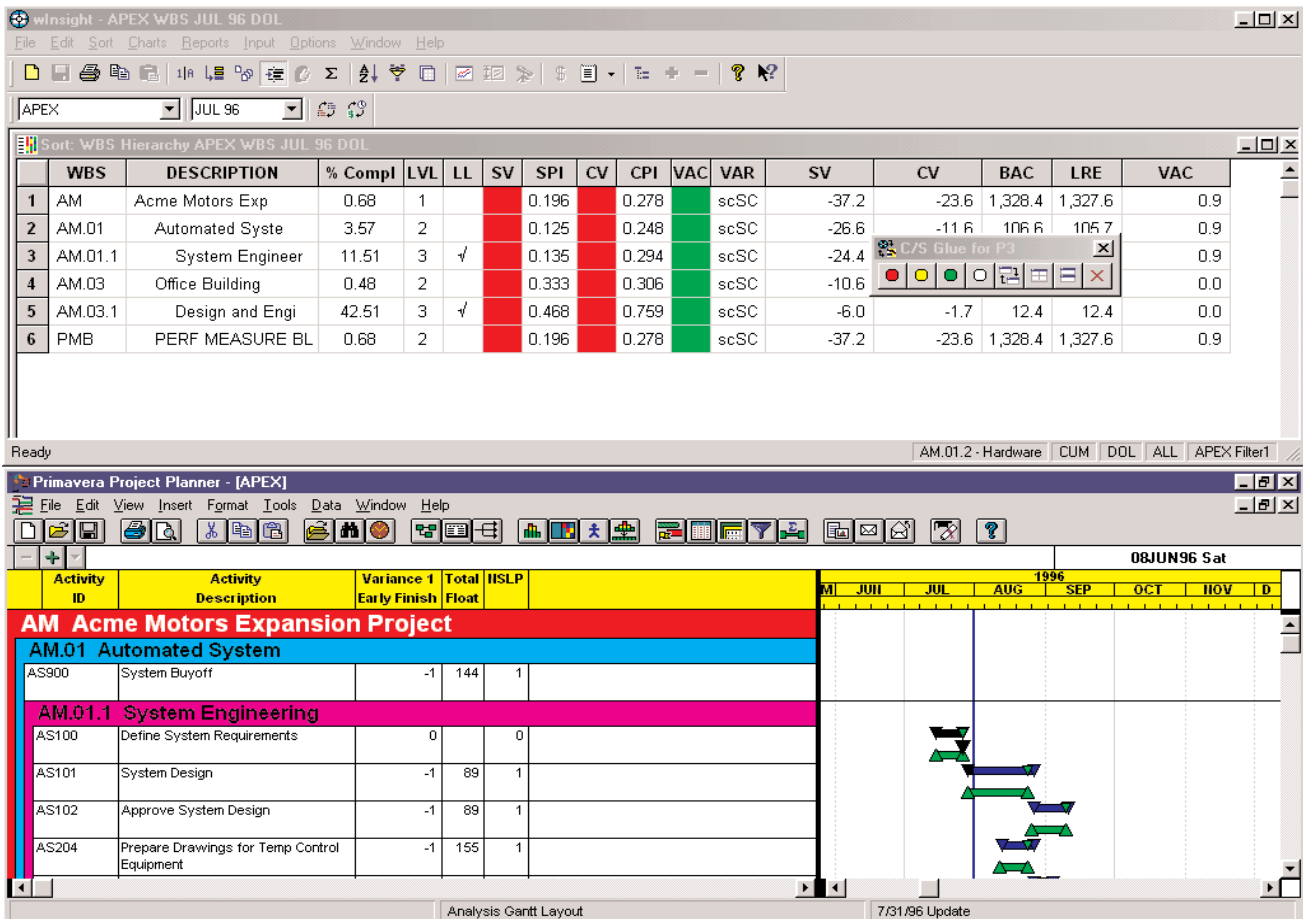


Figure 2—Work Packages Performance Analysis

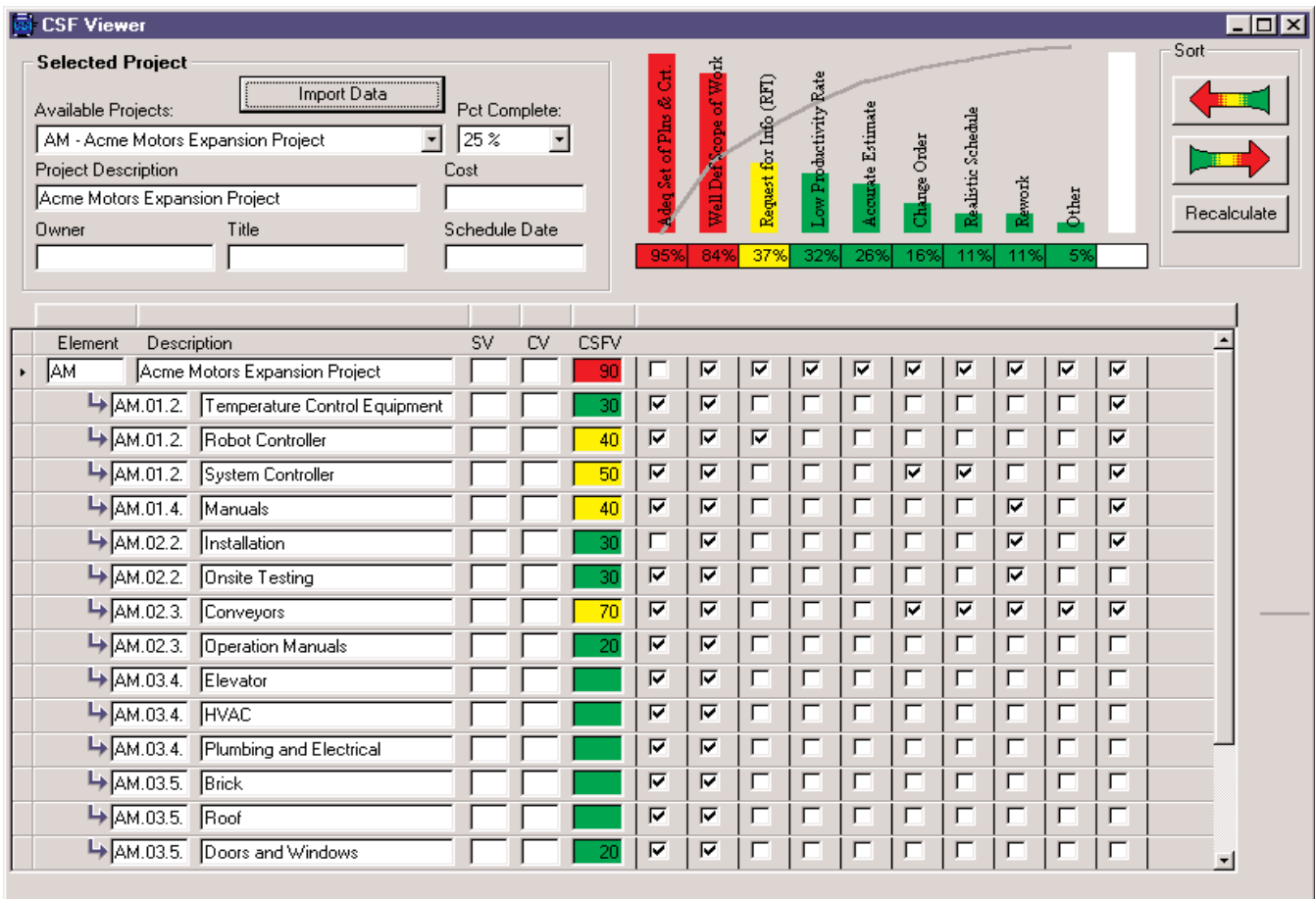


Figure 3—Work Packages Performance Causes Collection

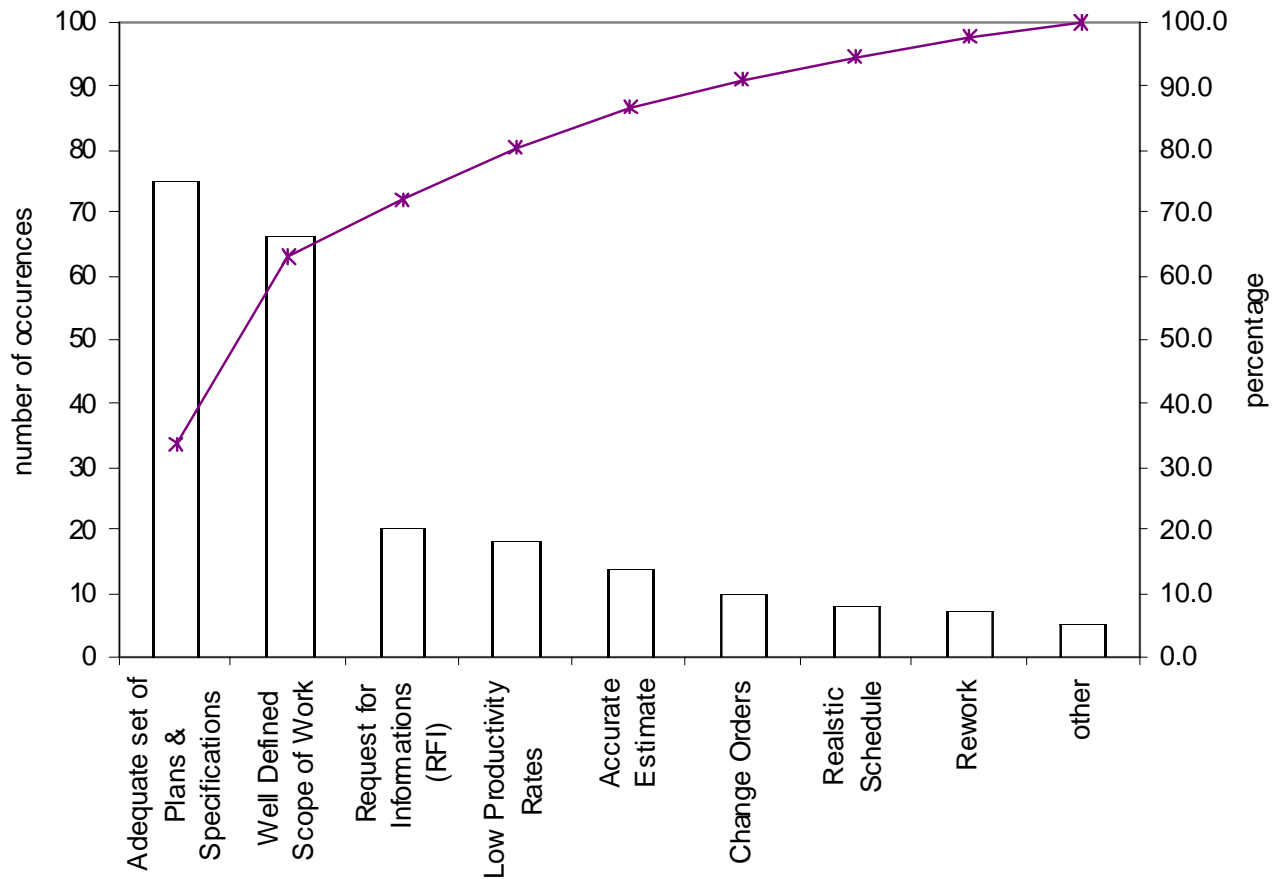


Figure 4—Pareto Analysis for a Project at 25 Percent Project Completion

Our methodology addresses some of these questions by defining project success at the project work packages levels (WPS), introduces a systematic approach for defining project success criteria, and a process to monitor CSF along the different project phases (25, 50, 75, and 100 percent project complete) to establish historical data for use on future projects using Pareto Principles.

## METHODOLOGY

### Planning

Methodology begins at the planning phase where prior to project starting, a project work plan should be developed. The project work plan includes establishing a standard work breakdown structure (WBS) to identify project work packages and level of details required to manage the project; a baseline schedule with the appropriate cost associated with each activity is identified; the baseline schedule is then cost loaded. This will provide us with the expected performance standard target that actual project progress will be measured against.

### Data Collection

Once the project is under way, periodical actual data is collected from the field and the project schedule (activities) is updated. The methodology demand that when the project is 25 percent complete, a comparison is made between

actual and estimated cost performance at the work package level using earned value techniques. If the work package cost deviates from the predefined thresholds (not meeting expected performance) the work package is flagged.

Next, all work packages that are flagged are filtered and brought to the attention of the cost engineer who is asked to identify causes of the poor performance. The methodology also calls for the causes of poor performance to captured at 50, 75, and 100 percent project complete. This approach provides us with more timely, accurate, and consistent data.

Sanvido [18] believes that “no single list will ever be totally comprehensive when it comes to a definition of success for a project. Therefore, for the purpose of illustration the following CPSFs are used:

1. an adequate set of plans and specifications;
2. a well-defined scope of work;
3. request for Information (RFI);
4. low productivity rates;
5. accurate estimate;
6. change orders;
7. realistic schedule;
8. rework; and
9. others.

The above list of CPSFs was selected from previously published related literature. It's unprioritized and is by no means inclusive.

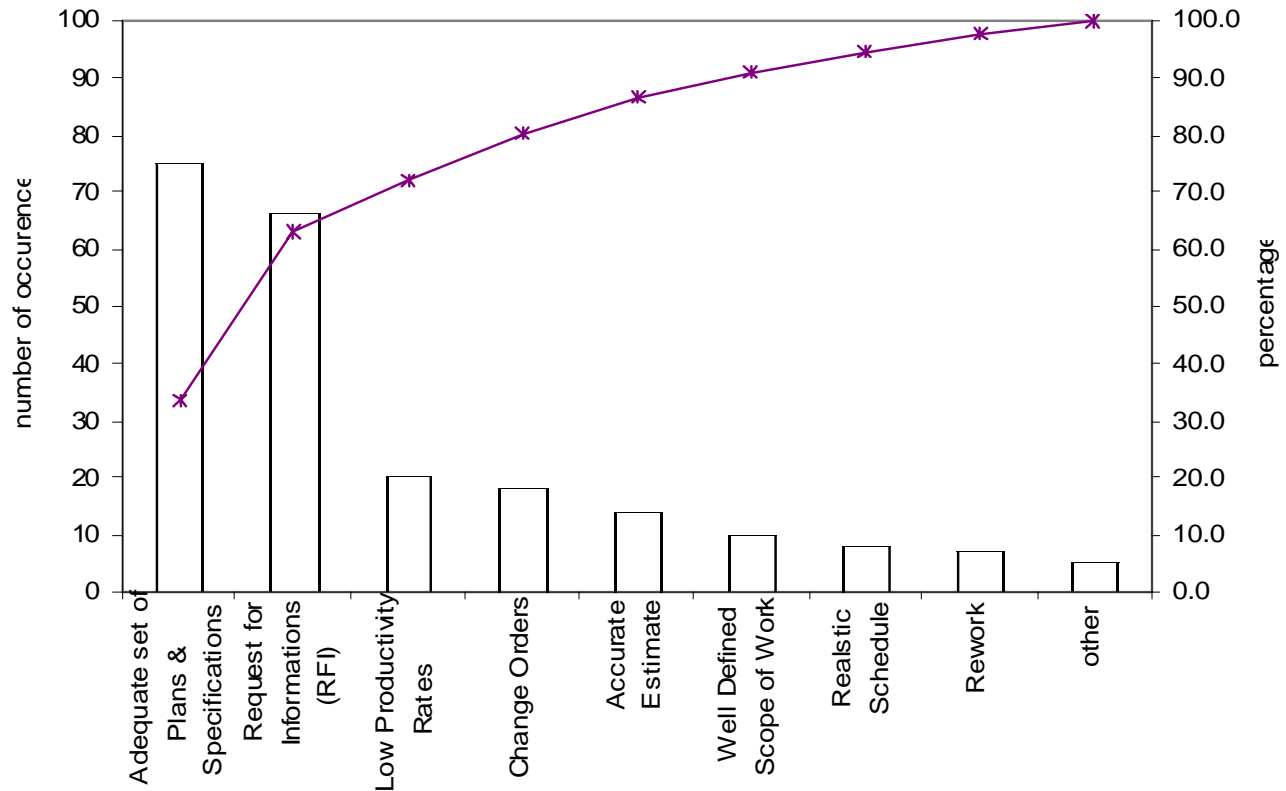


Figure 5—Pareto Analysis for a Project at 50 Percent Project Completion

Figure 3 above shows an electronic form that can be used to collect project performance, analyze the information collected, and produce a Pareto chart that will emphasize which few PCSFs are more important for the project's different phases.

#### DATA ANALYSIS (PARETO ANALYSIS)

Once the work packages data are collected, analyzed using earned value techniques, and poor performance causes are captured, they are summarized based on frequency of occurrence and as a percent of the total. The Pareto principle, is based upon the observation of Vilfredo Pareto in 19th century Italy that 20 percent of the population controlled about 80 percent of the wealth. Researchers have applied Pareto's concept to many other topics than wealth distribution and have found that in most cases, occurrences are distributed in a way such that a vital few make up the largest portion of the population of outcomes, but not always strictly in a 20-80 relationship [8]. The Pareto diagram is a graphic representation of this concept. The Pareto diagram itself is a histogram with the categories of data arranged in order from the largest to the smallest and a cumulative curve for all outcomes. Used in research applications, Pareto diagrams graphically allow the separation of the vital few items from which the majority of occurrences are generated. Resources are then directed to the vital few, thus maximizing the effective use of available resources. Used in such a fashion, Pareto diagrams have been used or proposed

for use in a number of applications such as quality control [10], engineering management [6], and safety [10].

Using the Pareto principle for different projects can provide us with a set of action guidelines to provide cost management direction at all phases of a project for a variety of types of projects. The advantage of our methodology includes.

- data are captured during the project life cycle and not after the fact;
- a structured framework is provided that can guide participants as they analyze performance and facilitate more efficient analysis; and
- once enough historical data is collected on various types of project a forecasting tool can be used to rapidly assess the possibility of a successful project. This is done using a list of specific factors that have been identified as critical to the cost success of projects. The real causes of poor performance can be identified, and timely corrective actions can be quickly taken.

**T**his work introduces a methodology to develop total project cost success factors, based upon a Pareto analysis of completed project cost control data. The methodology that is developed allows cost engineers to derive variety of cost project critical success factors. In addition, the Pareto analysis will also provide a measure of importance of each PCSF (by project type, subtype, and size).

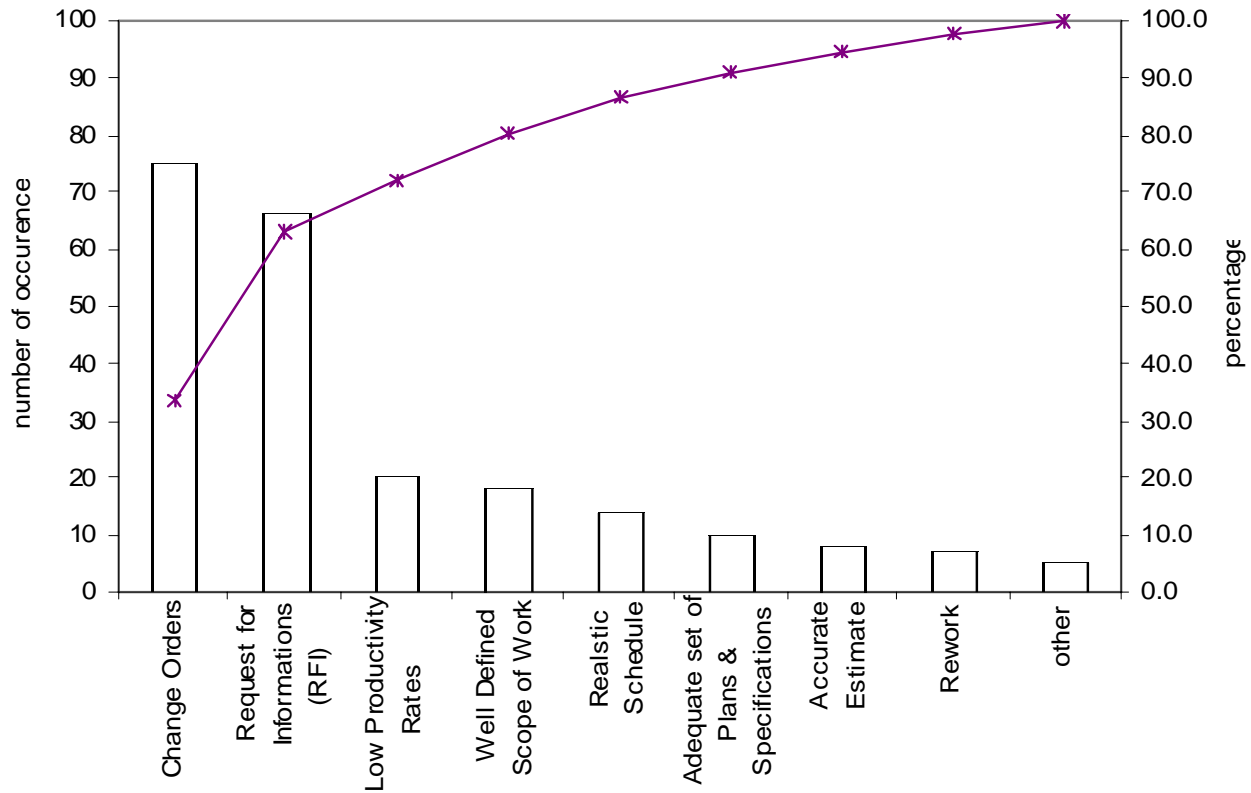


Figure 6—Pareto Analysis for a Project at 75 Percent Project Completion

This proposed approach has the following limitations:

- the definition of project success is limited to cost only; and
- only a few key CSFs are used.

Future research should include the following:

- Integration of cost and schedule when measuring work packages performance, instead of just analyzing cost performance.
- The CPSF can be weighted differently based on their importance (per project or phase).
- Provide a forecasting tool to enable team members to rapidly retrieve project performance information to assess the possibility of a successful project.
- Test methodology on different project types to collect more data to identify other key variables and determine if project success is guaranteed by the mere presence of certain factors.
- Development of a computerized tool to automate the process and make behind the scenes calculations analysis transparent to the end user (using existing projects data by integrating some of the existing project management control systems to avoid duplication of data entry and use their electronic outputs).
- We focused on the causes of poor performance. However, good performance causes can be captured as well, and should be duplicated on future projects.

It is important to point out that the proposed CPSFs are

not intended to be a replacement for sound engineering or management practices. Rather, they are an aiding tool.

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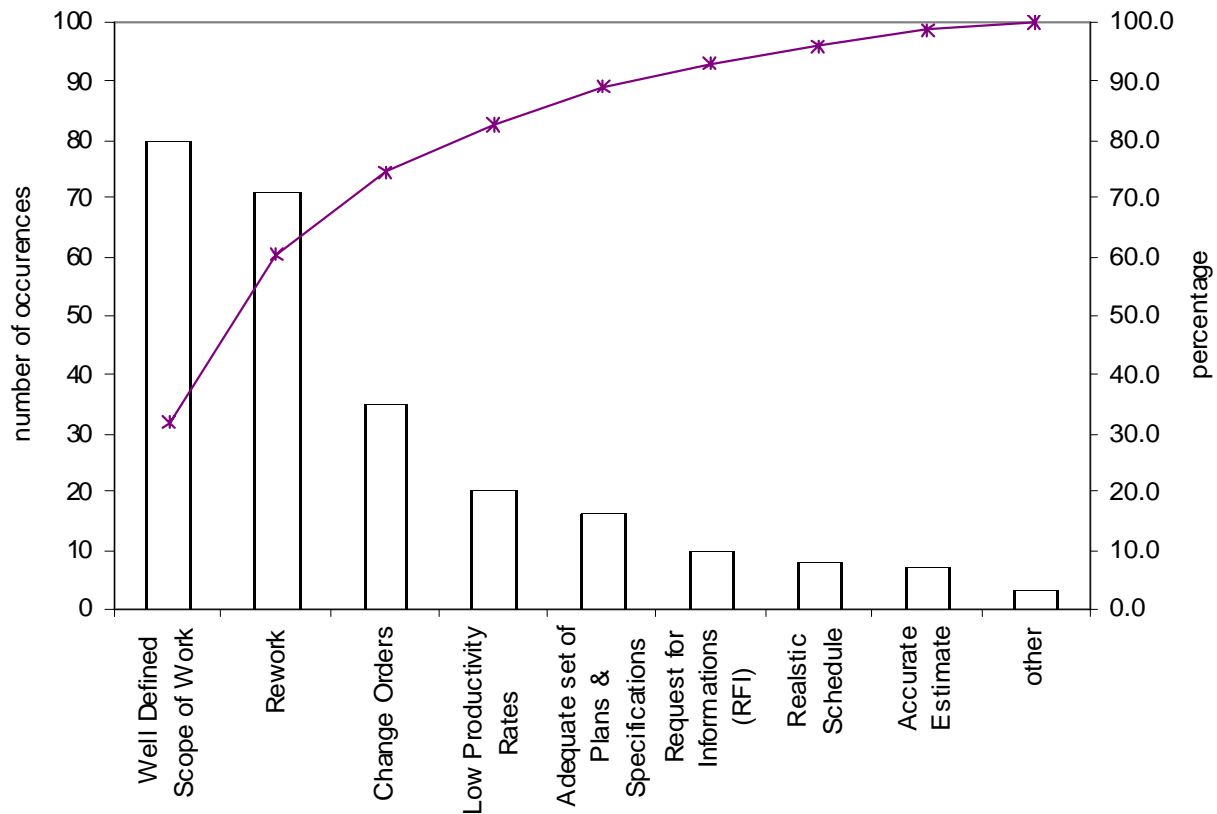


Figure 7—Pareto Analysis for a Project at 100 Percent Project Completion

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