An Approach to Analysis and Prediction of Portfolio Budget Variances Using JMP®

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Introduction

Many businesses are concerned about variations in expenditures against forecast. Understandably, a company's finance leadership frowns on "spending over budget" but of equal concern is "spending under budget" as the unspent money could have been better utilized elsewhere in the company. Using a class project[1], we review and analyze this typical scenario found in an IT organization. It looks at the problem from Diagnosis and Prescriptive perspectives. In the diagnosis phase, it uses JMP® to (a) explore and visualize patterns in data and (b) use quality control methods for root cause analysis. In the prescriptive phase, it uses Data Mining methods using JMP® to explore possibility of building models to classify/predict variances. This paper attempts to show use of JMP® in developing a draft methodology for potential improvements in quality of forecasts thereby reducing variations in expenditures.

Background and Problem

An IT organization was facing high variances in forecast versus actual spending and was trying to find a way to tackle this problem. The Box-Plots in Figure – 1 illustrates how budget variances in Q1 and Q4 exceeded the desirable ± 5% limits of variance. Though the variance showed reduction in 2009, it still remained a critical issue and needed to be addressed.

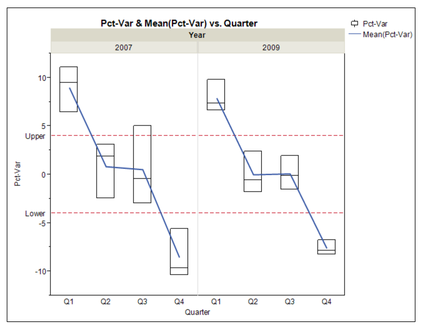


Figure – 1: Quarterly Budget Variance

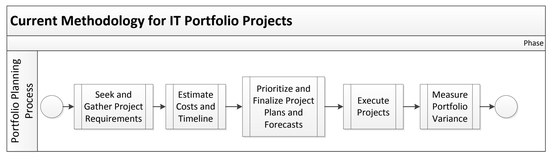


Figure – 2: Process for IT Portfolio Projects

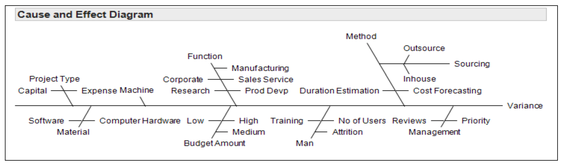


Figure – 3: Cause and Effect (Ishikawa) Diagram

Approach

1. Review Business Process: The first step is to examine the current methodology or process shown in Figure – 2 and understand the key steps and underlying factors that could be contributing to the issue of variance.

2. Understand Root Causes: The next step is to understand the relationships between different contributing factors. This is done by using the cause and effect analysis as shown in Figure – 3 using JMP®.

3. Identify Data Requirements: The findings from the cause and effect exercise as stated in Step 2 leads us to identify the variables required for further analysis.

4. Explore Data: The next step is to explore collected data. Figure – 4 shows distributions of some of the factors in the dataset illustrating that high variances occur in high priority, research, product development, expense and large budget outlay projects.

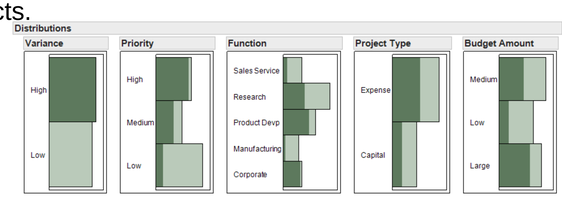


Figure – 4: Distribution of factors in the dataset

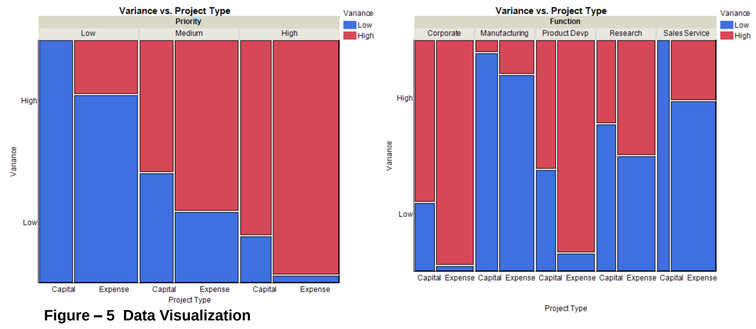


Figure – 5 Data Visualization

5. Visualize Data: Figure – 5 shows visualization of data in other dimensions. It shows that variances within medium and high projects are high in "*expense-type*" projects versus "*capital-type*" projects. The same trend is observed in all projects under the "*function*" category; e.g., *corporate, product development*, etc.

6. Build and Assess Classification Models: A Classification model built using JMP® is shown in Figure – 6a. This model was built using 5-fold cross validation with a minimum split size of 20. The key contribution factors in this tree are summarized in Figure – 6b. The R Square value of 0.58 (with five splits) in Figure – 6a and ROC Curve and Confusion Matrix in Figure – 6c show a robust model with good predictive capability.

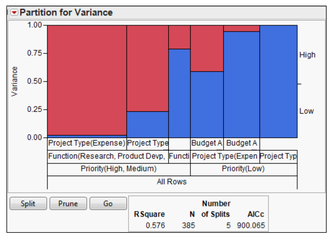
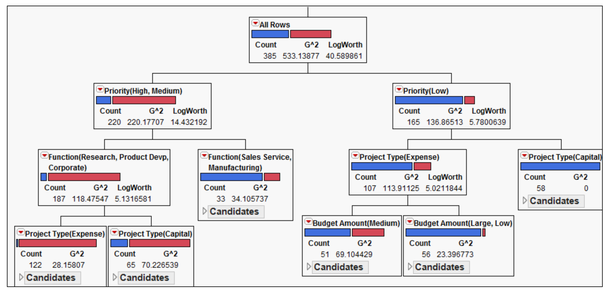


Figure – 6a Classification/Partition Model



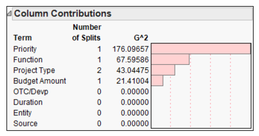


Figure – 6b Key Contributing Factors

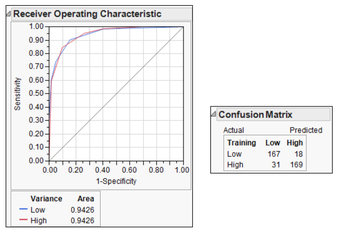


Figure – 6c Performance Measures

Proposed Analytics-based Methodology

Figure – 7 illustrates a simple analytic-based methodology where business analytics processes (as shown in blue) augment the current process to reduce variance. Steps 1 – 5 mentioned in the "Approach" section are included in the first box of the blue "Business Analytics" swim lane below, and the Step 6 is inherent in the second box of this lane. This model-based approach provides enhanced capability to classify high-variance projects that would need closer monitoring to control and reduce variance

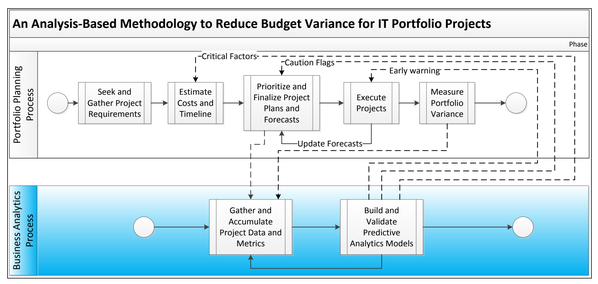


Figure – 7 Analytics-based Methodology

References :

1. Wali Haidri: A Methodology to Determine Root Causes of Budget Variance for Software Projects at an Auto Company - A Capstone Project, SBA, Oakland University, April 2013