Optimizing Test Effort Estimation-A Comparative Analysis

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ABSTRACT

Software testing effort estimation has always been an on-going challenge to software engineers, as testing is one of the critical activities in project life cycle. Globally there has been a challenge in arriving towards approximate estimates due to lack of standard project estimation techniques. Inaccurate estimates thereby affect project constraints like time, cost and quality in global IT industries.

This paper presents a comparative analysis of two test effort estimations and finding the optimum way for effort estimation using Absolute Error and Relative Error calculation techniques. This analysis would use two models viz. Parametric Estimates & Test Case Point Analysis for comparison on efforts of an IT project. Values of Absolute Error & Relative error would be utilized to find the better test estimation model and optimizing test effort estimations.

This proposal is technology independent and supports the need for optimizing test effort estimates. Researcher has involved an arbitrary organization and its project estimates to calculate Absolute Error & Relative Error. The results have convinced the researcher to recommend use of “Test Case Point Estimation” model for test effort estimation. Though this research has convinced the researcher for recommending the model, still stake holders are free to make their own decision based on their existing organization’s structure.

Keywords: Test Case Point, Comparative Analysis, Test Effort Estimation, Testing Efforts Calculation, Test Effort Optimization.

I. INTRODUCTION

Software testing is a crucial activity in project life cycle. Inaccurate calculation of test efforts results in less time available for testing team to test the project and directly influence the quality of the software. In order to carry out a systematic testing, it is absolutely necessary to predict the effort required to test the software. Unfortunately there is no standard method in the industry that can provide the accurate test efforts estimation. Hence this paper researches on optimizing the calculation of the efforts needed on testing projects. In this direction, we have captured the testing efforts of a single project from an arbitrary software industry done using two effort estimation models viz. Parametric Estimating & Test Case Point Estimations. Then author has utilized the organizational effort data to calculate Absolute Error and Relative Error in the estimates done by two different models. Finally the statistical data obtained at the end points that "Test Case Point Estimation" is a better technique for estimations and provides better estimates than other model being used in the industry.

II. EFFORT ESTIMATION USING TWO MODELS:

Parametric Effort Estimates

Development efforts coming for the project via function point analysis were 189 person days as follows:

<table>
<thead>
<tr>
<th>Summary Estimates</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unadjusted Function Point Count</td>
<td>43</td>
</tr>
<tr>
<td>Processing Complexity Adjustment Factor</td>
<td>1</td>
</tr>
<tr>
<td>Adjusted Function Point (AFP)</td>
<td>42</td>
</tr>
<tr>
<td>Calibration Factor (CF)</td>
<td>2</td>
</tr>
<tr>
<td>Total Function Point Measure (TFP)</td>
<td>86</td>
</tr>
<tr>
<td>Delivery Rate (DR) in P/months</td>
<td>10</td>
</tr>
<tr>
<td>Days per man-month (DPM)</td>
<td>22</td>
</tr>
<tr>
<td>High Level Effort Estimate (in person-days)</td>
<td>189</td>
</tr>
</tbody>
</table>

Diagnostics

Parametric estimates take 30% of development efforts as testing efforts and come out to be 56.7 person days (453.6 person hrs) as follows:

Testing Efforts = ((30/100)*189) days = 56.7 person days = 453.6 person hours.

Test Case Point Effort Estimates

Test effort estimation calculated via test case point estimation for the project were 52.88 person days i.e. 423 person hours as depicted below:
Exact Effort Estimates utilized by the project:
Exact efforts utilized in testing of project were found to be 50.4 person days i.e. 403.2 person hours.

### III. CALCULATING ABSOLUTE ERROR & RELATIVE ERROR:

**Absolute Error:** The absolute error is the magnitude of the difference between the exact value and the approximation.

\[
\text{Absolute Error} = \frac{\text{Exact Value}}{\left| \text{Estimated Approximation} - \text{Exact Value} \right|}
\]

**Relative Error:** The relative error is the absolute error divided by the magnitude of the exact value.

\[
\text{Relative Error} = \frac{\text{Absolute Error}}{\text{Exact Value}}
\]

**Example:** If the exact value is 50 and the approximation is 49.9, then the absolute error is 0.1 and the relative error is 0.1/50 = 0.002.

**Note:** The relative error is often used to compare approximations of numbers of widely differing size; for example, approximating the number 1,000 with an absolute error of 3 is, in most applications, much worse than approximating the number 1,000,000 with an absolute error of 3; in the first case the relative error is 0.0003 and in the second it is only 0.000003.

**Error Calculation for Parametric Model:**

\[
\text{Absolute Error} = \frac{\text{Exact Value}}{\left| \text{Estimated Approximation} - \text{Exact Value} \right|} = \frac{403.2}{(453.6 - 403.2)} = 8
\]

\[
\text{Relative Error} = \frac{\text{Absolute Error}}{\text{Exact Value}} = \frac{8}{403.2} = 0.02
\]

**Error Calculation for Test Case Point Model:**

\[
\text{Absolute Error} = \frac{\text{Exact Value}}{\left| \text{Exact Value} - \text{Estimated Approximation} \right|} = \frac{403.2}{(423 - 403.2)} = 20.36
\]

\[
\text{Relative Error} = \frac{\text{Absolute Error}}{\text{Exact Value}} = \frac{20.36}{403.2} = 0.05
\]

### IV. CONCLUSION

As calculated above, the relative error for “Parametric Model” is 0.02 and for “Test Case Point Estimation” model is 0.05. This means that first model has 50 errors in a unit whereas the latter one contains 20 errors in a unit. Therefore, it clearly states that latter model is having lesser errors and does better estimates than first model.

Based on these results, researcher recommends “Test Case Point Estimation” model to be more robust than the first one.

In cases of large projects, this would be more frequent that the first model has more number of errors than the latter one resulting in loss of cost, resources and time for the organizations.

### V. REFERENCES


