Enhancing Defect Removal Efficiency Using Adoption Rate for Released Products

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Abstract

The increasing emphasis on quality software has prompted the need for better software quality management using data driven and statistical methods. Various measures of development and released software quality have been created to make the process measurable, repeatable, and continuously improving.

Defect Removal Efficiency (DRE) is one of the commonly used metrics for measuring the efficiency of defect removal at various stages of the software development life cycle. By extrapolating the DRE metric to released products, an organization can measure the effectiveness of their quality assurance process based on the number of defects found in the product before and after its release.

A couple of key aspects that this metric fails to account for are the “number of customers” using the product and the “amount of time” a product has been out in the market. This paper accounts for these two key aspects and incorporates them as a measure of “product adoption” while calculating the Defect Removal Efficiency.

The paper also analyzes the effect of various parameters on the metric, which unearths more meaning from the metric value.

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Introduction:

The classic Defect Removal Efficiency (DRE) calculation has been successfully used to determine the efficiency of the defect removal process at various stages of the product development life cycle.

DRE[1] is calculated as follows:

$$DRE = \frac{\text{Defects Identified during a development phase}}{\text{Defects Identified after a development phase}} * 100 \qquad (1)$$

The value of the DRE is a percentage. The higher the percentage, the better efficiency is because it represents the timely identification and removal of defects at any particular phase.

This calculation can be extended for released products as a measure of the number of defects in the product that were not caught during the product development or testing phase.

Hence, the DRE calculation (1) can be modified for released products to calculate the Testing Defect Removal Efficiency ($TDRE_{Released}$).

TDRE for released products can be calculated as follows:

$$TDRE_{Released} = \frac{\text{Defects Identified before Product Completion}}{\text{Total Defects in the Product Today}} * 100 \qquad (2)$$

This $TDRE_{Released}$ value, calculated and charted over time can be used to observe the Defect Removal Efficiency trend for a particular product. A high $TDRE_{Released}$ value indicates good defect removal implementation and processes within the organization. A low $TDRE_{Released}$ value is an indication of poor defect removal implementation and processes and calls for some attention and investigation.

Missing Parameters:

A couple of factors that are not accounted for by this metric are the number of customers using this product after it has been released and the time this product has been available for customers to use. Both of these factors significantly affect the determination of the Defect Removal Efficiency.

Number of Customers using the product: The greater the number of customers using a particular product, the greater the chance of finding a defect in the product after completion. Some inherent assumptions made here are that all customers are exercising many different components of the product. (This is true in the case of webMethods where the products are configurable and customized in many ways based on the needs of the customer.)

Time after Product Completion: The time period for which the $TDRE_{Released}$ value is calculated is significant in understanding and comparing the value. The longer the duration, the higher the chance of customers using the product, and hence, the higher the chance of issues being found. The assumption made is that there are a few customers starting to use the product with every passing period of time after the product is released. (This fact is also true in the case of webMethods.) Another assumption made is that the customer adoption pattern follows the classic theory of the “Innovators”, “Early Adopters”, “Early Majority”, “Late Majority” and “Laggards”.

Factoring Missing Parameters:

It might be worth combining the two parameters, Number of Customers and Time After Product Completion into a new parameter, the “Product Adoption Rate” (PAR), calculated as such:

$$PAR = \frac{\text{Total Number of Distinct Downloads}}{\text{Number of Months after Completion}} \qquad (3)$$

PAR can be used as a basis for comparing the $TDRE_{Released}$ values of two versions of the same product or for two different products. A consistently high PAR value over a period of time would indicate a high adoption rate. Just by looking at the trend of the PAR value over time, one can guess the adoption pattern of that product. Also, a high PAR value product means that the product is in demand and might be a likely candidate for a strategically significant initiative going forward in the organization. A diminishing PAR value or a sudden decrease in PAR value of a product could be used as an alarm for investigation. The PAR value is a good indicator of an organization’s product strategy. For a new product, a consistently low and diminishing PAR value clearly indicates a product that is not required in the market and denotes poor product strategy, if adoption is any indication of good product strategy (excluding the effect of other parameters, such as sales, pricing, marketing, etc.).

Incorporating Missing Parameters:

Incorporating Product Adoption Rate with Testing Defect Removal Efficiency helps compare similar products with each other. It eliminates the comparison of a less adopted product with that of a highly adopted product because a highly adopted product is likely to have a greater number of fixes created for it. Integrating PAR with TDRE also involves the two significant factors “Customers” and “Time” into the DRE calculation.

Testing Defect Removal Number (TDRN) can be calculated as such:

$$TDRN = PAR * TDRE_{Released} \quad (4)$$

(This is not a percentage so we cannot call it efficiency. The modified DRE is just a mere number.)

There is an inherent advantage to using PAR as a multiplier to calculate the TDRN. To compare TDRN values across multiple products for which the PAR is not comparable, multiply the lower TDRN value with the multiplication factor between the PARs and the TDRNs are now comparable. Though this is not a recommended practice from a business perspective, it is feasible.

Analysis:

There are three parameters and based on the values of the three parameters, different conclusions can be drawn. Below is a summary.

$TDRE_{Released}$ = Low

PAR = Diminishing

TDRN = Low

This clearly indicates low Adoption Rate and low Defect Removal Efficiency, resulting in low overall TDRN. This can be a result of poor product strategy and poor implementation.

$TDRE_{Released}$ = High

PAR = Increasing

TDRN = High

This clearly indicates high Adoption Rate and high Defect Removal Efficiency, resulting in high overall TDRN. This is the desirable situation. This is a classic case of creating a product that is in tune with the market's requirements and good implementation.

$TDRE_{Released}$ = High

PAR = Diminishing

TDRN = Close to PAR

This clearly indicates low Adoption Rate and high Defect Removal Efficiency, resulting in TDRN close to PAR. This is a case of poor strategy but excellent implementation.

$TDRE_{Released}$ = Low

PAR = Increasing

TDRN = Away from PAR

This clearly indicates high Adoption Rate and low Defect Removal Efficiency, resulting in a TDRN well below PAR. This is a case of good strategy and poor implementation.

Enhancements:

The $TDRN_{Released}$ is currently not a percent value. This metric needs to be modified or adjusted to either convert it to a percent value or calculate a benchmark for comparison.

References:

(1) Defect Removal Efficiency - Linda Westfall