

Cost of Quality Metrics: A tool to direct investment in defect prevention towards maximum return on investment

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Abstract:

Product organizations are developing increased awareness and capability in effective process measurement to enable improved business decisions. We have defined and used a measurement that ties together internal process improvement, customer view of product quality and cost of defects to the organization.

The goal is to have monotonically declining 'Cost of Quality' month over month. The distribution of the same index across sub components of the product offering provides meaningful insight towards the problem areas on which the product team has to focus in near future towards improvements.

In this paper, we will discuss what is Cost of Quality (or lack thereof)? How we factor in the origin and other know categorization of defects to compute a single index. The paper will also discuss different weights assigned to defects depending upon the organization's business model and customer expectations. Lastly, this paper will illustrate a few application of this metrics in real life projects and how it helped to identify and push the right levers in getting the maximum impact.

1 Introduction

Making defects is not in a company's business plan, and as such the issues are often not tracked very well. But those defects are swelling the costs and eating away the profits. It is a good idea to have a true grasp of what you are actually spending. This paper presents a simple "Cost of Quality" metrics to help keep a watch on this aspect and highlight troublesome areas where the management attention is needed. One can use the results to communicate the real consequences of leaving defects with others in the workplace and help in establishing a process and work culture that thrives to prevent defects in the shipped product and contributes to overall customer satisfaction.

2 The "1:10:100" Rule

Based upon the work done by Deming in Japan, the software industry has worked out a rule of thumb, known as the “1:10:100” rule. According to this rule, the cost to fix a defect increases exponentially the later in the development lifecycle that it is identified. Accordingly

- A defect caught in construction phase costs factor of 1 (1x) to fix.
- A defect caught in QA and testing phase costs factor of 10 (10x) to fix.
- A defect caught in production phase costs factor of 100 (100x) to fix.

3 What is Cost of Quality

It is a single composite index of genuine defects found in the product. It takes into account the golden 1:10:100 multiplier for the engagement type of the defect or where in the product life cycle the defect is found. Therefore, it is directed towards defect prevention and R&D and Testing gate effectiveness in the software development process. Second level multiplier takes into account the severity and urgency aspects. Each identified defect in the collection is assigned an origination type weight and a severity weight. The cost index of that defect is the product of these two weights. This is the basic cost of quality concept used in this paper.

4 Weight and Cost Calculation

In our deployment of this concept, the focus primarily has been to look at the cost in relative terms. We have not spent much effort in tuning the formula to match our cost to actual dollar amount an organization spends in addressing quality issues in the products. That association is easy to create, though it will vary from organization to organization. In a product organization, the relative distribution is found to be sufficient in reaping the benefit of this approach. Leaving it at the relative level, makes the framework portable across organizations. The weights in our formula are listed below in Table 1:

Engagement Type			
Maintenance (Customer)	100		
Pre-Sales	100		
Beta Test	10		
Internal	1		
		Severity	
		911	10
		S0	4
		S1	2
		S2	1

Table 1 : Weights used in the calculation

As per this table, a customer identified S0 defect will have a cost of 400 and a 911 (production stopper) reported by a beta site will have a cost of 100.

5 Why another metric?

While the basic concept, definition and computation behind this cost of quality index are easy to appreciate, a more fundamental question arises why another thing to measure? Are we not already measuring too much? The chances are yes, though it may vary organization to organization. For us, the primary motivation in creating this new measurement was to simplify the metrics that is tracked organization wide.

Quality is becoming a key business differentiator in current times. It is no longer just a desirable thing. It is normal for organizations to measure and track

- Defect arrival rate
- Turnaround time (TAT) for customer reported defect
- Ratio of 'Internally' v/s 'Externally' reported defects
- Product Lifecycle Gate effectiveness
- Regressions, etc

While these are all necessary measures and an organization must invest in collecting the necessary data to be able to carry out any analysis indicated above, it is costly to monitor all of them on an ongoing basis. Also, at times, it is possible to lose sight of a potential issue buried in the volume of the data being monitored on an ongoing basis.

The proposed Cost of Quality index can become a single metric to be tracked on an ongoing basis by an organization. The grouping of the defect data for this computation can be done a meaningful manner and the trends can be reviewed regularly. Only when there is an issue visible in the above trends and deep dive can be done and lower level metrics must be studied before instituting a corrective measure.

6 Application

6.1 Monitoring the general trend

We have used this concept to monitor the quality of the sub areas of our product ownership. A quality dashboard is generated once every month. The year till date (YTD) collection of defects is generated using automation scripts which also compute and assign the engagement type and severity weight to each defect. The collection is used to generate multiple views of the data to derive meaningful insight with respect to overall product quality. Figure 1 shows a same graph from our records. Any unexplained movement of the trend line becomes a candidate for further drill down and corrective action. Whether the trend does or does not correct in subsequent intervals, indicates the soundness of the corrective action taken.

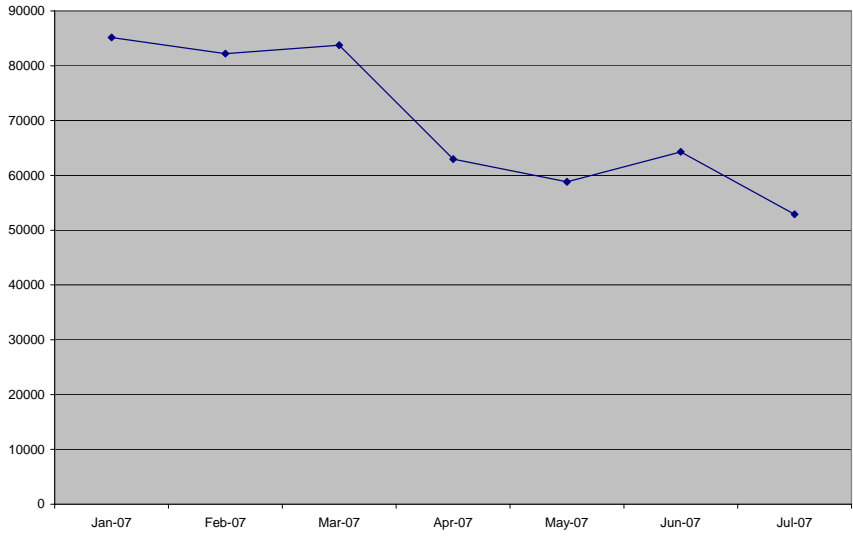


Figure 1: Trend analysis of the total cost of quality (cumulative of all the defects reported in the interval)

6.2 Team level categorization

The sub-product or team wise categorized representation in Figure 2 helps in identifying the top few areas to focus at a time to maximize the return on efforts. In our specific analysis, we found that top 5 areas contributed to roughly 50% of the cost of quality. Instead of increasing the total spending towards defect prevention, testing and automation for these products, we were able to get fruitful results by just readjusting the same total spending and clustering them to these 5 areas. This also reduced the day-to-day overheads in monitoring.

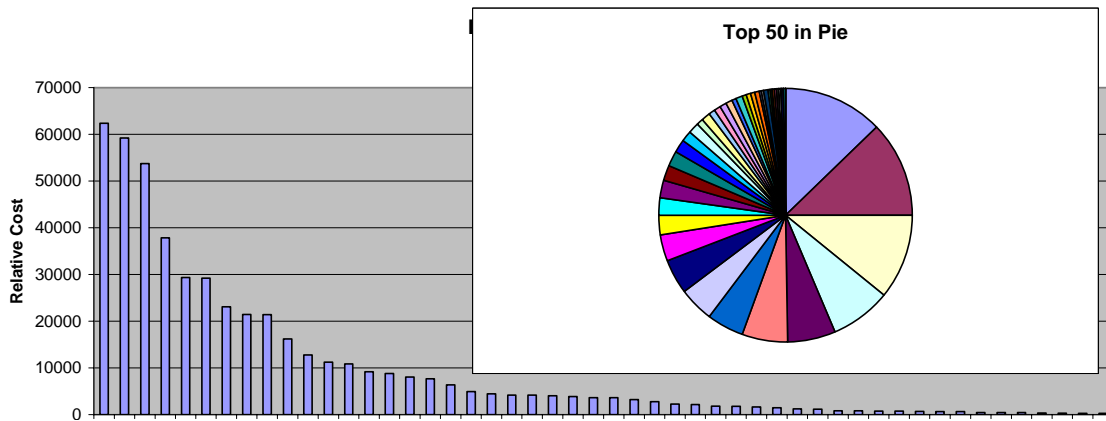


Figure 2: Distribution of Cost of Quality data across teams/modules

6.3 Average Cost of Defect categorized at Team/Module level

From the data above, we also looked at the average cost per defect in each of the sub area by dividing the cumulative cost by the total number of defects in that category. This distribution provided a handle on the soundness of the quality practices instituted in that area and room for improvement by cross pollination of best practices.

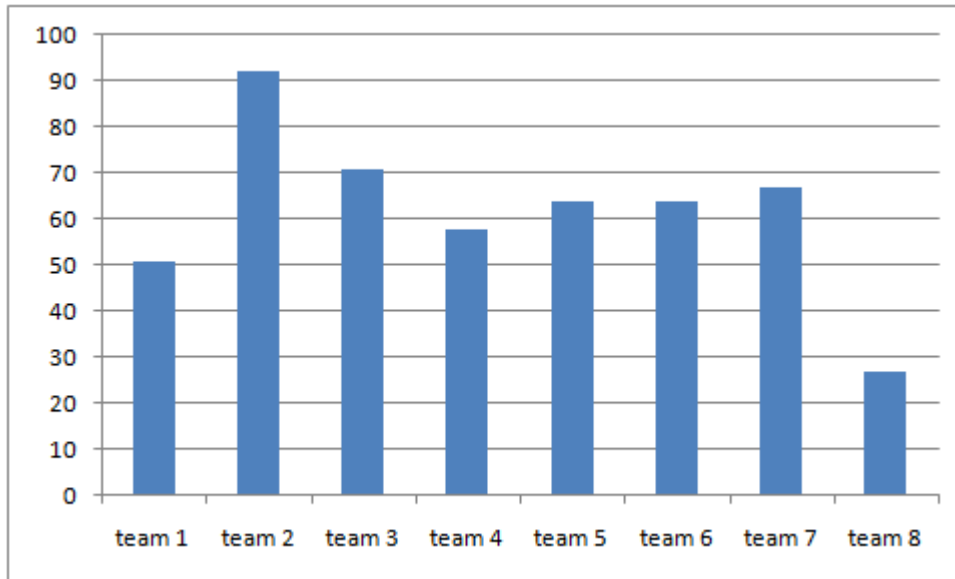


Figure 3 : Team wise distribution of average cost per defect

7 Future Work

I am working on models to project the hard cost. In my experience I have found that it is important to get that some times to attract senior leaderships attention – as to how big a problem mending bugs really is.

References

- [1] Test2008: 2008: Conference Proceeding Template.
<http://test2008.in/icsd-template.doc>