

Abstract

Traditionally in software development literature testing has been seen as a mechanism to detect faults or deviations from the design specification. Software reliability growth models have been developed with this perspective. But these models due to their narrow focus did not address the business issues faced by software product companies at large. Recent studies have found that testing has been used by leading software product companies as a strategy to sense customer needs, to test alternative technical solutions, and to integrate the knowledge gained from both markets and technologies. It has been observed that Microsoft 's software testers accounted for 45% of its total development staff. Hence testing has major cost, quality and time implications for any software product companies.

Cost, quality and time are the three interrelated dimensions of product development performance. Firms must consider potential trade-offs among them and the choice of what to prioritise will depend upon its overall economic impact in the given context. So intensity of testing will have to be found from business perspective keeping in view the performance objectives and context.

In this research we conceptualize product development as a disciplined problem solving approach. In recent years problem-solving approach has been discussed and explicitly adopted in the product development literature. Its focus is on effective organization of work with a focus on the development process and product concept and hence is more suitable for our research. This approach enables us to think of product development as a deliberate business process involving scores of decisions with each decision composed of numerous problem-solving cycles. Our interest in this research is to find the optimal number of testing cycles at different levels of product development process.

Through study of projects/ published materials on the software product development, current development and testing processes are investigated to develop relevant frameworks. Mathematical models are developed for unit testing, integration testing and Beta testing to sharpen some of these insights gained from the framework. Further, these models are analytically solved to derive the optimal solutions in all the three cases. Additional insights are derived through sensitivity analysis and analytical derivations. The literature did not reveal any work of similar nature.

Fidelity of tests conditions, cost of testing, cost of rework, cost of delay and cost of software quality is the significant parameters affecting the testing strategy choice. These parameters differ across types of testing. The literature review did not reveal any work, which covered all of these parameters. Also no work was found related to Beta testing. Hence, it is assumed that modeling and analyzing the impact of fidelity differences for different types of testing and the analytical model developed for Beta testing in this thesis are the original contributions to research.

We have attempted to add some new building blocks in this new and growing area of academic research. We feel that frameworks and models developed in this research will result in effective managerial decision-making.