QUANTITATIVE QUALITY ASSURANCE APPROACH

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Abstract: Software Quality is an important phase in software industry which mainly depends on various factors involving process and product development. In this era attaining or achieving standard quality level in software is very essential because of high customer demands. The critical factors of quality management practices in the software industry are first identified from the literature survey and validated through an empirical study. The study attempts to probe the influence of "age of quality" and "use of software" over software quality management practices and programs. The results of the study shows that the "age of quality" and "use of software" have partial influence over the software quality management. This paper identifies reviews and addresses the factors affecting the quality of software in long run and indirectly suggests improvement for achieving it.

Keywords: Software Quality Assurance Process, Software Quality control, Software as End Product.

I. INTRODUCTION

Software Quality Assurance as per IEEE is a "planned and systematic pattern of all actions necessary to provide adequate confidence that an item or product conforms to established technical requirements"[1]. A set of activities designed to evaluate the process by which the products are developed or manufactured. IEEE Standard defines QA as "a process for providing adequate assurance that the software products and processes in the product life cycle conform to their specific requirements and adhere to their established plans"[2]. Thus quality is treated as measurably (not philosophical issue) meeting expectations and conforming to requirements. The rigor of the process should be chosen to suit the needs of the product and organization[2].

Software Quality control is defined as "a set of activities designed to evaluate the quality of a developed or manufactured product" (IEEE, 1991). A company has to produce very high quality products to achieve a respectable position in global market. In this era of globalization things are changing and moving with great pace. To survive in this world of global competition needs efforts, money, people and time. Time is very precious and one cannot go back to find mistakes and errors committed during the process as it involves cost, time and resources. Whatever is done should be consider as first and last time. To avoid such problem the organization should come up with major factors influencing the quality of process and the product.

There have been many incidences of failure in real time software system which led to serious consequences. The main role of SQAP (software quality assurance process) is to maintain the quality of the software products. SQAP is very important as it builds quality into the products. In traditional development SQAP requires reviews at each stage, with careful records, verification and signatures. In an agile programming environment SQA has to be more flexible. The quality assurance principle under open source software development is an approach to improve software product quality against traditional methods and techniques. Someone must be responsible for assuring testing of basic requirements, rapidly updating and recording regression test and ensuring progress reviews quality assurance under open source development deals with larger development community and security issues[3]. Delivery of high quality products and services is for increasing customer satisfaction is the need of open source development[4]. SQCP (software quality control process)is the process for controlling and monitoring the quality of the software. All this results into a standard product with high level of quality. Software Quality is an important factor in software industry which depends on many factor involving process and product development. In this era achieving standard quality level in software is very important because of the high customer demands 1. Software Quality is an important factor in software industry which depends on many factor involving process and product development. In this era achieving standard quality level in software is very important because of the high customer demands. Software quality assurance (SQA) consists of a means of monitoring the software engineering processes and methods used to ensure quality. The factors have to be identified which will optimize the software development activities and bring profit to the industry. It is human centric process and involves time. Process maturity level predicts the quality of software and other aspects. Identifying of requirements and finalizing them is time consuming process. The software development should be dynamic and not mechanical activity and hence factors should be identified. Moreover the relationship between various factors should be identified. The process adopted for developing software needs to take into account these factors.

Mapping is required between various factors to optimize the process of software quality. The journey of software development can be divided into following major phases which are Quality Assurance Process SQAP i.e. Input, Quality Control Process SQCP i.e. Measure and Software send product SAEP i.e. Output.

SQAP - Software Quality Assurance Process SQAP is the process involving various activities of software development. It involves building quality into the product through four main phases which are requirements gathering, converting requirement into the design phases, implementing the product developed, maintaining the product. There are four main developmental approaches i.e. structured, object oriented, component

base and web based development [5]. For any process the goal has to be defined. SQAP determines whether everything is going according to polices standards and procedures. QA is about providing assurance and credibility the product should work right and people should believe that it will work right. It is an expensive time consuming process. It touches all aspect of project. It pushes the product outdoor.

II. RELATED WORK

We identified principal/key factors which affects the software quality assurance process. Several authors have been classified the various factors under specific domains. Some have suggested techniques like Inspection, Peer Reviews useful for all phases of software development. Review or analyze of documents and artifacts, design documents, coding documents are important for quality control activities. Inspection is very important for assuring quality in software development. Inspection and survey helps for detecting and removing the errors. Revision is basically sort of revising work in all phase. Revision gives confidence in the process. Some authors have classified factors according to the inspection and n number of revision. Some have classified them on basis of software development phases or whole SDLC (Software development life cycle).

Coleman (2005)[29] discussed The Chaos Report of 1994 published by the Standish Group International Inc. The report found that 31% of software projects ended in cancellation and more than 76% of remaining projects experience significant delays or significant cost overages or significantly reduced functionality or some combination of the three. There is a lack of published studies on software development in South Asia, which is fast becoming an IT outsourcing hub (Sison et. al., 2006)[30] .

III. RESEARCH METHODOLOGY

A. Searching and Selecting Papers

The main criteria for searching were journal, conference paper, ieee papers, blogs and other paper on factors. Searching was done manually and also on internet.

B. Information Sources

We have searched and collected information raw or refined from various sources which are listed in references:

1. **www.acm.org**
2. **www.ieee.org**
3. **www.sciencedirect.com**
4. **Springer Journals**
5. **Elsevier Journals**
6. **Conference papers (National and International)**

C. Threats to Visibility

The main validity threats of this study are publication selection bias, miss classification and unavailability of research paper. We have tried to search journal and conference paper on Internet but we could get limited papers from IEEE, Springer, and ACM. We are not getting proper information about this topic. We would like to submit a detailed analysis of paper with relationship between these factors in future. Presently we identified and listed factors based on research paper available with us.

IV. FACTORS AFFECTING QUALITY ASSURANCE PROCESS

The factors have to be identified which will optimize the software development activities and bring profit to the industry. It is human centric process and involves time. Process maturity level predicts the quality of software and other aspects. Identifying of requirements and finalizing them is time consuming process. The software development should be dynamic and not mechanical activity and hence factors should be identified. Moreover the relationship between various factors should be identified. The process adopted for developing software needs to take into account these factors. Mapping is required between various factors to optimize the process of software quality. The journey of software development can be divided into following major phases which are Quality Assurance Process SQAP i.e. Input, Quality Control Process SQCP i.e. Measure and Software as end product SAEP i.e. Output. A. SQAP - Software Quality Assurance Process SQAP is the process involving various activities of software development. It involves building quality into the product through four main phases which are requirements gathering, converting requirement into the design phases, implementing the product developed, maintaining the product. There are four main developmental approaches i.e. structured, object oriented, component base and web based development. For any process the goal has to be defined. SQAP determines whether everything is going according to polices standards and procedures.

QA is about providing assurance and credibility the product should work right and people should believe that it will work right. It is an expensive time consuming process. It touches all aspect of project. It pushes the product outdoor. SQA is the responsibility of separate independent group and has authority of redevelopment and retesting when needed. It is involved in improvement of process and product. It works like the process police. Thus it is a preventive approach and prevents faults from occurring by providing rules and methods. It prevents defects from occurring. It establishes process. Planning (objective, review plan, appraisal plan) Any activity associated with SQA has to be planned and should be with objectives. The plan has been reviewed, approved with concerned person. Standards (code, design) Standards are the set of guidelines which help to achieve best results. The standards include CMMI and ISO but it is difficult and costly for small Software Development Organizations to follow the standards. Rules Legal Procedure

Procedure should be made legal so that they are followed properly. They are developed to help organizations to achieve quality products. Documentation (of Process and Product) Any legal activity which is going on should be documented.

Guidelines: Their should be guidelines for every activity which are taking place under SQAP.

Responsibility: For every activity which is being carried there should be responsible person.

- Technology
- Right Conduct
- Authority
- Approvals
- Environment
- Culture

Culture difference among software developers,project managers, and executive managers were the main reason in Thailand for not implementing software process models and improvements.

- Risk
- Size
- Report
- Reuse (code and design)
- Virtue and Ethics

Poor quality of software presents an ethical issue for society. Quality in recent times is extremely poor causing significant monetary and social problems. Quality problems are also affecting our national security. E.g. National security plan is required to protect the cyberspace. Some other factors are listed here with. There are many innumerable sub factor/aspect on which a factor depends.

Cost involved Efforts (Manpower, tester, others) :

- Practice [4]
- Schedule
- Schedule Pressure
- Approaches
- Techniques (Customization)
- Feedback/Customer satisfaction
- Output of each phase entering into other phases
- Tools
- Time limit (deadlines)

Revision (all phase, design, code review, technical review, walk through) Checklist, Manuals Inspection (code inspection) Fagan and Gibbs have suggested on code inspection Defects (low, high, medium severity)

Certification (quality attributes, process, level of that attribute) Management (Co-ordination and Team Communication)

- Result Oriented
- Budget Pressure
- Resources
- Process Metrics

Key activities are identified, controlled, monitored and measured by metrics[7]. Key parameters are identified and variations are measured. Corrective actions can be taken in case of deviation.

- Information Diversity[14]
- Task conflict[14]
- Learning[14]
- Project Management
- Methodologies[8]
- Cycle Time (speed of process)
- Complexity (process, code)

The Software complexity has a deep relationship with constraints, testing, quality, development and productivity. Process Maturity Security (in open source development).All above factors are being listed from papers (journals, conference) listed in reference. These entire factors have impact on the quality of the software. These factors are in some way influencing the quality assurance process thereby building, accumulating quality drop by drop into software. Many times it is seen that these factors if not taken care starts eroding the quality from software. So all the factors has to be taken care of in some or other way. Some authors have classified the above factors as per their influence as listed. Influencing factors. Development Context (Development process e.g. waterfall, Programming language++, UML, Reuse, High, low, med).

Goals (Quality attributes e.g. reliability, Quality levels i.e. high, medium, low, Defect classes i.e. critical, major , secondary goals e.g. team building) .New Technology e.g. Ajax Resources (efforts i.e.7/8 hours, experience, time, team size), Artifact (Size, Complexity, Defect density, Extent of quality). Tools e.g. QTP Variable factors Focus (Quality attribute, defect class), Resources (Effort, Team Size, Experience) Scope, Entry/exit criteria (reading techniques, inspection (Applied phases e.g. planning, meeting, Roles, Process structure, Documentation, Defect detection procedure) Testing (tool, test execution, test methods), and General (resources, Scope of QA, focus of QA, criteria)

Some other have classified into two major :

- Distrustable factors
- Dependable factors

SQCP - Software Qualty Control Process SQCP prevents deviation from normal development is indirectly influencing quality. The process which is going on is controlled by different ways. It is monitored and evaluated to keep it to maximum level for optimized output. It is corrective approach. It find faults, corrects faults when occurs. Task is conducted on products. It implements process. Testing is one of the activities which are process. Testing is one of the activities which are carried from starting to last phase. Testing and Quality are like two sides of same coin. More we spend on quality, better we get the results. Factors controlling the process are listed as below :

- Examining
- Monitoring
- Inspection
- Measuring /Measurement(process, product)
- Evaluation (Establish, Specify, Design, Execute the evaluation)
- Testing (What goes into QA?)

A solid test plan should ensure that design is appropriate, the implementation is careful and the product meets all requirements before release.

- Continuous Improvement [3]
- Audit (fail / pass)
- Improvement (process, product) [6], [14]
- Product Metrics
- Product Evaluation
- Feedback
- Evaluation Report
- Team involved (Certified or not, experienced or not, skill, relationship among them)

SAEP - Software As End Product SAEP i.e. output Product which is obtained is measured, checked and used further. Various techniques like regression tree, case based reasoning, neural network, genetic algorithm, Bayesian Network, Principal component analysis, Fuzzy logic, Function points, metricsâĂŹ based are employed by authors for estimating the quality of the product.

V. RESULT,CONCLUSION AND FUTURE WORK

Software Quality is dependent on many listed factor. It is very important to list all factors to optimize the process of software development. Identification of all these factors depends on availability of number of research paper. Improving quality leads to decreasing rework, cost, and schedules. This leads to improved capability which in turn lowers prices and larger market shares. All this causes increased profits and business continuity. One of the major problems with software development organization of low and medium process maturity is that the priority is always to maintain the stability of the organization. Such organization cannot afford to invest more money in process improvement as their future is unpredictable. Our future work is to develop a model on software quality assurance. The relationship can be established among these factors.

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