SURVEY TO IMPROVE SOFTWARE QUALITY ASSURANCE IN DEVELOPING COUNTRIES

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Abstract—Quality is a central factor in software industry. Software quality depends upon the user’s satisfaction, which can be attained through applying standards and quality procedure. These standards and procedures might be company’s local or in house procedures. In this time achieving quality software is very key factor because of the high customer demands and market pressure. Developed countries are being good at in software industry and improving day by day. On the other hand developing countries like Pakistan are struggling with Software quality and cannot maintain reputation in International Market. Software Quality lacks due to several reasons. This paper will address the problems for lacking interest in improving the software quality by higher authorities and software assurance team. We have provided answer to the addressed problems by changing the method of survey as from interview to questionnaire and included more questions related software quality assurance, to give the flexible time to concerning people for their best suggestions.

I. INTRODUCTION

Every application or business domain faces a specific set of software quality issues and software quality must be defined accordingly. It is important for each software development project to define its specific meaning of software quality during the planning phase. Such a definition contributes to the basis for setting objectives and practical measures of quality progress and determination of readiness for release to customers [1].

Software Quality Assurance (SQA) is a planned and systematic approach to ensure that software processes and product and products conforms to the goals of SQA are to improve software quality by appropriately monitoring both software and the development process the ensure full compliance with the established standards and procedures[2]. The software quality assurance must be used to make a balance between quality and productivity [3]. Quality improvements affect operations performance in various ways, such as increasing revenue, reducing costs and improving productivity. Quality has been regarded as one of the major drivers of competitive strategy in every industry [4]. Software development has been one of the fastest growing businesses over the last two decades. The global competition has become even more severe as the number of software development firms increased at a much faster pace. To survive in this intense competitive environment, software vendors need to differentiate their products in ways that are meaningful to their customers. Quality is a proven way to achieve this differentiation. Quality in software industry is derived from three important sources namely people, technology and management (Owe and Yaacob, 1996). Software Quality Assurance (SQA) provides means for monitoring the software engineering processes and procedures used to ensure quality. Software firms pay less attention to quality assurance as it is frequently the first area that is cut back when deadlines are missed (Miller, 2007). Software firms develop quality programs which include reviews, inspections and audits detecting faults/defects at early stages of the software development process and therefore, prevent wastage of project resources and diversion from user requirements. Companies also use automated tools for software quality assurance that helps the quality assurance professionals to perform their activities (see eg., Sneed and Merely, 1985). The most commonly used quality assurance standards are ISO 9000 series, Capability Maturity Model (CMM) and Capability Maturity Model Integration (CMMI). ISO 9001 is well established quality framework, currently being used by organizations in almost 170 countries worldwide (Yoo et. al., 2004). Coleman (2005) 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). In this paper, a study of software industry is carried out to find out the SQA trends and to investigate the influence of “age of quality” and “use of software” over SQA with respect to the critical factors of quality.

The main role of SQA (software quality assurance) is to maintain the quality of the software products [8]. For that it is to make sure that the standards and procedures are properly followed. Software Quality Assurance [1] standards are developed to help organizations to achieve quality products [3]. Standards are the set of guidelines which help to achieve best results. The standards and procedures include CMMI and ISO but it is difficult and costly for small Software Development Organizations to follow the standards. These software quality issues [2] are more prominent in developing countries like Pakistan. We have surveyed many highly ranked Software Solution providing organizations in Pakistan and interviewed many SQA employees. The analysis of those interviews resulted in pointing out some critical problems which are degrading the software quality. We have also suggested that how to cope with these problems. Also suggested how the relationship between developers and QA team can be more cooperating and how team leads should react to some problems to solve it. Following our guidelines organizations can achieve high quality and can provide more customer satisfaction.

In section 2, literature review is given. Proposed methodology is explained in section 3. In section 4 and 5 conclusion and future work are given.

II. LITERATURE REVIEW

Problem addressed in Agarwal et al paper [1] is to use methods and techniques which improve quality of agile methods, resulting improvement in software products. Agile method with some improvements was used for achieving enhanced quality products. Agile method provides easy and convenient way to be
followed and implemented. For improvement of agile method some features are suggested to be assured, like, agile method should be implemented in SQA as a whole instead of only testing, testing process should be done parallel to the development process, improve quality by getting feedback from users, select best language, avoid ambitious targets, negotiate properly with customer and use advance and competent process as well as team for developing a quality assure product. The proposed solution results a quality product up to some extent but it requires highly trained and professional team of developers i.e. the team should be kept trained and aware of the new and efficient technologies and languages.

Problem addressed in Raya et al paper [2] is that how to get quality assured and cost effective product which will meet the user requirements and expectations. And to select such a method which can reduce the failure chances of software development project, and also avoid the production of over budgeting and deficient projects. Agile method is used for achieving these aforementioned features. As contrast to non agile methods this method appreciates the involvement of customer in judging the software during development process. The strength of this process is the involvement of the stockholder to the development process. The suggestions made by stakeholder are implemented with the time and which result a good and quality product. This also reduces the failure rate of software developing projects. Also reduce the rate of over budgeting and deficient projects. The team must aware the stakeholder by providing a prototype which can be evaluated by him according to his needs. The changes suggested by the customers are implemented by time to time. This leads to an unbalance schedule and also renewal of the payment agreement is required. Which cause an over burden for the developers as well as for the management team.

In [3] Elrayyes et al. discusses software quality assurance (SQA) dependant factors with which quality improves in development of web application and propose a model in advancement of previous implemented model issues. SQA is an essential part of software expansion process with the fast technology and progress in software appliance and a planned and methodical approach to guarantee that software processes and product confirms to SQA goals. Numerous researchers have developed different quality structure i.e. Garvin et al. developed a quality framework considering an eight aspect product quality and Parasuraman et al. developed Capability Maturity Model Integration (CMMI). Beginning with the Capability Maturity Model of Software (SW-CMM) and now continuing with the CMMI framework software development organization have achieved momentous gain in their capability to develop and convey system with expected results. ISO 9001:2004 International Organization for Standardization is the world’s largest developer for standards. Proposed model helps to keep and advance quality in Web Application and model divide into three parts, the first part: server side, second part: Client side and the third part server side intersection client side and there party factors helps to enhance SQA. Server side factors are testability & flexibility, reliability, re-usability & maintainability and client side factors are portability & usability, privacy, correctness and standard design. Server side Intersection Client side Factors are Security & Efficiency, Integrity & Ethics. In this paper, they tried to resolve and add some new model to sustain the Website Quality Assurance. Since day by day users ready to use websites and applications converts the windows app to Web Apps and must enhance the Quality Assurance in the party of website from the client and Server Side. Different factors influencing and we have to save into website. For further improvement possible to create mode to check up all factors in model, to make sure that the factors work in true way.

In [4] Ali et al. investigates the role of quality organization practice in software production of Pakistan and a contrast between the more-experienced and less-experienced firms w.r.t significant factors of quality management. The serious factors of quality management in the software industry are first identified and validated throughout an experimental study. Quality in software trade is derived from three important sources namely people, technology and management. SQA provides means for monitoring the software engineering processes and procedures used to ensure quality. Software firms pay less concentration to quality declaration as it is regularly the first area that is cut back when deadlines are missed (Miller, 2007). Software firms extend quality programs which include reviews and inspections detecting flaw at early stages of the software development process and thwart wastage of project resources. Companies also use automated tools for SQA that helps quality assurance professionals to do their activities. In this paper, a study of software industry is carried out to find SQA trends and to examine the effect of “age of quality” and “use of software” over SQA w.r.t critical factors of quality. Difference between the firms that develop software for internal use and firms that develop software for commercial use w.r.t critical factors of quality. The results show no significant difference between the firms that develop software for internal use and firms that develop software for commercial use w.r.t Investment on SQA (PI), Strength of SQA Staff (SS), SQA Training (ST) and Automated Tools (AT). However, a significant difference can be observed between firms that develop software for internal use and the firms that develop software for commercial use w.r.t Quality Certification (QC). Only 2/6 factors i.e. QC and AT were found significant between “more-experienced” and “less-experienced” firms indicating that not much difference present between firms w.r.t critical factors of quality. Software firms in Pakistan needs to make improvements in their quality management policies, they can differentiate their products from others in terms of quality. In [5] Qazi et al. addresses that developing countries like Pakistan are struggling with software quality and cannot uphold standing in global marketplace. Software quality deficient due to many reasons. This paper will deal with predicaments for lacking concern in improving the software quality by higher authorities and software assurance team. In this white paper, many issues related to quality are identified. Major conscientiousness of the team managers to assist team and provide them the good working environment. There are many ways to improve the understanding like some proper training courses. Parnas et al. explained the required inspection in SQA to decrease the issues, how to find errors in software. Major methodologies behind the assessment action are dividing and conquer, it ensures to discover errors in development. Quality affecting factors were explained in the research of David et al. That model explained that the quality of the free software is higher than the other projects. The main issues addressed in this research contains
• Time
• Budget
• Less use of quality standards
• Lack of specialists
• Project durations
• Compromise on quality due to less profit
• Developer’s attitude
• Team formation for requirements gathering
• Politics

In this research SQA problems are identified to deal with those problems and improve the software quality. Software organizations get a reputable point in universal marketplace if they ponder on quality. SQA plays an important responsibility in business because the aspect which results in getting reliable projects from enduring customers is his agreement.

In [6] Muazzam et al. research SQA problems are identified and solutions are suggested to cope with those problems and improve the software quality in under development countries. Software organizations can only get a upright position in Global Market if they ponder on quality. SQA plays a very important role in business of Software Company because the only factor which results in getting consistent projects from permanent customers is customer satisfaction. Quality is an essential factor in software industry. Customer satisfaction only achieved by quality product by applying quality standards. The achievement of quality software is the high customer demands. Developed countries are excelling in software industry, at same time developing countries are struggling with software quality. This situation also has the impact on Pakistani software quality industry and cannot maintain reputation in International Market. Software Quality lacks due to many reasons, this paper address the problems and provide the possible solutions. In this paper author first of all discuss different software quality model e.g Parnas Model; this says the role of inspection reduced the quality problems. To find the quality factors and problems area for open source projects, in this research many interviews are conducted to find the solution of software quality for Pakistani or under developing countries. The main issues addressed in this research contains: Shortage of Time, Limited Budget, Less use of quality standards, Lack of specialists, Project durations, Compromise on quality due to less profit, Developer’s attitude, Team formation for requirements gathering and Internal Politics. Some solutions are suggested on the basis of survey and interviews. With the help of research, different procedures and standards are closely observed in highly ranked organizations. If these guidelines are implemented properly to solve Time (Deadlines), budget, skilled professionals and environmental factors. Then on average it increases the success rate up to 95%. Deploying CMMI Model, Certified and Specialized SQA Team, improve the developer’s attitude, Grip over the domain knowledge, implement the no compromised on quality policy, to avoid the internal politics, Schedule the time properly, estimation of cost accurately, implementation of quality standards and provide the training to all team members, division of project duration, good recruiting process, go for technical certificate, training session, seminar and workshop conduct to improved skills and attitude, right job for right person and control the environmental factors we get the good quality software product for market. In [7] Jain et al. discuss Agile software development approach has changed the way the Software’s are built today, unlike traditional development approach. Agile prefers short iterations (sprints) during software development and it would not be wrong to state that it has moved development from process oriented to people oriented. Agile methodology encourages people collaboration through the project and it responds to change quickly and efficiently as it is incremental and iterative. Due to the dynamic approach of Agile methodology the role of Quality Assurance becomes all the more important to ensure that that products are delivered to the client with highest level of quality as quality has always been the core focus of any company. This paper, will highlight broadly the role of QA within Agile development model, comparison of traditional and agile model, distinction of agile method, and discussed the challenges faced by Agile, strategies and how to help for improvement of software product, and discussed how to measure the quality of software product by using agile approach, with focus on fresh thoughts and approaches to improve the overall quality of product developed using Agile methodology. Big question is that how to ensure Quality of product developed using agile model. This poses a series of questions like: Role of QA, QA a skill, need members with QA backgrounds, Agile tester, and Are we ready to hand over the testing keys to the developers? Difference between waterfall- More properly called the ‘Traditional’ approach. It is the linear approach to software development. It represents a distinct stage of software development, and each stage generally finishes before the next one can begin. Agile - It is an iterative, team-based approach to development. This approach emphasizes the rapid delivery of an application in complete functional components. Agile different from traditional method its base on incremental & iterative development, Greater Collaboration (Process vs. People-oriented development), Responds to changes quickly & efficiently, Requires far greater discipline throughout the development cycle, Testing is done concurrently with implementation, Requires cross-functional teams and Every user story must satisfy the acronym INVEST: • Independent • Negotiable • Valuable • Estimable • Small • Testable. The goal of the Transition phase is to successfully deploy your system into production. This can be quite complex in practice, including training of end users, support people, and operations people; communication/marketing of the product release; backup and potential restoration (if things go bad); pilot/staged deployment of the system; formal translation of the and documentation; formalization of system and user documentation; and so on. During the release iteration there is still some testing at the end of the lifecycle to ensure that the system is ready for production. Test driven development is related to the test-first programming concepts of extreme programming. In test driven development, each new feature begins with writing a test. This test must inevitably fail because it is written before the feature has been implemented. In [8-10] Mathrani et al. illustrates the use of Managed Test Lab Model as a quality assurance strategy for distributed software development, Control mechanisms are deployed on an online framework for ongoing development and verification with appropriate toolkits to support the evolution of software artifacts and be better informed on quality processes. Distributed software development is becoming the standard as it is measured as more cost effective way of developing the software. Businesses seek to shrink development time with parallel teams spread across geographical spaces as they jointly
collaborate in designing, building, and testing the evolving software artifacts. Methods have been employed to investigate how a shared virtual platform is deployed by development teams across three countries – Japan, India, and New Zealand. Iterations of testing and verification tasks are linked to responsibility matrices outlining the nature of work breakdowns, work allocation against time and budget constraints, and for overall guidelines for coordinating development, verification, and validation tasks. MTLM further lays out the process for analyzing test reports, status reports, and log files for identifying defects as soon as they arise to ensure no last minute compromises jeopardize the project schedules. The files are jointly reviewed across locations to monitor the nature of testing activities and provide assurance on effectiveness of quality levels. The transparency of testing activities basis for future profiles in creating new test suites, vendor aims to be involved with client application much earlier than the go-live stage, testing is an ongoing activity alongside software development, and if the managed test lab is used at the alpha or preliminary stage of testing, revisions to the software module will be minimal, the vendor will operate alongside the client under the managed test lab environment and work towards a concentrated verification and validation strategy from the initial stage. However, a number of challenges remain in this model, as balancing services and resources online across client and vendor teams is context driven and requires customized installations across the virtual platform. Further, if either side is less cooperative, the test lab or sandbox environment may not result in adequate testing. Reporting of defects can be rectified pro-actively with proper code reviews, updates, or patches which can then be immediately transferred onto the managed test lab for further verification is still an issue. Testing at offshore site performed concurrently with software development, which enhance productivity, reduce cycle times, and be more cost effective to the client, since operational costs not confined mainly during the development phase. But the vendor too cannot be involved in commissioning functional and compatibility testing during earlier phases of development before the system/integration testing phase is conducted. And the roles of developer and third party tester merge, as they jointly share details during the built, operate, and transfer phases. The managed test lab model cannot be extended to cover the verification from an early stage in the software development cycle. This Project development in the software development process is no longer localized to one geographical site, but has been extended to a global environment within appropriate technological configurations in place for confidentiality and security.

III. RESEARCH STUDY

Our base research spans of [6] was target to eight highly professional and competitive organizations in Pakistan, and they conducted interviews of highly skilled and experienced professionals from those organizations and then the critical areas are identified but we find to quality factors and problem selected 36 highly professional quality assurance testers and developers from open source projects, in this research we used questionnaire method to find the answers related software quality assurance implementation in developing countries. The research covered as two sections and thirty four questions are included, to find out the software quality assurance issues and their proposed solution. Questionnaires are distributed among all quality assurance testers and developer.

In this paper as shown in Fig 1 we evaluate the different problems of SQA in developing countries as:

Section 1.
1. Shortage of time
2. Lack of resources
3. Standards are not followed
4. Individuals perform multiple tasks.
5. Project plan are not followed by all project members.
6. Compromises on quality
7. Developers attitudes are no cooperative
8. Requirement phase is not critically analyzed.
10. Products are not tested as per test plan.
11. Use shortcut method for testing.
12. Not giving importance to design and coding phase
13. Not proper follow testing rules
14. No checklist followed in whole SDLC
15. Joint application development tools are not used for the customer involvement
16. Size, cast and timing documents not used for the tracking of software
17. Manager and technical procedures not followed

Section 2.
18. Tester not fully informative, functionality of software being tested
19. Not provide proper training and enough experience for Requirement development & management activities.
20. Contractual Requirement change impact not evaluated on whole process
21. Complexity and size of software packages is a challenge for SQA implementation
22. Greater Accuracy, Complete & shorter reaction time problem creator.
23. Increased customer tolerance level
24. No use of extended professional standards
25. Commitment issues
26. No Fair SQA policy in written form
27. Not provided enough resources for proper planning
28. Planning process not strongly support entire life cycle.
29. SQA activities not properly planned
30. Weak Objective verification process
31. SQA reviews and audits result live impact on individual job.
32. Non-Compliance not properly communicated with senior management
33. Contractual Requirement change impact not evaluated on end users & stack holders
34. Not Periodic and even-driven basis reviewed of requirement development & Management activities

As shown in fig 2, the proposed model give more focused on the planning and requirement phases, because they are critical areas if we success to cope these area then it bright chance by following of plan get quality product. training and meeting with stack holder is much important for the software quality assurance, because training change the developer’s behavior and meeting developed the trust on team lead.

IV. CONCLUSION AND FUTURE WORK
In existing research authors find the different quality factors which are hurdle for implementation of SQA in under developing countries, they completed the survey by adopting interviews method. In our survey we included twenty SQA. According to the identified problem we proposed a software quality assurance model to reduce the issues and used this model for improvement of software issues and used this model for improvement of software quality. One thing we noted, all software houses admit about lacking of software quality, but not provided picture of their company experiences, as their result to find the real scenario of Pakistani market. We will enhance our area of research about software quality assurance issues and there feasible solutions not only from software houses from different universities and involved all stack holder which indirect or directly affected by low quality or related issues. In current research we only target the problem identification and their proposed solution, but in future we will try to identify the probability of all indentified issues and their impact on product and customer’s trust.

V. REFERENCES


