Approach to improve software quality assurance in emerging countries

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Abstract— The most vital component in software industry is product quality. Quality of software is a bug free product delivered on time by meeting customer's need. Quality of product can be attained by implementing standards to meet customer demands. Emerging countries are growing their market. Emerging countries like Pakistan are striving for software quality but cannot sustain their standing in international market. In this paper we will discuss the problem that is faced by the organization to maintain their reputation in international market. It also addresses the issues for lacking of software quality by organization. We also provide solutions to enhance quality of software by having direct relation and communication between organization and quality assurance team.

Index Terms— Customer Satisfaction, Customer Demands, Excelling, Reputation, Quality Assurance, Quality Procedures, Quality Factors

1 Introduction

Nowadays IT industry is growing rapidly. To accomplish better place in market of IT industry, an organization must need to assemble quality products [1]. Because of high challenge, it is exceptionally hard to expel errors from the product subsequent to delivery. It requires much effort to remove errors after shipping and likewise impacts organization's repute in market. A legitimate quality steps can assist an organization with avoiding from this issue [2]. Software quality affirmation assures the quality of the product. Issues identified with software quality are confronted for the most part in immature nations where associations have fewer budget plan, less resources or deficiency of experienced people of software industry. It is vital for each task to clarify its particular critics of software quality amid the planning stage. Quality assurance standards [3] are constructed for organizations to help in achieving quality of product which incorporate CMMI and ISO however it might hard for small organizations to use as they are expensive. The product quality issues [3] are increasingly apparent in immature countries like Pakistan which lead toward the debasing of software houses.

We highlighted the most prominent organizations in Pakistan who provide software solutions also performed questionnaire and interviewed their developers and SQA team. Our analysis of survey pointed some basic issues for debasing of software organizations and furthermore proposed for their enhancement.

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We additionally centered around connection between QA group and software developers to be helpful and how group leads ought to react to take care of the specific issue. Software Organizations can accomplish a quality item and consumer satisfaction by our given clarifications.

2 Literature Review

We relate numerous problems about quality and responsibilities for management to identify those issues in this research. Administration plays an essential role in the Software Quality Assurance [5] and they are responsible to provide a good working environment. They can provide some formal education to their staff to improve their knowledge in particular project. Seminars or meetings with different expert in domains also helped to improve their knowledge. [6]

Question stated in Ray's paper [4] is that how to certify cost and quality effectiveness of product that will encounter the user need and to choose such a method which can help to avoid over budgeting and minimize failure chances of software. The proposal given by stakeholders are implemented in time results a quality production. This extends to disturbed timetable and also require repetition of the payment contract which causes an extra burden for managers as well as developers who are working to meet the customer's requirements..

Elrayyes discusses [3] how to enhance quality in web development by using Software Quality Assurance and avoiding the problems that were faced in the past. SQA helps to expand the software system using modern technology. Researchers have improved various quliaty artifacts i.e. Quality Framework was developed by Garvin [3] which was based on eight aspects of the quality and CMMI(Capability Maturity Model Integration) was developed by Parasuraman. By following CMMI , capability of organization to develop high quality products has been increased . International Organization for Standardization also makes standards to enhance quality in web applications. It has provided a model that classifies a web application in to three parts: server side, client side and server side intersection client side. Internet users are increasing exponentially they use websites and applications, so the website's quality should be assured from both server and client side.

Ali [7] researches and compares the more experienced and

less experienced firms in software industry of Pakistan in the sense of quality. Experimental study helps to find and distinguish the quality factors. Quality is achieved through management , people and technology. Miller says that when the deadlines are near then quality gets compromised. Reputed Software organizations start to ensure quality at starting stages of the development so to they save customer's time and money. Automated tools are also used to assure software quality. In this paper study shows that difference between the more experienced and less experienced firm is based on Quality Certification and Automated tools. If Pakistan's firms want to differentiate their products from other they should improve their policies related to the quality.

Qazi et al. [8] stated that under development countries like Pakistan are struggling hard to maintain software quality in international market. Software Quality is get affected by many reasons. This paper tell that quality goes down if specialists don't do their assigned work efficiently. Quality can also be increased by training the people who are working on the software products. Trained person can pay attention while developing the product . Parnas et al. [2] explained that divide and conquer method can be used to identify and minimize the issues/errors in software. David et al [13] explained quality affecting factors in his research . His research contains following factors:

- Project Time Period
- Allocated Budget
- Fewer usage of standards for achieving quality
- Lack of particular Area Experts
- Project durations
- Determine quality due to inferior benefits

3 RESEARCH STUDY

Software in most recent couple of decades, has caught a premier circular segment of mankind. It is presently not a result of self-assertive and impulsive practices and simple programming exercises. Present Software items are built under the act of utilizing chosen process methods to enhance the quality of a product improvement exertion.The need of choosing and following a formal practice for software advancement is to give wanted control to convey the quality expected for business achievement and maintaining a strategic distance from the wastage of time, misuse efficiency, dampening in developers etc.

To find quality factor and problems [14], this research contains questionnaire. We send formal questionnaire to different quality assurance engineers and developers who gave the answers of questionnaire which were collected and explained their findings. Questions are related to quality practices and development which discussed that how documentation, fundamental base and processes cause the lack in software quality. In this research we revealed some leading quality issues including coding, bugs reporting, security and communication problems. Much quality aspects with the help of this research are known which cause problem for software development. We did questionnaire and interviewed top 10 most competitive organizations in Pakistan in term of questionnaire and got positive respond from these organizations. Their most experienced and high skilled developers and software quality assurance engineers filled out the questions which leads us to find the critical issues as a result of this analysis. Our survey divided in four major categories including 55% software development companies, 15% Product oriented organizations, 20% Project oriented companies and 10% IT solution provider.

Figure [1] Organizations Surveyed

Our Questionnaire divided into four major categories shown in figure [2]:

Figure [2] Questionnaire

Questionnaire contain 51% Software assurance engineers, 33% developers, 9% SQA team and 7% quality managers. The research contains the most fundamental issues :

- Time of project
- Allocated budget plan
- Fewer usage of standards for achieving quality
- Lack of particular area experts
- Determine quality due to inferior benefits
- Developer's mannerism
- Collaboration of team for requirements gathering
- Internal House Politics.

3.1 LACK OF PARTICULAR AREA EXPERTS:

Software companies in evolving countries often have insufficient SQA and testing teams. Developer often performs responsibility of testing in small companies that is the main reason of lack of quality. Testing becomes ineffective if developer is performing on his own code. In many cases quality is con-

sidered as the functionality of the system, that approach lessens the reputation of an organization.

3.2 FEWER USE OF QUALITY STANDARDS:

CMMI and ISO are the quality standards that are used to enhance product quality . Due to lack of resources like team members and budget it becomes difficult to follow a standard to achieve a required quality. This absence of quality standard in small organizations leads to the poor quality of software , that can cause a failure which may require more cost to remove.

3.3 DEVELOPER'S MANNERISM:

Software quality assurance team can face difficulty while interacting with developers due to communication gap of misunderstanding. For example it is reported that developer don't cooperate mostly with SQA team because they believe that they have written the code in right way. Some times lack of domain understanding can create problem for developers as well as SQA team. Problem of not appreciating someone's work also exists, that effects the environment of cooperation in negative way, it also effects the quality of the product being created.

3.4 IMPRACTICAL DEADLINES:

Quality of the software also depends upon the time period[12]. Many times teams have very short time to deliver the product that effects the quality, teams have to compromise on quality by only fulfilling the functional requirements. Much of time is also consumed on learning and discussing domain knowledge. Domain knowledge is very necessary to make quality products. Because if a developer or tester don't know the domain completely he can make severe mistakes that may lead to wrong output of the system or failure.

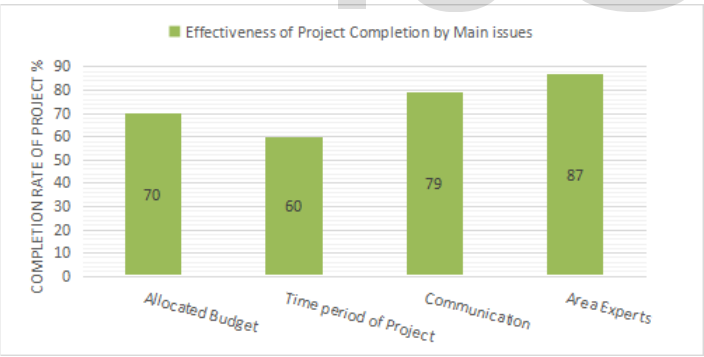

Figure [3] Effectiveness of Project completion by main issues

3.5 DEPENDENCY OF TEAM ON QUALITY:

Quality of a software is directly proportional to the team members' expertise because if the team members are expert in specific domain development then they can easily understand the problems and make preventive strategies to error of failure. If the requirement gathering team is expert then all the feasible functional requirement will be gathered. There should be representative of SQA team in Requirement gathering [13] team to avoid any problems in future. But if the project has low budget then companies engage few number of persons that causes low quality. Projects with More profit margins attracts the team members to work on. Quality of that kind of projects is also check frequently. Clients that come from foreign countries demand high quality product and they pay for it. This is reason developer perform efficiently on foreign projects. They also fear that their foreign client may hire third party team to assure quality to they work on projects with quality plan. Organizations also consider that local clients don't have much technical knowledge as compared to foreign client, this perception reduces the quality of project that comes from local client

3.6 IN-HOUSE POLITICS:

Sometimes quality of software gets effected due to internal politics of the organization[11]. Like other fields leg pulling is also a prominent problem in IT industry. Experience and relations are used to get the high post in the organization to become more powerful. Gifts are exchanged to get more favors in the organization

4 SUGGESTIONS

Suggestions are given based on our research that how organizations in emerging countries improve their quality of product.

4.1 IMPLEMENTATION OF CMMI :

CMMI defines standardized processes to achieve quality. A lot of time and budget is required to implement CMMI but product that are created are quality products that meet customer's requirements. It also increases the reputation of an organization because by following specified processes , organization achieves levels of quality that are pronounced as CMMI level. There are five levels of CMMI. Any organization that is following CMMI, is creating improved quality software.

4.2 CERTIFIED AND EXPERIENCED SQA TEAM

A company must have a experiences SQA team to make quality products. If a coder is also doing testing then he will not be able to do effective testing of the system he developed, because he is not going to prove himself wrong. Experienced quality assurance team member should assure that all the processes are followed to lessen the faults in product. They also help the developers to know upcoming issues and how to prevent them. So, to improve the software quality SQA team is necessary.

4.3 DEVELOPER'S ATTITUDE:

To improve quality of software healthy relationship between SQA team and developer is necessary, but usually it is not seen existing. Team leads and managers should play their role to decrease the differences between both developers and SQA team because quality depend upon these both parties. Both should be taught to work collaboratively in workshop and training sessions. They should also be assigned tasks which are done with collaboration of other members. They should think positively and should consider other person a source of knowledge. Gatherings should be arranged to make environment of harmony and interaction with one another. Managers should get help from other expert members to make their organization's members able to work with other persons.

4.4 COMMAND OVER DOMAIN KNOWLEDGE:

Quality of a software is get effected if developers or SQA team

has insufficient domain knowledge. In the process of requirement gathering SQA representative should be involved to analyze the requirements according to quality perspective. Domain understanding will also become easy for SQA team in this way. SQA representative can help to reduce errors by knowing the probability of occurrence of errors. If the team has worked on the project of same domain then it will be easy for them to complete their product in short period of time because they know the domain sufficiently.

4.5 NO COMPROMISE ON QUALITY:

Usually in developing countries only those projects are focused which have strong business, so the local projects are ignored. Working on foreign projects SQA teams get more salaries that working on local projects. Profit margins are the only reason to compromise on quality because organization get more profits from foreign projects. So they work on more foreign projects and pay less attention to local projects, this lead to decrease of quality of software. Organizations should pay proper attention to deliver quality software regardless of the profit margin. It should be ensured by the higher administration that there is no compromise on quality of project without the difference of foreign or local project. Numerous highly ranked organization avoid to work on local projects just because of profits margins. This can be better approach if you are unable to handle quality on the basis of profit.

These guidelines are based on experienced SQA group leads from various software organizations which positioned on CMMI 4 and level CMMI 5 in Pakistan. With the help of our research diverse procedures and standards are firmly observed in exceptionally positioned organizations, guidelines on premise of this analysis are given. These guidelines are also helpful for already developing high quality product organizations.

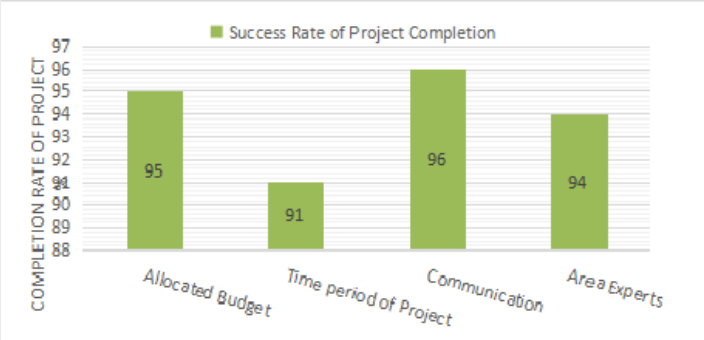

Figure [4] Success Rate of Project Completion in %

Shown in Figure [4] that if we follow these guideline, software success rate improved. If organizations implemented these guidelines in proper way to solve the critical issues including Allocated Budget, Time Period, Area Experts and Communication between developers and SQA team then the average success rate must be above 90%.

5 DATA VALIDATION

The research is implemented on many develop projects. Firstly we discovered the upcoming errors and problems in deploying stage. Furthermore we applied our suggested idea on them and again determined the results. Our finding end up on main determinant factors considering lack of area experts, non-certified SQA team, non expert domain developers and somehow internal political issues.

Then we observed the success rate of project completion when it given to area experts and non area experts. It sum up in the form that 99% success rate calculated when given to area experts and only 75% of success is calculated when project is in hand of non area experts.

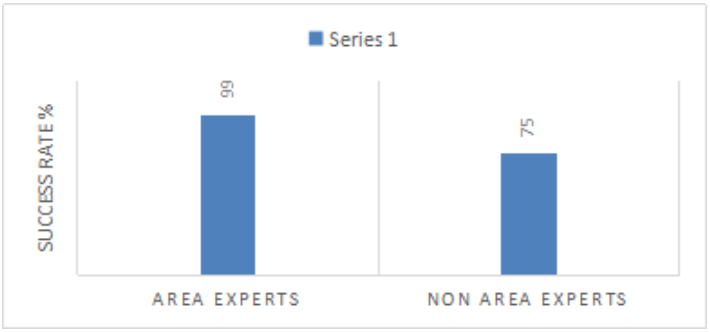

Figure [5] Project Success Rate Effected by Non Area Experts

Then we guided some expert developers to improve these critical issues and as shown in Figure [5] when job is given to right person rate of success reached to its peak. Experts assures that how to solve the particular problem in their areas.

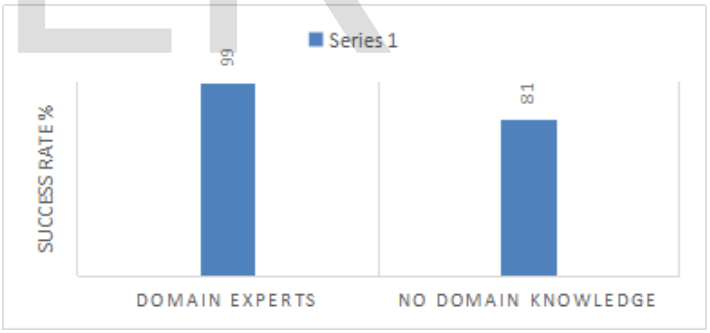

Figure [6] Effect of Domain Experts

Shown in Figure [6] that Domain knowledge is also a critical issue when lacking in quality. If manager improves the domain knowledge of developers then it definitely help to get maximum success rate. We observed a project success rate when delivered to domain expertise member and results sum in the form that success rate is 99% as compare to just 81%.

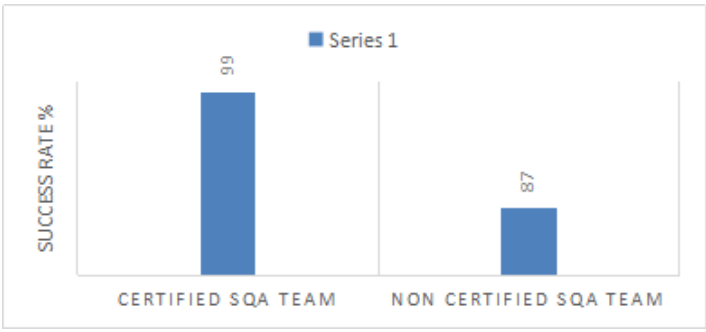

Figure [7] Effect of Certified Team on Success Rate

One of the major factor in SQA is certification. Company must spend more money to get certification of their employees in new technologies. With addition in success rate to 99% from 87% it also increase the reputation of company if it gets more certifies employees.

6 CONCLUSION

Software should be created with formal and standard practice. This research contains SQA problems and how to get rid of them to improve software quality. By adopting formal development process with well defined policies, correct products can be made which meet the customers needs and post development cost can be reduced. The most important factor in software industry is customer satisfaction and SQA plays a vital role in it to make your permanent customers by developing a quality product. Day by day complexities of software projects are increasing, customer want to get high quality product in low price and on given time so the continuous improvement in development processes and standard leads it to take place..

ACKNOWLEDGMENT

We might want to thanks Miss Maria Latif because of her assistance and direction in concluding this research work and we expect that this exploration paper will be useful for different researchers in future.

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