

An Approach to Improve the Software Quality Assurance

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Abstract: the demand for software and the expectations are getting increased day by day. Due to this, a heavy competition prevails in the software market. Quality becomes the important criteria for all the software industries in the market. Quality checks how well the product is built and makes sure all the user requirements are fulfilled. Measuring quality can also help in finding priorities in the user requirements and makes it easier for the developer as well as the whole project team the areas which needs to be concentrated more. Many countries like U.S, India have occupied the top position whereas countries like Pakistan are still trying to maintain the reputation in the International software market. This paper describes the problems related to establishing the quality assurance department and managing quality assurance, all the possible solutions to eliminate those problems.

Keywords: Reputation, Demands, Expectations, Requirements.

I. INTRODUCTION

As said earlier quality plays an important role in developing a software product. Quality can also be explained as transforming the user needs to some measurable characteristics. Software quality can be of two types- software functional quality and software structural quality. As the name itself refers Software functional quality means how well the product meets the functional requirements and how well it complies with the design. Software structural quality refers to the product compliance with the non-functional requirements such as maintainability. After the product is delivered to the customer, making changes in the software affects the reputation of the organization and this can lead to losing valuable customers. There can be many reasons for poor software quality and one of the main reason is improperly defining the objectives, improperly defining the QA department accountable, misinterpretation of QA departments responsibilities, releasing the QA department obligated for project, avoiding, misinterpretation and dispute risk, the QA department is marked down the organization, QA department is lacking in reporting are the other reasons for the poor software quality. Hence, quality assurance can prevent defects in the produced software. Quality assurance refers to the set of activities and procedure to check all the goals and requirements are fulfilled. SQA (Software quality assurance) helps in maintaining the quality and checks that all the standards and procedures are properly followed.

II. LITERATURE SURVEY

For the quality to be achieved through software quality assurance, establishing QA department and managing the quality are very successful techniques. The software quality assurance itself contains various standards. The main goal of establishing QA department is defect finding. QA department conduct the inspection. As defects pop ups from the existing work product the inspectors will not approve until the defect being removed. Inspection techniques have been evolved and modified throughout the years. Quality planning is a set of procedures which are used in the on-going project and product development. Quality planning makes sure that the products are unflinching. This uses quality standards and procedures to ensure quality in the system and the developed product.

III. RELATED WORK

Code Review:

As, humans write the code for developing a project there can never be error free or a bug free code. The code will be having some or the other mistake and hence automated code reviews can be done. Or the other way can be giving the code to some other person in the development team who has not been involved in developing that set of block of code. This inspection is done on a small set or a block of code to check whether specified function of that block is done. This can help us to find the incorrect code and the errors of the developer which do not satisfy the requirements of the customer. This also helps in better training of the developers and can identify the areas they lag.

Peer Reviews:

This model describes about the importance of the recommendations of the customers. Continuous feedback is always taken back from the customer at each and every stage of the project development. As the feedback from the customer is taken at each and every stage of the product development the faults and defects can be rectified at a very early stage. Hence, earlier the defect detection more revenue or the return on investment for the organization. Another way of peer review is software walkthrough. This method differs from all the other methods. Compared to other technical inspections and reviews software walkthrough is more open. The inspectors can suggest undeviating alterations on the developed product or the software and hence deficiency of motivation on the training regarding the process improvement.

In view of quality planning management, there exist various tools and techniques for making the quality of the project more reliable:

Cost Benefit Analysis:

Cost benefit analysis is mainly used in government and other private sector organization. Cost benefit analysis means to identify the best practices that can be used for the development of the product or project which also checks the feasibility of the chosen practice and also in terms of the cost constrains. They simultaneously analyze the benefits and the cost of attaining those benefits. After all the analysis then we come to a final conclusion which practice to adopt. Cost benefit analysis approach gives us a proper investment criteria and their feasibility. Another purpose of cost benefit analysis is that it provides a platform for comparing other similar projects and to check how much the benefits overshadow the cost. Cost benefit analysis not only checks for the benefits it gives equal importance for negative aspects of the project too. It also provides a platform for risk analysis and ambiguity associated with the project. By dropping the positive and negative influences of a project to their comparable money value Cost-Benefit Analysis administrates whether on stability of the project is meaningful. Finally, we can say that cost benefit analysis gives us clear path which is unsurpassed for us. Cost benefit analysis need not to be performed manually, there are many tools available in the market which makes this analysis automated.

Benchmarking:

Benchmarking is a method which compares the process and metrics of one organization to the best practices of other organization which is available in the current market scenario. It means using a specific indicator for measuring the performance of one business organization. There is nothing called specific benchmarking procedure or a process which has been universally followed but after series of research benchmarking have been finalized into a 12 stage methodology.

Software quality assurance has various standards as listed below:

- ISO 9000- The ISO 9000 group reports the various phases of quality management. These standards ensures the product satisfies all the user requirements and the developed product is up to the stated quality.
- CMMI- (Capability Maturity Model Integration) CMMI is a method of developing and improving the current business process to meet the business target of an organization. There are various maturity levels in CMMI- initial, managed, defined, quantitatively managed and optimized.
- SW-CMM (Software- Capability maturity model) - The main aim of CMM is to improve the current business process in terms of their quality. The term maturity denotes to the amount of correctness and optimization of the business process.

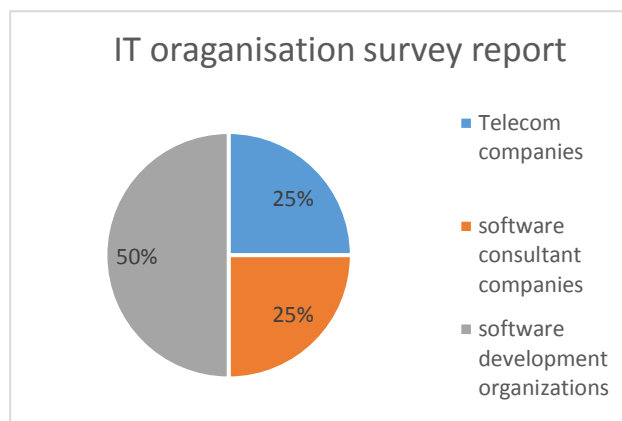
Agile In Quality Assurance:

Some of the agile methods can be used for improving the software quality assurance. Agile methods must be implemented on the whole to the project rather than only focusing on the testing part. Continuous feedback from the user, choosing the best language and evading uncertain targets will help in the quality development. For a product development we have to choose a technique which cost efficient and able to handle risks in a proper manner. Agile is used to attain above-mentioned features. The major strength of the process is the degree of user involvement and the suggestions made by the stakeholders are implemented in the project from time to time to achieve best quality of the product. The usual phenomenon which occurs in an organization is that when the deadlines starts nearing or when the deadlines are missed the importance on the software quality assurance gets reduced as the whole team will work to their fullest just to hand over the final product to the customer rather than too much of testing and checking the quality of the delivered product.

IV. RESEARCH STUDY

As a research we conducted interviews of highly skilled and experienced people of an organization and identify the critical areas of the project. Using a questionnaire method this research was directed to find out the software quality assurance issues and their proposed solutions are analyzed.

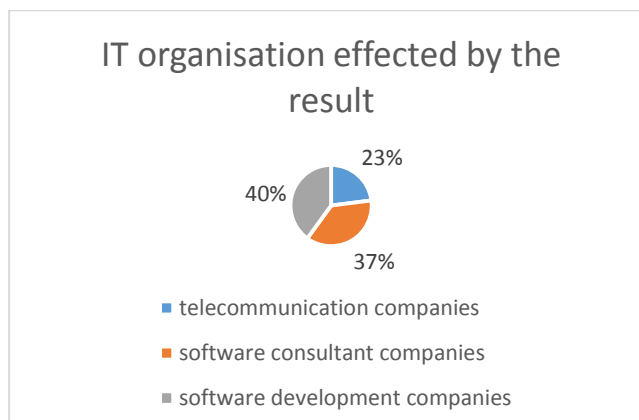
We have conducted interviews to highly skilled professional from high reputed software organization and as a result of the analysis we have found critical areas. We have surveyed three major categories of organization 1.there are 50% of software development organization, 25% of telecommunication companies and 25% of software consultancy companies.



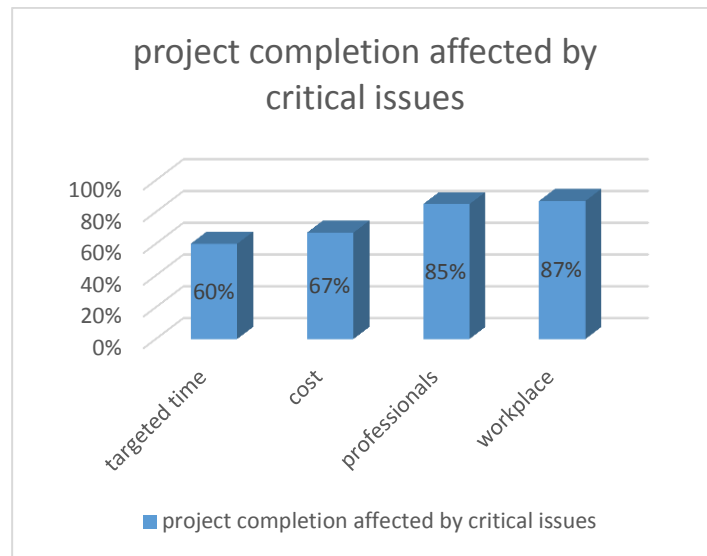
Interviews are distributed into three major categories

V. PROBLEMS IN SOFTWARE QUALITY ASSURANCE

Software industry struggling in developing countries like Pakistan, there are many reasons behind that, some of the reasons are discussed in this research paper. The survey says that the company has severe impact on this critical issues



40% of software development organization, 23% telecommunication companies and 37% of software consultant companies are effected by the critical issues.



Properly Defined Objectives:

The primary objective of a QA department should be able to ensure successful projects. This may seem obvious, as stated or followed.

Most of QA departments are established without a well-defined objective or with an objective something like,

- Improving quality
- Achieving CMM level x
- Implementing a new methodologies
- Process improvement attributes activities.

These objectives may be considered as good secondary objectives, but they are not considered as successful projects. In order to define a proper objective should focus too much on any one goal. (e.g., date, budget, user requirements, etc...).

For example, IBM had a better operating system with OS/2, but lost the marketing battle to Microsoft's windows because IBM was too late getting to market, similarly many software companies releases their products before they were ready. Due to improper definition the clients might not be satisfied and this may not lead to business profits.

Improperly Defining Qa Departments Accountability:

Ensuring successful projects requires a QA department to work with project managers. QA department's responsibilities goes beyond by defining the responsibilities of the QA group to be just defining process and conducting reviews. The QA staff should work more closely. QA department must take responsibility with the project manager for the success of the project.

There might be no experienced staff. QA staff will need to understand the issues such as,

- i. User involvement
- ii. Budget
- iii. Calendar
- iv. Technology

The QA department must be staffed by people who will be respected by the project manager. There must be an effective working relationship with one another. The project manager should take the responsibility of working.

Misunderstanding Of Qa Department's Responsibilities:

If senior management does not understand their role in the QA process, then QA department is ruined. The defining moment comes when senior management decides how to staff the QA department and determines where it will fit in the organization.

If the QA department is not led and staffed by personnel who have the respect of both senior management and the project managers, then it is ruined from the start

There might be no proper coordination between the project manager and the QA department. The project manager starts complaining about QA staff such that they are not understanding our business or staff does not know what they are talking about. If QA departments are not staffed appropriately and does not have clear understanding of its objectives, this complaint may be valid.

Management focuses on budget time, it always tempted to reduce or eliminate the QA department's budget. The senior management does not understand the QA department's contributions clearly. This occurs due the misunderstanding of project managers and the QA staffs. When there is stalemate between the QA staff and project manager, senior management should prepare to resolve issues.

Releasing The Qa Department Obligated For Project:

Accountability comes with responsibility, if QA department is responsible for ensuring success, it should also be held accountable. If senior management does not hold the QA department accountable for unsuccessful projects, it is a notice that management does not believe in the value of a QA department or the capability of QA staff.

Both the QA staff and project manager are accountable for the success of a project. If the project is unsuccessful then both the QA staff and project managers would be called into a meeting with the president. If QA staff could not resolve issues with project manager, then it would be reported to senior management to resolution.

Avoiding, Misinterpreting Or Dispute Risk:

Risk is inherited in software development. The risk of delaying a system and forgiving possibly signifies the benefits.

The risk cannot be eliminated but can be reduced; the goal is to understand the risk. QA is really a form of risk management. The problem might occur due to integration and the improper measurements.

The requirements might not be clear, no proper estimate documents and misunderstanding of requirements. Communication between features might not be up to the level.

Qa Department Is Lack In Reporting:

Even if QA department is doing a good job ensuring successful projects, the QA department may not be secure. The QA department may be eliminated if senior management does not understand the contribution of what QA is making. The QA department needs to produce a deliverable that senior management wants, such as a report that includes the following kinds of information:

- Project status information: Qualitative and Quantitative status.
- Critical metrics information.
- QA activities.

The QA Department Is Marked Down In The Organization:

The QA department must be a look closely or positioned higher than the application development organization. The QA staff is responsible for conducting the reviews. It should be look closely or higher than the project managers.

The QA department is positioned too low in the organization such as,

- It cannot be staffed properly because of compensation, skill issues etc...
- It is more difficult to influence project managers if the QA is not a high level.
- It is more difficult to raise issues to the proper level of management that can resolve them.

The QA department is not concentrated on the software quality; they have been addressing more importance to corporate quality objectives (e.g., manufacturing quality, service quality etc...) they did not have much impact on software quality.

The QA department needs to understand software development and to work closely with the people developing in software.

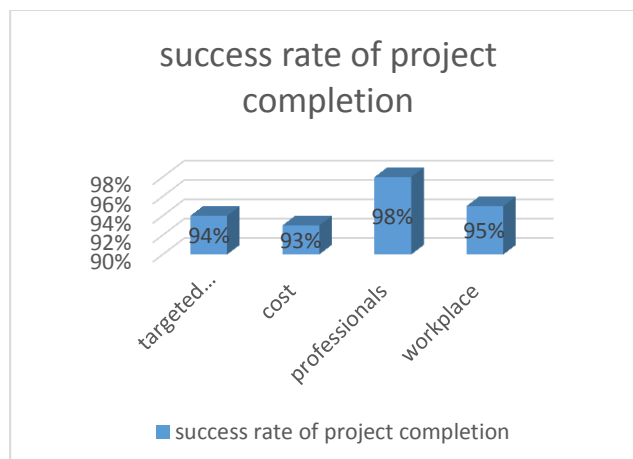


We have interviewed highly skilled professional from highly reputed companies, interviews conducted to the professionals include 21% of project manager, 53% of QA teams and 21% of senior management. The main problems identified in this research contains

1. Improperly defined objectives
2. Improperly defining QA departments accountability
3. Misinterpretation of QA departments responsibilities
4. Releasing the QA departments obligated for projects
5. Avoiding, misinterpreting or dispute risk
6. QA department is lack in reporting
7. QA department is marked down in the organisation

VI. RESOLVING ISSUES

Some of the proposed ideas are on the basis of survey and interviews conducted to the highly skilled professionals. With the help of our research, procedures and standards are closely noticed and guidelines are provided to those QA teams in order to establish the QA departments, improve the quality of software and to increase the success rate of project completion.



These guidelines can also be used for those organizations which are already developing highly software products and also maintains the quality of software products.

Objectives Properly Defined:

Some of the secondary objectives of the system are

1. Quality improvement.
2. Improvement of process.
3. Attaining CMMI level X.
4. Improving process.

These are the secondary objectives that are need to be properly defined. Although despite of achieving secondary objectives, it is more important to achieve the primary objectives that make sure the project is successful. To achieve primary objectives two major criteria are to be considered.

1. Customer requirements should be properly met and should satisfy the customer needs.
2. Business should gain profit

Avoid projects like which would be in doubt to meet success. Such projects would have no adequate resource supplements. Allocate the resources that have more impact. QA department provide resources to high risk project to low risk projects in accordance with the rank. This may be differed with low risk projects. Discuss the problems and risk issues with the senior management. Senior management will resolve the problems and provide key decisions appropriately.

Defining the QA Department Responsibilities Properly:

A QA department staff should perceive the significance of the problem that lead to project success. A QA department staff should also explain the scope of the process that will result in the success of the project. A QA department staff are to be respected by the project managers and QA department should develop the efficient and desired working relationship with the project managers.

Understanding The Responsibilities Of QA Department By The Senior Management:

A QA department furnish a consequences of checking and balance on the process. If the responsibility of the management is satisfied, the review conducted by the QA team will identify the problem in the early stages. It is common for more importunate responsibilities to draw away the attention of management from paying the close attention. In such situations, the projects can be checked in accordance with the consequences of service by a QA department. An independent and objective perspective can be furnished by the QA department. A QA department is appropriately responsible for the process.

QA Department Is Accountable For Project:

If there is a deadlock between the project management and QA staff, senior management should be formed to resolve the problems. Resolving increased problem will provide the senior management a capability of understanding the truth into the most important problems, which determines who is the responsible for the problem, whether it is QA team or project management. In few cases, user management may be root of the problems. Attention of senior management may be needed to resolve such problems, senior management should be formed for frequent increase in the early stages of the QA department. Quarrel between the QA team and the project management should be minimized, as they establish working relationship with each other. In some rare cases, the problem should be escalated to make a higher decisions. There is a situation in which the project duration plays a major role, in such cases the QA department might feel that project did not ready for delivery. Such problems are to be resolved by the senior management and provide a business decision.

Resolving Ignoring, Misinterpretation and Disputing Risk:

The risk/issues affiliated with the target time and cost estimate are to be documented in the estimated documentation with the proper and clear communication of the risk/issues to the senior management by including the assumption with the estimate is one of the better way communicate the issues associated with the estimate. The associated risk with the user

requirements are to be estimated by involving the user in the developing stages of the software only if the requirements are not precise and not well understood. High-risk piece of system are given high priority in testing. To find, communicate and point the risk, metrics is the powerful approach.

Providing Higher Position To The QA Department:

QA department should be positioned higher or to be part of the development of application team. QA department is responsible to conduct reviews at the thing which is equal in ability or standards level should be higher than the project manager. The QA department should concentrate more on development stages and should move closely with the people in the development team.

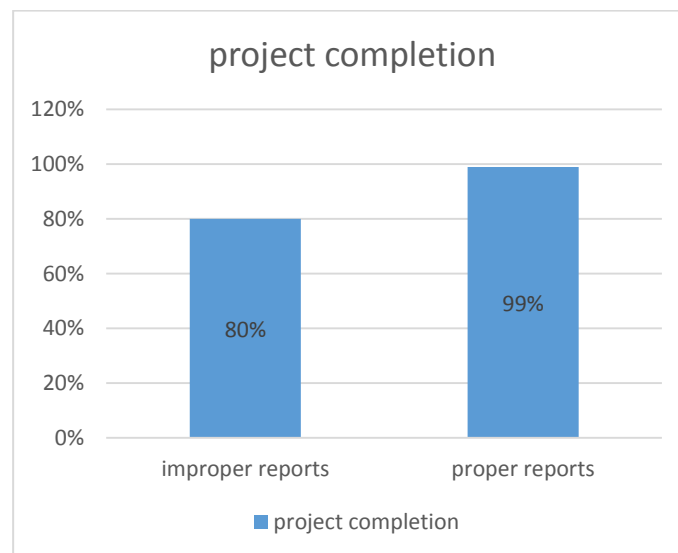
QA Department Reporting To Management Appropriately:

QA department may provide insufficient report to the management. To resolve this issues, the report should include the following criteria.

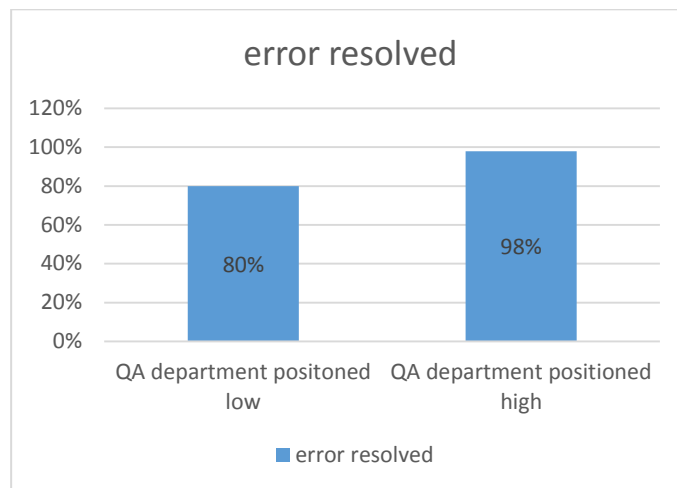
- 1. Critical metrics details and project status details:** The main objective of this criteria is to provide a management easily understandable, yet a capability of understanding the truth, quantitative vision of status of the project. This project status details from distinct project status account would be reported and make into a critical metrics reports.
- 2. Information of the measurable project status:** the main goal is to give measurable project details which is analyzed and make appropriate recommendations.
- 3. QA activities:** A QA department should discuss that what it is done to the organization to add values that are not reported in the above information`

VII. SIMULATION

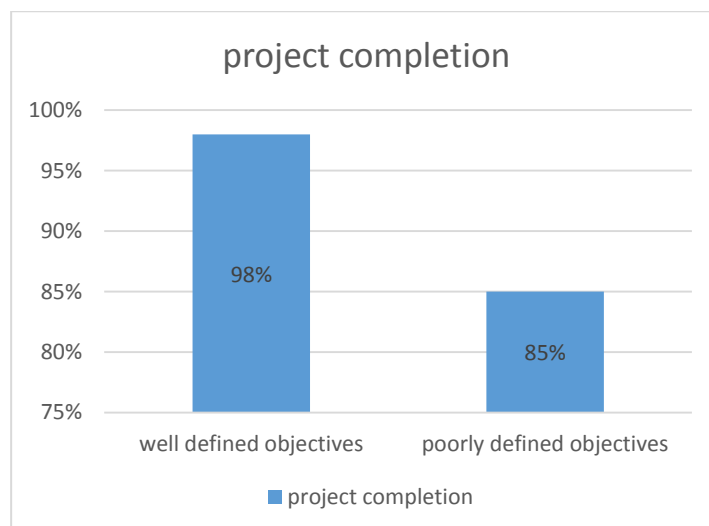
We have done simulation on already done refined project. We have observed the errors and problems occurred in the project which are in deploying stage. We have invoked our suggested idea on refined projects and noticed the results. In accordance with the obtained result, the most powerful factors are avoiding, misinterpreting and communication risk, improperly defined objectives, QA department marked down in the organization and lack of reporting skills of QA departments.



Based up on our proposed guidelines we have directed some of the QA teams and senior management to make better their problems. Due to the improvisation done by the QA teams and senior management, the success rate is escalated high. As explained in the above fig. when a QA department is provided with proper report guidelines with includes critical metrics, project status details and QA activities, the QA team exactly know what they should report to the management without any exiguity. When a QA team is provided with the proper report guidelines, the rate of project completion went up to 99%.



By placing the QA department higher than the application development team or to be a part of it are also very important factor. By conducting reviews at the thing equal in ability or standards level, place the QA department at higher position. So by focusing more on development stage and closely interact with the development team, the rate of project completion goes to 98%.



As given in fig poorly defined objectives was another essential factor in the project completion. So by avoiding projects like which would be in doubt to meet success, by allocating the resources that have more impact and by communicating with the senior management about the risks and issues to make a key decision which improves the rate of project completion under study.

Another important factor handled was release of QA team obligated for projects, senior management resolves the problems to make sure to avoid the deadlocks between the QA teams and project management. So by acquiring improvement in various aspects, the project completion are fluctuated high to 98% from 85%.

Our proposed idea to establish the QA team really helped in project completion and increased the quality of the software by lessen the errors than before.

VIII. CONCLUSION

In this research SQA problems are identified and solutions are suggested to cope with those problems and improve the software quality. Software organization can only get a respectable position in global market if they concentrate 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.

The key elements of a successful QA department include:

- Proper definition of objectives and responsibilities.
- A senior management that understands its own responsibility for software quality.
- QA department accountability and joint responsibility for success.
- Integration of methodology and enforcement responsibilities.
- Integration of measurement and risk management into the software development process.

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