Jumpstart to Software Quality Assurance

Software Industry has grown a lot in the last few decades, and there are many players are there in the market. Most of the software is made in an unknown country and by unknown people. Though cost and people competency are the major influencing factor for determining, who will produce the software or provide the service, in reality almost all the contracts are made by looking at delivery methodologies, process maturity and demonstration of technical capabilities. Most of the contracts are not awarded for people skill, considering no one knows which person is working in the service provider organization. The contracts are awarded based on Processes, past performance and technical understanding, which the service providers demonstrate along with good costing. It's because the only way a client can believe the unknown you is, by knowing your way of working and your processes. You would agree, most of your clients are not your neighbor, friend or relative, so that they can blindly give the work order to you! Neither all our companies are doing Research projects, so that based on people competency we are awarded projects!

Who develops these processes, who maintains them and how come these processes have become matured, and how you are able to demonstrate your processes and delivery methodologies are in par or better than your competitors, who are those people, who makes your prestigious client to believe you… There are many, like Operational teams, center of excellences, heroic sales team and vital management team, and beyond this, we all would agree it's the Software Quality Assurance team which plays key role in ensuring process implementation, stability and capability. This book is written for those who are aspiring to take up a role in Software Quality Assurance or those who wants to set up a function and get the benefit out of it or for those who wants to understand, how practically the Software Quality Assurance function works. Today, Software Quality Analyst (SQA) role is a key component in any successful service provider's delivery system.

To perform as SQA, it's expected the person develops all around competency required for that role in the initial years. As they get experienced they can concentrate on specialized areas to improve their competency and contribute to the organizations. Many a times, we see the new SQA's struggle to get a complete a view of their roles and knowledge areas in Software Quality Assurance. Lack of complete understanding on software quality assurance affects their productivity and career path. This book is intended to provide those details, which are essential for Jumpstart to Software Quality Assurance. A SQA can gain experience by working with projects, but may not learn the basics, responsibilities and techniques/methods required to perform in his/her role! This book provides you the theoretical and pragmatic view on Software Quality Assurance!

Contents

Quality Fundamentals

As we do normally, we will ask the difficult question to ourselves, what is Quality? Why this question is difficult, because there are so many variant in its definition. Also quality is most subjectively used word in this word. We all use this word commonly in our life and I am sure

frequency is also high. However in a given condition if we show a product to multiple people their evaluation of quality on the product will differ much. For example if we show a low end smart mobile phone costing around 150$ to ten people, their understanding on quality will vary, and some will concentrating on camera features, some will be on Audio quality, some on video quality, some on feather touch quality and so on. Quality in this case is based on different features offered for the price range, and comparison with similar products available in market, and what user thinks as friendly interface to them. For someone who is looking for high end features in camera in that phone, it's not of quality and for someone who is expecting high end audio this mobile is not of quality. What this tells us is, Quality is subjective in nature and also it's determined by comparing similar product/service available in that range of cost. However the International bodies and Quality Gurus have worked greatly in this area to reduce subjectivity and bring in the perspective with which every product/service can define Quality in that particular instance. They have defined few of the characteristics we should consider, while fixing boundaries and target for our product/service Quality.

ISO definition for quality is, "The totality of features and characteristics of a product or service that bears on its ability to satisfy the stated and implied Needs" which tells us, as long as the product is meeting the agreed and implicit requirements, we can assume it's of quality. Similarly the degree to which the product's characteristics excel also determines quality as not all the characteristics are having equal importance. Some of them might be must have and some might be like to have, and we would definitely want the must have features satisfied by the product or service. We all know most of the basic software like word, excel, etc are having so many features in them, but we would concentrate on few features like word style, formatting, and review options more and we may use very rarely the export to blog, PDF, etc. When we have word document creator software which doesn't have many options in formatting, we would not prefer, even it has direct export to social media sites. What it means is, identify the right features and satisfying them is also part of Quality.

Quality Gurus:

Phil Crosby

- 'Conformance with requirements'

If your product meets the stated and implied requirements, it means your product is of Quality. When we buy a television we see the features listed, if our requirements and the features are in line we go for that television, else we choose some other one which is very close to our expectations. However if we don't what's written in the feature list, than the product has not met the requirements, and we claim it's not of quality.

Juran

- Definition: "fitness for purpose"

- Quality does not happen by accident

- Quality is a result of intention and actions

This is the most used definition in our normal life. We don't care what's written in the product or service description, but what we care is, whether this is of real use. Assume we bought a PDF software and most of the time we use PDF conversion to ensure the document is not editable and also we expect when we convert them from basic format (.doc, .xls, etc) to PDF it becomes smaller in size, so that we can mail it. Assume the product is converting the documents well as PDF but gives you something bulky in size and you don't have option to reduce the size of final output, then it's of very less use, in fact we will search for something which is fitting our purpose.

Other than Art, I don't think in engineering we can say quality happens by accident. Even in art, now a day there is some level of planning and technical perfection has been brought intentionally.

Ishikawa

- Quality is beyond the quality of product. Quality of after sales service, quality of management, quality of the company and quality of people - all matter

It's simple, when we buy a car, we just don't say the product is awesome, we wait for the servicing, we wait for replacements and then we say this is a good product. Assume you got the Costliest car in this world, but the side mirror which got damaged by a motorist is not available for replacement and you need to wait for another few months or the service person has to travel from some other country to replace it. How do you feel about your product? Most of us will feel it's a pain. Assume you have bought a top selling Antivirus product, and its license key is not working or registering and you are trying to contact their support team, there is no email/communication from them for 2 weeks, what will you do with this product. In fact we assume the product sells well, because it has good service also.

The Other important person in this Quality world is Dr. Edward Deming and his definitions and experimentations are world famous and have changed the Quality Industry a lot. His 14 principles of quality is a separate book and we would recommend the readers to spent time on those writings. The fact is most of the organizations still having basic problems with quality and many of them have been already pointed out by Deming.

There is something which Deming has given to the world, which will make him always the greatest is the PDCA cycle.

P - Plan

D- Do

C- Check

A-Act

This is a wheel, Plan->Do->Check->Act->Plan

For improving any system or feature or activity or anything, this cycle of activities are basic.

In our normal life we keep applying this principle without our knowledge on daily basis. If we go to buy groceries in a shop, we normally plan what to buy and take stock at our home, and we add products to our cart, and we check whether we bought all the required products and if not we go take the relevant products and add it to our cart. This is the same for going to a bank or purchasing a camera or anything. When we don't follow this cycle, we have more chance of not meeting our own expectations or failing in something.

This is the wheel which is adopted in many process improvement models and standards like ISO as basis. Though there are many concepts evolved with variations with this base model, this one remains the basis and most used improvement wheel.

Based on all these views, we can define quality something like this,

Quality is the degree to which product or service possesses a desired combination of attributes –

– *C: Capability (F: Functionality)*

– *U: Usability*

– *S: Scalability*

– *P: Performance (E: Efficiency)*

– *R: Reliability*

– *I: Install-ability (P: Portability)*

– *S: Security*

– *M: Maintainability*

And there are always two views exists with Quality,

– *Producer's view: Meeting Requirements*

– *Customer's view: Fit for use*

In the previous examples also we saw, that producers collect requirements from known client or from potential clients through market research and try to meet those requirements. However for a

customer it's always, how good the product meets their requirements. In the of example of mobile phone, where every producer try to determine the requirements well and almost of all of them might be meeting what they identified as requirements, but customer feels only few products are really fit for them to use, and that's the reason few are sold well and few are not. The one, who tries to reduce this gap, eventually makes success with their product or service.

Quality Assurance and Quality Control:

There is always some level of confusion in using these terminologies in Industry and it's not the confusion with the activities, but it's more to do with the perspective with which they look at the Quality Activities. First of all, to achieve quality it's important to have the right intentions, plan and execution to prevent non conformities, and meet requirements and achieve planned services. The activities to achieve quality can be primarily split in to Quality Assurance and Quality Control.

Quality Assurance is defined as set of activities whose purpose is to demonstrate that an entity will meet all requirements. Quality control is defined as set of activities whose purpose is to ensure that all requirements are met in the final product/service.

Quality Assurance	Quality Control
Preventive in nature	Detection in nature
From beginning of a project and in beginning of a phase	In the later part of project and in mostly end phase activity
Process based	Product based
Process Quality Assurance team is involved	Product/Service Quality validation team is involved (Ex: Testers, Reviewers)
Organizational wide Strategy	Product/Service wise strategy

Quality Assurance is the activity which a Software Quality Analyst is expected to perform. Some organizations call the testing activities as software quality assurance and the testers as Software Quality Analyst, however this is not an industry wide practice and most of the standards or models don't recommend testers to be called as Software Quality Analyst or Quality Analyst.

As we saw in the table the Quality assurance activities are at organizational level and process based it's important for us to understand, how they are built at organizational level and what components are part of it. Be clear, organizational wide Quality Assurance strategy is built, however it's also tailored and applied at project level also. The organizational wide strategies help to ensure consistency across different products/projects in the organization.

Wherever we use the term Product in this book, please consider Services also along with it.
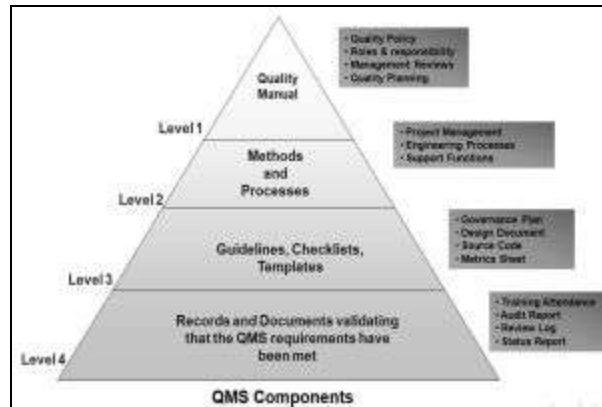
Quality Management System and its components:

This is the famous word in the Quality Assurance world, "Quality Management System (QMS)". What is a QMS? It's nothing but the existing management system in your organization, which has processes, people and tools which are aligned to achieve Quality in the delivery and where required additional capabilities (like roles/tools) are added to ensure that your system is aligned and working towards achieving quality. When we say financial management system, legal management system and so on, in an organization, it doesn't mean a new management team, or documents or tools, it's the Organizational management system component which is aligned to take care of a particular aspect like finance or legal needs.

Also be clear that many people think QMS is nothing but set of documents, which is not the reality. A QMS contains Processes, Tools, Roles and Responsibility, Policy, objectives and so on. Any component in the organization which is contributing to the achievement of Quality in the product/service is part of Quality Management System.

Since we use the word "System" many times here, what is a system? It's a set of interrelated components which along with relevant resources, process the inputs as expected output. In our body we have digestion system, respiratory system and blood circulation system, etc. They are system as they perform certain processes with their interrelated components using relevant resources and achieve the expected output.

Now we have used the word "process" few times here, what is a process? Its set of sequential activities performed to achieve desired results using the relevant resources. A system normally consists of multiple processes. In the case of Respiratory system in our body, the body inhales air is a process, the body separates the compounds in air is a process, the compounds are mixed and segregated from blood is a process and body exhales air is another process. If we want to split inhaling process in to smaller process, we can do, that's a sub process. In this case, nose inhales air, air is filtered in nostrils, air passes through the respiratory tube, air enters inside lung all can be sub processes. So who decides what sub process is and what is process? To tell you simply, we do write only processes and we use processes in normal life, however when we want to understand deeper the activities and control it we split the smaller activities as sub processes. You can even call the entire respiratory system as one process in body. Ultimately it's the criticality which decides what the level of process is.

With this understanding let's see the components in Quality Management System, which are usually part of it,

Quality Manual
Level 1
- Quality Policy
- Roles & responsibility
- Management Reviews
- Quality Planning

Methods and Processes
Level 2
- Project Management
- Engineering Processes
- Support Functions

Guidelines, Checklists, Templates
Level 3
- Governance Plan
- Design Document
- Source Code
- Metrics Sheet

Records and Documents validating that the QMS requirements have been met
Level 4
- Training Attendance
- Audit Report
- Review Log
- Status Report

QMS Components

There are many Levels of documents are part of Quality Management System. Ideally these documents are created from Level 1 and reaches up to Level 4. This is simple, whatever your organization is doing and intent to do or the way you want to work, all these are documented (it can be electronic copy/hard copy/audio/video/automated tool or any other useful methods) and made available for your employees, so that all of them follow similar working method. In this case Level 1 is Quality Manual, which is the Apex document in the Quality Management System. Level 2 is methods and processes which are used by the employees to deliver outputs in their area. Level 3 is Guidelines, checklists and templates, they are used most often on daily basis and all of them help to ensure consistency in the information the deliverable contains. Level 4 is Records and Documents for validation, they help us as evidence of activity which is useful for any reference and proof.

Quality Manual:

Every Quality management system contains quality manual as apex document, which provides detail on how the quality policy, objectives are achieved in the organization. The scope of processes, process architecture, and detail of every process is detailed in the manual. The Quality manual helps anyone to understand how the system is defined and helps to navigate the processes.

Quality Manual contains the following sections,

1.0 Introduction

 1.1 Purpose

 1.2 Scope

 1.3 References

 1.4 Definitions and Acronyms

2.0 Business Overview

Quality Policy:

This is the intention and direction of an Organization, in regard to achieve quality, as formally expressed by the top management.

Example: "Effective processes and competent people usage to deliver successful products with high Quality to our clients"- this can be a policy of an organization, which expresses how they want to achieve the quality and the means (Effective Process and competent people)

Process:

Set of activities performed in pre identified manner to convert inputs to required outputs, with usage of relevant resources.

Process will vary based on the activities sequence change or alteration of resources or input variation, etc. For an example, if we take cheese making process, the material/ingredients used is same and overall set of activities are also same, but just with variation in usage of material, application of resources (like heat/days storage/etc), there are more than 200 types cheese produced. What it means is the process in fact varies and 200 types of processing happen. What it tells is, a Process is with fixed steps, method and resources, so that the output also consistent (a range), if we change the process step or resource application level, the results would vary (un-predictable). So every successful organization wants the best process to be documented and used by their employees, so that they can repeat the success.

In normal life, most of us are following processes, but not all of them are written. When we live as in small family, we communicate the processes to others and ensure everybody follow the processes in life. However when it comes to an organization where unknown people work jointly to execute some work, this oral communication of process will not work in many cases and that's the reason we document the processes and make it available for everyone.

The simpler and effective way of writing a process is using ETVX method. E- Entry Criteria, T – Tasks, V- Validation criteria and X- Exit Criteria. This method will help in achieving clarity in writing processes. Similarly if we have a clearly developed workflow, that can help in reducing chaos.

We will take for example the Technical review process,

Entry Criteria: New or Revised product ready for review

Tasks: Prepare for review, conduct review, record review comments, close the review comments

Validation: Review Report submission, Audits

Exit Criteria: Agreed review report

In addition to these Inputs and outputs, Roles performing the tasks will be mentioned and measures considered for the process.

The following can be the Process description details,

1 Objective

2 Scope

3 Entry Criteria

4 Acronyms and Abbreviations

5 Inputs

6 Process Descriptions

 6.1 Activity 1

 6.2 Activity 2

 6.3 Activity 3

7 Recommendations

8 Permitted Tailoring

9 Measures

10 Validations

11 Quality Records

12 Exit Criteria

13 References (CMMI, Other Processes and Other Standards)

14 Process Profile Matrixes

Standard

Standards specify uniform use of specific technologies, parameters or procedures when such use will benefit the organization. Ex: Coding Standards

Guidelines

Guidelines assist users in implementing policies/ procedures, which may warrant variations, or which are under trials and imposition of standards is not always achievable. Ex: Estimation Guideline

Procedures

Procedures assist in complying with applicable policies, standards and guidelines. They are detailed steps to be followed by users to accomplish a particular task. Procedures may contain certain templates to be followed while executing the task.

Templates

They are prescribed format for creating documents/deliverables expected by the processes. A well defined template helps us in achieving consistency in capturing information and reduces the redundancy.

Earlier we have seen the sections of Quality Manual and process was given, they were nothing but templates. We can add the relevant details to make a document out of it.

Checklists

They help in gathering data in required manner and also not to miss out any relevant information, which also help us determine the occurrence of event.

Ex: Review Checklist, travel checklist and so on.

Documents in QMS:

Documents are key part in Quality Management System, as they are live in nature and kept updated to communicate the relevant information to the relevant groups in the organization. Documents are part of QMS, and documents are also part of projects or product development or any relevant activities. Documents have life and they undergo changes, primarily they are current and futuristic, and old documents are archived. To simply define the lifecycle of documents, we can say, create, review, release preparation, release & distribute, update and archive and retain.

In order to control the document in this lifecycle (traceable and easily detectable) it's important to assign version numbers and maintain the release details. Example of Documents can be a project plan, schedule, user manual, etc

Records are of special type of documents which conveys the information/data of a particular instance, simply a snap shot. Records are mostly used as evidence and they are not modifiable and they are documents which will undergo changes. Examples of records are attendance sheet, meeting minutes, training feedbacks, etc

In the past we used to have Master List of Document Control sheet as key document, which has the complete list of all documents and records, so that better control and traceability on documents were achieved at project level/functional level/organizational level. Now a day since we have many tools like share point and others, they simply create the master list and our job of manual maintaining them is reduced.

Master List of Document Control

Sl.No	Document Name	Document ID	Version No	Author	Distribution List	Path /Location
1	Quality Manual	JHF-MAN-QM-01	2.0	MR	Entire organization	Link
2						
3						
4						
5						
6						
7						
8						
9						

Master List of Records Control

Sl.No	Record Name	Document ID	Author	Custodian	Record Media Type	Retention Period	Path /Location
1	Fault Log			System	Soft Copy	3 Years	Link
2							

3							
4							
5							
6							

A Quality Management System contains in addition to these items, Roles and Responsibility document. Which is actually describes which roles are performing what activities in the organization.

In addition to these the Quality Management system may contain repositories. They are nothing but useful information derived from projects which are available for the new projects to refer. Past estimations, plans, samples, defects and so on can be collected from projects and categorized and cleansed and added as part of repositories. They help for the new projects to understand quickly from others data or learning.

The following are the typical repositories maintained in organizations,

(i)   Measurement Repository

(ii)   Estimation Repository

(iii)   Defect Repository

(iv)   Service issues Repository

(v)   Risk Repository

(vi)   Lifecycle Repository

(vii)   Tailoring Repository

(viii) Best Practices Repository

(ix)   Lessons Learnt Repository

(x)   Samples Repository

(xi)   Technical Know How – FAQ's

And other different repositories like reusable repository, domain specific repositories, etc

Every repository may have an identified person allocated to maintain it. The data cleansing activity is performed, before adding the data to a repository. Adequate Communication in this

regard will help in better utilization. Some organizations use share point or web portal to publish their repositories, and hit counters are enabled to check how many clicks to the portal happened for the repository.

QMS Benefits:

- Quality Management System helps an organization to perform effectively.

- It helps the Organization to deliver Quality Product/Service.

- Projects are handled systematically and project deliveries are controlled

- It increases the employee confidence in performing a task.

- It ensures systematic way of handling changes and applying innovative technologies.

- Process stability and capability is improved in the organization

- Improves reusability of components in the organization

- Reduction in cost of the product development/service delivery

- Improvement in delivery cycle time and time to market

Quality Assurance Functions

Quality Assurance (QA) activities as we discussed earlier are the one which gives confidence to the organization and to client that by following the Quality Management System the final product or services will be of quality. It may not be possible to get the quality product/services as soon as we define set of processes, templates, roles and responsibilities, etc (QMS) it may need few iterations to learn that what's working for you and what's not. Most of the times, the system is improved by getting feedback continuously from the Operational teams and by measuring the process capability. Based on the feedback and improvement opportunities the processes and system components will be updated by the identified teams. These new updated/revised processes in the system are implemented by Operational teams and again they are measured and feedback is collected. The system is updated or revised till the expected quality is achieved. In order to perform this cycle (its similar to PDCA) we need different Quality Assurance functions to act in the system. The following are some of the key functions within QA,

Software Engineering Process Group (SEPG):

The group consists of Subject Matter Experts from various engineering and management areas and Process quality assurance members/ Software Quality Analysts. Few of the SME's can be permanent members and few can work on need basis (depending on how often their process is

discussed). Typically each SME is identified with relevant processes in mind. The Process Quality Assurance Members who are contributing in process definition and who are performing facilitation & audits shall represent. This helps in getting real issues from the ground and discusses with SME and put it in presentable process format.

- SEPG is responsible for Process Focus and alignment with business objectives

- SEPG ensures that relevant processes are defined to support the delivery

- SEPG ensures that process assets are created and maintained

- SEPG makes deployment and process action plans

- Process revision and maintenance is taken care by them

- Process tailoring and relevant analysis is performed

- Process Improvements achievement and sources maintenance

- SEPG is responsible for process appraisals

- SEPG is responsible for overall Quality Management System development and deployment

Process Quality Assurance/ Software Quality Analyst Group:

This group consists of people who has competency on process quality assurance. Typically it includes people who can understand the process architecture, its application and improvement needs. Process compliance activities like QA reviews and Process compliance audits are performed by them. Independency and objectivity should be maintained on forming this group.

- Project facilitation and hand holding on Process implementation

- Process training performed by them

- Product Quality Assurance review performed

- Process Compliance Audits are performed

- Project level metrics analysis support

- Tailoring of processes are supported

- Interact with SEPG, project teams and metrics team to provide relevant updates

- Some organizations use them for Risk Assessment or other security compliance standards implementation.

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