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1.0 Introduction

Quality Assurance (QA) is assuring quality through fitness for purpose and in any development project should begin when the project is conceived, not just at the end. Quality Assurance should be included in every step of the Project Life Cycle, from Requirements Definition and Functional Specification, through Design, Programming, and Documentation. Quality Assurance helps prevent defects from entering a development project, whether software or system related.

The following report will examine what quality is, its importance and benefits and what it then leads to if quality standards are met by organisations and IT Professionals. You will be able to see how quality can bring organisations success and when used by IT professionals, how quality management is achieved and what it is achieved through. It will then go on to explain how IT Professionals can achieve SQA

Software Quality Assurance is a field that is broad and intricate, this report will aim and discuss a miniature part of Software Quality Assurance and some aspects that are related to it.

2.0 What is Quality?

Quality has many definitions, it is subjective and can be defined in different ways depending on the context in which it is being used.

Quality can be taken as being defined as:

> "The set of characteristics of a product or service which satisfy a customers requirements and expectations" (Ayres 1999)

In an information technology product or service, quality is usually defined as "meeting the requirements of the customer". However, a general definition is fitness for use (Juran).

Quality assurance is a systematic process for ensuring quality during the successive steps in developing a product or service. **ISO 9001** is a standard for ensuring that a company's quality assurance system follows the best industry practices.

Today, software is playing an increasingly important role in every product and organisation. The cost of software defects places a heavy burden on software development organisations. The number of mission critical applications, those with a high cost of failure, or a high cost to fix, has increased exponentially in recent years, making the need for proactive quality assurance greater than ever before, for example the Arian-5 disaster as it cost over 500 million pounds.

Quality is essential to the success of business. To make a difference, good quality practice must be embraced by senior management and instilled within an organisation's culture. Quality is not just about implementing a system or working towards a set standard. It is an attitude, a way of working, which not only improves businesses but the way people work and live.

2.1 ISO 9001

ISO 9001 is an international standard that many companies use to ensure that their quality assurance system is in place and effective. Conformance to ISO 9001 is said to guarantee that a company delivers quality products and services. To follow ISO 9001, a company's management team decides quality assurance policies and objectives. Next, the company or an external consultant formally writes down the company's policies and requirements and how the staff can implement the quality assurance system. Once this guideline is in place and the quality assurance procedures are implemented, an outside assessor examines the company's quality assurance system to make sure it complies with ISO 9001. A detailed report describes the parts of the standard the company missed, and the company agrees to correct any problems within a specific time. Once the problems are corrected, the company is certified as in conformance with the standard.

Within the software development department of the company I worked for on my placement, they followed the ISO 9001 standard outline of quality.

2.2 Quality Assurance

In developing products and services, quality assurance is an systematic process of checking to see whether a product or service being developed is meeting specified requirements. Many companies have a separate department devoted to quality assurance.

Today's quality assurance systems emphasise catching defects before they get into the final product.

2.3 What does Quality Assurance lead to and Importance of SQ A

A quality assured system increases customer confidence and a company's credibility, to improve work processes and efficiency, and to enable a company to better compete with others. Quality assurance was initially introduced in World War II when munitions were inspected and tested for defects after they were made (Ayres R 1999).

By keeping up to the standards of ISO 9001 and incorporating quality into the entire development process of products and services, by meeting customer needs, wants and expectations, organisations can achieve customer satisfaction, and subsequently, gain the loyalty of their customers. The quality of products can determine whether the product/service will sell.

Customer satisfaction is the determining factor for success or failure for many organisations today. Organisations have discovered that quality applies as much to the way people are treated as it does to their products. Today's world-class organisations have learned to keep current customers and attract new ones by gathering quality feedback so they can consistently reach or exceed expectations in every area.

Crucial to this process is the popular Customer Feedback or Satisfaction survey. This type of survey is one of the most familiar methods used to quickly measure an organisation's ability to work with and satisfy their customer needs. A customer satisfaction survey helps

an organisation bypass unnecessary filters in order to gather feedback directly from the end-user of the product or service.

The importance of customer satisfaction to customers, businesses and IT professionals is that if the customers are not satisfied with the product or service that they are being provided with then businesses would not be recognised as being well established and then their products and services would not be patronised. This would then lead to their contracted IT professionals not having a secure job.

During my year placement at Active-Resource, we considered customer satisfaction to be very important within the organisation. As a helpdesk operative, providing software solutions to specific software application. The system that the end user used was a on-line banking system. The software was installed by the user onto their personal computer and would then use it to transfer money and pay employees electronically. I gained customer opinions on how they thought the online banking software they use can be made to a better quality. This was done by asking customers over the telephone what they think about the usability, maintainability and accuracy of the software. Information was then used to improve customer satisfaction, thus leading to increase in customers and improved in the quality of the software to meet customer expectations. This was a very good way because of direct contact with customers, getting feedback on how it can be improved.

Customer satisfaction is a factor which is of importance to quality assurance, other factors are software safety and maintainability.

Maintenance is an important section in any software development cycle. This is because systems do not remain inactive. They are subject to requests for enhancements, for adaption to different environments, as well as simple programming changes. These tasks are difficult, but can however be overcome by considering maintainability issues during the software development process.

Software safety is concerned with the satisfaction of system safety satisfaction requirements that are consigned to the software, and the identification and verification of adequate safety constraints that are to be implemented into the software. If software is not same then it could lead to major catastrophes within organisations, thus making software safety a rather large proportion of software assurance.

2.4 Software Quality Assurance

Software Quality Assurance can be defined as a planned and systematic approach to the evaluation of the quality of and adherence to software product standards, processes, and procedures. Software Quality Assurance includes the process of assuring that standards and procedures are established and are followed throughout the software acquisition life cycle. SATC (1999).

Software development, like any complex development activity, is a process full of risks. The risks are both technical and programmatic; such as, risks that the software will not perform as intended or will be too difficult to operate, modify, or maintain are technical type of risks, while risks that the project will overrun cost or schedule are programmatic risks. The goal of software assurance is to reduce these risks. Appropriate standards should

be used in software development in order to over-come risks. The main point is that software assurance activities can help to reduce risks.

Software Quality Assurance is an essential part of the development and maintenance of software. Software Assurance forms part of the triad of activities, along with software management and software engineering that, taken together, can provide a successful software development, enhancement, or maintenance activity.

2.5 What can an organisation do to ensure its customers are satisfied before symptoms of dissatisfaction appear?

One of the keys to achieving bottom line performance in an organisation is by constantly measuring their customers' satisfaction, and then making changes to increase that satisfaction. There are many ways to measure customer satisfaction. Another way is to track the results, or "indicators", of your customers' satisfaction, such as repeat business, complaints, and product returns. However, these measures do not allow your organization to prevent customer defection. That is why simply monitoring and fixing complaints is a reactive effort. Because only some dissatisfied customers take the time to complain, complaint monitoring does not provide a total picture o f your customers' satisfaction. A better way is to track your customers' satisfaction before you see complaints and defection.

2.6 The role of an IT Professional to assure Software Quality

The way in which IT Professionals assure software quality is by introducing quality management.

Total Quality Management (TQM) is "a system of continuous improvement employing participative management and centred on the needs of customers" (Jurow & Barnard, 1993).

Key components of TQM are employee involvement and training, problem-solving teams, statistical methods, long-term goals and thinking, and recognition that the system or users may not always be efficient.

For IT professionals to achieve quality management and to assure software quality, they should follow a quality assurance plan or in other words a project life cycle. A quality assurance plan is a well documented system that ensures consistency and the improvement of working practices are included the development plan of the future products and services. They are based on standards, which specify a procedure for achieving effective quality management. ISO 9001 is the most commonly used international standard that provides a framework for a quality management system.

The Quality Assurance Plan is of utmost importance because it serves as a guideline for the entire project. As such, it defines all the standards for a software development team to follow. The standards are required for all the development processes to assure quality deliverables. All teams should carefully read, understand, and comply with the Quality

Assurance Plan. Failure to do so will result in project delays and substandard products, which may not be acceptable.

3.0 Critical Evaluation of a system and management failure

London Ambulance Service Computer Aided Despatch System failure

On 26 October 1992 the LAS introduced a computer aided despatch system which was intended to send a quicker response from ambulances to patients. However, as the number of ambulance incidents increased, the amount of incorrect vehicle information recorded by the system increased. This had a knock-on effect in that the system made incorrect allocations on the basis of the information it had. For example, multiple vehicles were sent to the same incident, or the closest vehicle was not chosen for dispatch. As a consequence, the system had fewer ambulance resources to allocate. The system also placed calls that had not gone through the appropriate protocol on a waiting list and generated exception messages for those incidents for which it had received incorrect status information. Overall the system started to run slower and staff could not allocate resources fast enough. Claims were later made in the press that up to 20-30 people may have died as a result of ambulances arriving too late on the scene.

Does this mean that the LAS didn't appropriately follow a quality management system? According to an investigation into the LAS system failure, there was no involvement from ambulance crews in the creation of the system requirement specification.

Ambulance crews had little consultation of this system. This could have had an impact on the system failure as the ambulance service could have given feedback to what they require.

The software was incomplete and unstable, in particular, the emergency backup system remained untested. Questions were also raised about the choice of the development tool and the host operating system. Throughout the project there are references to functional testing, whereby the system is tested to ensure that it does what is expected, and load testing which is designed to test the ability of the complete system to perform under maximum load. Unfortunately, the completeness and quality of systems testing was in doubt, because the system was delivered in fragments, and not the complete system as planned.

The above case study suggests that the IT Professionals involved did not attempt to follow any quality management system methodology in the development process of the system.

They neither consulted with all the relevant users, nor did they provide adequate training upon the installation of the new system.

It is also obvious from the case study that there are many aspects to achieving software quality assurance, including training, user involvement, system testing, project management and maintainability. Quality is made up of many aspects and IT Professionals should consider these different aspects in order to create the best quality for their products.

Without software assurance there would be an even higher percentage of software systems failure and dissatisfied customers.

4.0 Summary/ Conclusion

Software Quality Assurance is the planned and systematic set of activities that ensure that software processes and products conform to requirements, standards, and procedures. Processes include all of the activities involved in design, development, enhancement, and software maintenance; products include the software, associated data, that is its documentation, and all its supporting paperwork. Software Quality Assurance is not an concept, but a defined set of related activities.

Quality comes by understanding and generating the involvement of users. The users are more important than the system, as shown in the London Ambulance Service CAD system in view of the fact that it is users that drive the system and not the other way round. Quality Assurance and Total Quality Management are both approaches to Quality.

Quality is not just about implementing a system or working towards a set standard.

Customer satisfaction is the determining factor for success or failure for many organisations. Customer feedback can be used to improve customer satisfaction.

Quality in the appropriate context is essential to the success of business. Quality Assurance processes help to improve the overall development process and quality of the software system, thereby reducing the potential or possibility of defects to the final product. The cost of software defects places a heavy burden on software development organisations, and consequently on IT Professionals. The goal of software assurance is to reduce these risks and defects.

Software Quality Assurance is an essential part of the development and maintenance of software. ISO 9001 is the most commonly used international standard that provides a framework for a quality management system, without software assurance there would be an even higher percentage of software systems failure and dissatisfied customers. IT Professionals should comply to the set standards of ISO 9001 to deter software failure.

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