

The Software Quality Group's Relationship to Development

Douglas Hoffman
Software Quality Methods

San Jose, CA 95130

Abstract

This paper presents the roles of the Software Quality Organization in software development as observed in dozens of commercial organizations. It looks at the different ways the quality group's purpose and charters were viewed. The potential benefits and drawbacks for various charters are discussed, along with the organizational structure and typical activities for each. The idea that the charter for the quality group changes over time is also presented, along with observed progressions in organizations. The various possible organizations, charters, and roles are described and related briefly to quality systems described in both the SEI Maturity Model and ISO 9000 Standards (ISO 9001 and ISO 9000-3). It describes the impact on product quality of the different types of development process, and possible roles for the software quality group.

Introduction

The purpose for software quality organizations ranges from testing products to providing information and expertise about the product and development process. The group may also provide knowledge and training on product testing, process creation and management, toolsets, and metrics. The various tasks of the software quality group are described, and the order they typically appear as the organizations grow and mature presented. This provides a foundation for understanding the contribution of the quality assurance organization and the value they can add to the product and process quality.

The roles of software quality assurance basically correspond with the tasks they accomplish. The roles range from acting as an extension of development for debugging

software products, to development process definition and control. Verification and validation, acceptance testing, measurement and metrics, and process consulting are also roles that software quality groups sometimes assume. The various charters that the organization may assume are described, and the impact on quality is addressed for each charter.

As the organizations grow and change, the needs and roles also change. Depending on the type of product and organization itself, the life cycles may differ and the tasks done by the quality organization evolve. The evolution takes familiar tracks, following patterns based upon the maturity of the organization and other factors. The SEI Maturity Model and other standards are relevant in understanding the importance and roles for the quality group.

Quality Group Purpose and Roles

Figure 1 shows the basic purposes, roles, and activities established for software quality groups. It also describes some of the activities and roles for such organizations. Although an organization may fit the description well at one time, it is likely to change as the organization evolves and matures. It is also likely that any given quality group has characteristics of many of the organizations. Generally, however, there is one primary or predominant theme in the group.

When the goal of the organization is to test products, the group usually acts as an extension of the development organization in performing a debugging function. The group's primary activities are to develop and run tests, with the primary emphasis on reporting defects. The majority of time is generally spent running the tests and reporting the results.

Another, more subtle version of the testing goal is to measure the quality of products. This differs from simply testing in the group's emphasis on achievement of specific levels of quality. The group often does not do the primary testing, but rather oversees and reports on the results of other group's activities. Although they may act in a more advisory

capacity, the focus is still on testing and measuring the quality through product defects.

A different goal for the quality group occurs when they focus more on the organization's processes, rather than the products. This often occurs when the organization focuses on metrics programs and expands beyond the nebulous "defects happen" theory into an understanding that "defects are built in". The role becomes more general, that of information brokers seeking insights from whatever data is obtainable. These metrics programs change the role of the quality group in information engineers; applying the data to understand and improve the organization.

When process definition is the goal, the quality organization performs more of a role of quality and process engineering. They assess risks and design processes to reduce the risks and increase the quality. This becomes more of a management approach than a technical one.

As a guidance resource, the quality group provides expertise and reference information so others in the organization can effectively do their jobs and improve quality. This reference information includes how-to as well as what-to guides, and measures of quality and their meanings.

<u>Goal</u>	<u>Activities</u>	<u>Roles</u>
Test Products	Test development, test execution	Testers; extension of development
Measure Products	Test oversight, reporting results	Measurers; Quality hurdle
Measure Processes	Metrics	Information Engineers
Define Processes	Process and Risk management	Quality and Process Engineers
Guidance Resource	Quality Reference	Quality Engineers

Figure 1: Quality Group Goals and Activities

Software Development Life Cycles

The various Software Development Organization Life Cycles (SDLC) are described in Figure 2, and situations where they are most applicable and effective are shown. The SDLCs described include the classic waterfall, prototyping, spiral, decomposition/integration, and variations encountered and created in various organizations. The appropriateness for the life cycles is described in relation to the stability and understanding of product requirements.

For example, the classic waterfall approach to software development is most appropriate when the requirements can be fully known before beginning development, and they don't change substantially during the product development. If they change substantially, a spiral approach is more likely to fit the organization's needs.

The quality group's roles occur independently of the life cycle involved. The specific activities differ on a technical level, but the various possible roles remain the same, and the progression and evolution occur in the same ways.

<u>Life Cycle</u>	<u>Product Requirements</u>
Waterfall	Known, unchanging
Prototyping	Unknown, changing
Spiral	Unknown, unchanging
Decomposition/Integration	Known, unchanging
Cleanroom	Known, provable
Fourth Generation Techniques	Unknown

Figure 2: Most Appropriate Software Development Techniques Based Upon Product Requirements

Organization Maturity

Organization maturity is not an indication of the age of the group. It has been defined as a loose measure of the formality of the processes used by software development. In my experience, this maturity roughly correlates to the role of the software group.

The relationship of the charter of the software quality assurance group to SEI's Process Maturity Model is shown in Figure 3.

The five levels of maturity generally occur in organizations with specific roles defined for the software quality groups.

This close relationship between the organization maturity and the role of the software quality group is worthwhile understanding. Although they seem closely correlated, I believe there is a chicken-and-egg problem in trying to determine which causes which.

The role of the quality group evolves from testing to process definition and control as the

organization evolves. Trying to control and optimize the development process in an organization at the Initial Level does not make sense. On the other hand, paying no attention to process does not make sense either.

The most effective role for the quality group is the one that best supports the organization

today, while preparing to improve it in the near term. Without advocating any particular model for organization development, the quality group must understand and support some model - what ever model the organization agrees fits its needs.

<u>SEI Maturity Level</u>	<u>Role of Software Quality Assurance</u>
Initial	Testing
Repeatable	Quality hurdle
Defined	Oversight, Metrics
Managed	Process and Risk management
Optimizing	Reference, Oversight

Figure 3: Organization Maturity and SQA Roles

Other models and standards, such as ISO 9000, may also be applied. The role of ISO 9000 is as the framework for a quality system, rather than a process methodology or prescription for the software quality

organization's charter or function. The relationship of the quality system to the business system and development methodology is graphically described in Figure 4.

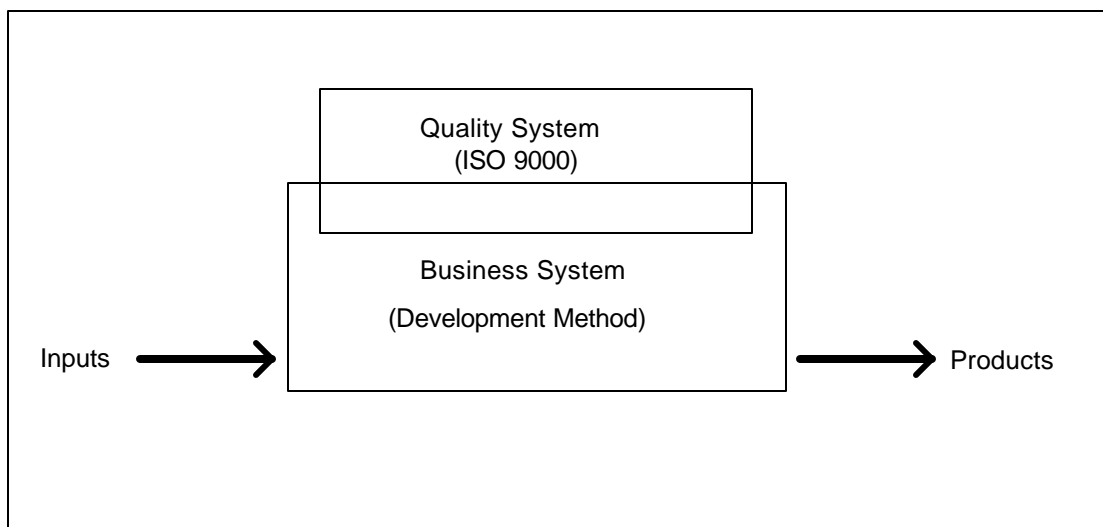


Figure 4: Quality System and Business System Relationship

Neither SEI's Process Maturity Model nor ISO 9000 describe in detail what the right process is, who should do what, or how things should be done. ISO does not begin to prescribe these things, but rather provides rules for knowing if a given quality system might qualify under its guidelines. Neither system addresses the product or product quality directly.

The models don't prescribe methods because each problem situation is different to the point that there is no unique solution. In order for generalized models for development organizations or quality systems to be useful, they must be applicable in many situations. If the models prescribed specific methods and techniques, they would not be applicable to the majority of organizations that have different needs and characteristics. Organizational requirements are unique, and are based upon the product characteristics, customer needs, and organizational politics.

The models are also process oriented, not product oriented. They focus on the processes organizations should have, not the products. They do not address testing of products or product quality directly. They point out how the process must be defined, controlled, and improved. Only by controlling the process can the product quality be predicted and controlled.

Summary

What does this mean to the organization and to the quality group? First, we need to establish what the organization is doing. The role of the quality group should be set based upon the needs of the organization. These needs can be predicted by the maturity of the organization and the need to change. Then goals for improvement of the process and evolution of the organization can be set. The

quality group can play a big part in the planning and implementation through understanding of organizational development needs and techniques. Then an improvement program to attain the goals can be begun. This is the foundation of any continuous improvement program, and ultimately should be the goal of the software quality group and all of management in the organization.

References

Humphrey, W.S., *Managing the Software Process*, Addison-Wesley, 1989

Humphrey, W., "Characterizing the Software Process: A Maturity Framework," *IEEE Software* (March), 73-79, 1988.

Quality Management and Quality Assurance Standards, ASQC, documents ANSI/ASQC Q90, Q91, Q92, Q93, and Q94-1987.

Biography:

Mr. Douglas Hoffman is an independent consultant with Software Quality Methods. He has been in the quality assurance field for over 20 years, consulting and working for numerous organizations including MasPar Computer, Informix Software, Pyramid Technology, Sun Microsystems, and Hewlett-Packard. He specializes in identifying the appropriate development processes and tools for software quality based upon specific organizational requirements. Currently, he is Chairman of the Santa Clara Valley Software Quality Association (SSQA), a Task Group of the American Society for Quality Control (ASQC), and Program Chairman for the Third International Conference for Software Quality. He is also active in the local section of the ASQC and the ISO 9000 Task Group, and is in the process of becoming registered with the RAB as an ISO 9000 Registered Auditor. He received his MBA from Santa Clara University, and his MS in Electrical Engineering and BA in Computer Science from UC Santa Barbara.