Quality Control for Global Software Development

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Global sourcing of software has become a viable option for many U.S. corporations. Technical solutions have removed barriers such as distance and time, but quality concerns remain. Customers are demanding that their software suppliers prove they can deliver reliable, high-quality software systems on a repeatable basis. This paper examines the ISO 9000 series of standards and the process maturity guidelines offered by the Software Engineering Institute’s (SEI) Capability Maturity Model (CMM) as well as some well-known related variants of these models that offer both customers and suppliers of software guidance on improving software quality by focusing first on process.

Conventional economic wisdom has suggested that dominance in any industry is dependent upon fierce competition in a large, domestic market. This has led many to infer a sustainable U.S. dominance in software development. Bradley et al. (1993) disagree by suggesting that the forces of globalization that are transforming the information systems (IS) industry are also transforming the nature of competition among firms in that industry. Software development knows no boundaries and transmission of code and data is becoming easier, faster and cheaper. Unlike other global industries, competitive software development does not require low cost inputs and components to be successful. Instead, software uses relatively high-cost inputs in the form of highly educated individuals. Software development has the potential to be the ultimate exportable commodity inasmuch as transportation costs approach zero and governments will be unable to distort trade in order to protect industries. Or, as Ambrosio (1996) asks “Global Software?”

Clearly, global sourcing of software is a viable option for many U.S. corporations. Technical solutions have removed barriers such as distance and time, but quality concerns remain. Targeting the quality issue, Yourdon (1992) contends that less than 10% of U.S. software organizations are taking a world-class approach to software quality and cautions:

The quality of software is just as important (if not more important) than the productivity with which it is generated. This, I think, is going to be the key issue of the 1990s—and it is an area where I think the American programmer is at a terrible disadvantage...Nobody (to my knowledge) has yet attempted any large scale surveys of software quality on a national basis...If such a survey were made, American software would rank near the bottom.

Yourdon (1996) subsequently ameliorates his criticism of American software quality by noting that substantial improvements in American software quality (as measured in post-release defects) have occurred over the last 10 years with many of the gains occurring in the last few years through the use of CASE tools, structured methods, software inspections and various other disciplines. He cautions however that the range between best and worst software quality has increased dramatically in recent years. Where the difference between the best and worst was 10:1 at the beginning of the 1990s, it has now risen to 100:1. While companies such as Motorola and Hewlett-Packard may well be producing software that is as nearly zero-defect as possible, other American software com-
panies appear to be adopting a “good enough” approach to software quality.

An obvious explanation for the lack of quality management of software comes from reports such as provided by Abdel–Hamid (1988), which contend that the addition of quality assurance into a software development process increases the cost of the total project by as much as 3.5 times. Marciniak (1994) explains that, although control of quality began as early as 1916 at Bell Laboratories, the application of these ideas to software development did not occur until the 1950s. Publications regarding software quality assurance, first appearing in the late 1960s, referred to quality testing rather than quality software development. Oskarsson and Glass (1996) admit that quality is an elusive topic—difficult to define, achieve, or even measure. Software quality is even more elusive, with each difficulty multiplied. Software projects vary in size, application domain, criticality and innovativeness. They do not lend themselves to a one–size–fits–all standardization approach.

After a careful review of the available research, Cheney and Kasper (1993, p. 22) recommend improvements to and expansion of IS education programs to increase the qualifications of IS professionals for the following reason:

*Success in global competition is largely dependent upon the quality of the firm’s global information system* (emphasis added).

In spite of unresolved quality management issues, Meadows (1996) provides three reasons why outsourcing software development to emerging economies is necessary: 1) worldwide shortage of systems developers, 2) maintenance backlogs, 3) globally used systems need to be globally developed using local expertise. She concluded that a framework is needed to guide managers with the critical decisions regarding partitioning the software development tasks across national borders. A useful framework must consider methodological and organizational integration concerns as well as the distinctive capabilities of local developers.

This paper discusses such a framework by examining several models such as: ISO 9000 certification, the Trillium framework developed by Bell Canada, Northern Telecom, and Northern Research and the process maturity guidelines offered by the Software Engineering Institute’s (SEI) Capability Maturity Model (CMM) as ways to reduce quality concerns.

**Common Roots; Common Purposes**

Two of the most widely recognized models used to assess quality management abilities are the ISO–9000 series of standards and the CMM. Both, coincidentally, were introduced in 1987. Two such models coming into existence simultaneously raised many questions regarding overlap, conflict and consensus. One obvious difference: the SEI’s CMM document is 504 pages long and contains specific details about 18 key process areas, 54 goals, and 316 common features of the software development process, whereas ISO 9001 (the ISO component that is most related to the software industry as opposed to the manufacturing and service industries) is only 7 pages (3800 words) long and is a general model providing the minimum criteria for acceptable quality assurance in design/development, production, installation, and servicing.

A more subtle difference between the CMM and the ISO 9000 series is in terms of the meaning of quality. The ISO 9000 series looks at quality in the sense of fitness for purpose and safe use. Thus, the ISO perspective on quality control involves ensuring that the product or service is designed and constructed to satisfy the customers needs. The CMM states that the purpose of software quality assurance is to provide management with appropriate visibility into the process being used by the software project and of the products being built.

Marquardt (1992) shows that upon closer examination there is nevertheless much commonality of purpose between the ISO 9000 series and the CMM. In fact, both can be traced to the U.S. Department of Defense (DoD). The CMM was developed in the mid–1980s by the SEI directly via DoD sponsorship, while the ISO 9000 model can trace its roots back to the DoD somewhat more circuitously. In 1959, the DoD published the MIL-Q-9858 quality management program standard, which was adopted in 1968 in principle by the North Atlantic Treaty Organization (NATO) as AQAP1, AQAP4 and AQAP9. In 1979 the British Standards Institution released commercial versions of the NATO standards as the three-part BS 5750, which evolved into ISO 9001, ISO 9002, and ISO 9003.

**ISO 9000**

The International Organization for Standardization (ISO) is a nongovernmental organization established in 1946 to develop worldwide standards to improve international communication and to promote smooth and equitable growth of international trade. Headquartered in Geneva, Switzerland, the organization is currently composed of more than 90 countries and has chapters in Germany (DIN), the United States (ANSI), France (ANFOR), and the United Kingdom (BSI).

According to Schmauch (1994), the ISO 9000 series, developed to provide a common standard for quality management and quality assurance, have become the most widely recognized and accepted standards in the world. Many countries have adopted ISO 9000 standards, often in the form of a national standard written verbatim, with local representation and sponsorship. For example, in the United States ISO is represented by the American National Standards Institute (ANSI) and the ISO 9000 series is ANSI/ASQC Q-90. The European Community is represented by the European Nations (EN) and called EN 29000. The United Kingdom is represented by the British Standardization Institution (BSI) and called BS 5750. Norway is represented by Norway Standards (NS) and called NS 5801. Thailand has the Thai Industrial Standards (TIS) 9000.