Chapter 5.5
A Study of Software Process Improvement in Small and Medium Organizations

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ABSTRACT

Presently, the majority of software development, including outsourcing, is carried out by small and medium size software development organizations all over the world. These organizations are not capable to bear the cost of implementing available software process improvement models like CMMI, SPICE, ISO, and so forth. Therefore, there is a need to address this problem. In this chapter, various software process assessment and software process improvement models for small and medium scale organizations are discussed and compared. This will lead towards development of standardized software process improvement model for small and medium sized software development organizations in the future.

INTRODUCTION

Quality models and standards have been developed to improve product quality. Software quality is defined as all characteristics of a product that bear on its ability to satisfy explicit and implicit needs of the user (ISO/IES 9126, 1991). According to Pressman (2002), software quality is defined as conformance to explicitly documented development standards and implicit characteristics that are expected of all professionally developed software. Therefore, this definition suggests three requirements for quality assurance that are to be met by the developer (Galin, 2004):

- Specific formal requirements, which refer mainly to the outputs of the software system.

- The software quality standards mentioned in the contract.
- Good software engineering practices (GSEP), reflecting state-of-the-art professional practices to be met by the developer even though not explicitly mentioned in the contract.

The way with which we develop software impacts the quality of the software and hence software process is one of the most crucial factors in determining the quality of the software. A software process is a set of activities, together with ordering constraints among them, such that if the activities are performed properly and in accordance with the ordering constraints, the desired result is produced. The desired result is high quality software at low cost. As each software development project is an instance of the process it follows, it is essentially the process that determines the expected outcomes of a project (Jalote, 2002). Improving the process automatically results in improved quality of the product (software).

Today only few software organizations around the world achieve a high quality level for their development process. A considerable amount of software is produced worldwide by small and medium sized enterprises (SMEs) ranging from 1 to about 50 employees (Gresse von Wangenheim, Punter, & Anacleto, 2003). In this context, the German and Brazilian software market of these companies was around 77% and 69% during 2001 (Ministerio da Ciencia e Tecnologia, 2001). This is further supported by Richardson (2002) that there is need for small software companies in the Irish sector to improve their software process. The term *small setting* has been defined as an organization or company of fewer than approximately 100 people and a project of fewer than approximately 20 people (Software Engineering Institute, n.d.). As mentioned on the Software Engineering Institute (SEI) Web site for small settings, a major aspect to be considered in these environments is that the amount of resources used to support a process improvement effort would be a large percentage of an organization's operating budget. Johnson, Johnson, and Brodman (1998) define a small organization as fewer than 50 software developers and a small project as fewer than 20.

A vast majority of software producers, which have not yet implemented a methodology for software process improvement, are paying high costs of production and systems maintenance, and therefore being displaced from the global market, not being on the same competitiveness level as companies that possess a process improvement method (Herrera & Trejo Ramirez, 2003). There are several models for software process improvement, such as the Capability Maturity Model Integration (CMMI), the software process improvement and capability determination (SPICE), and the ISO 9000 norms from the International Standardization Organization (ISO). These models provide quality patterns that a company should implement to improve its software development process (Herrera & Trejo Ramirez, 2003). Unfortunately, the successful implementation of such models is not generally possible within the context of small and medium-sized software organizations because they are not capable of bearing the cost of implementing these software process improvement programs. The proper implementation of software engineering techniques is difficult task for small organization as they often operate on limited resources and with strict time constraints. Cultural issues like resistance to change from the employees or management who regard the extra work required for quality assurance as a useless and complicated burden put on the developing team. According to Biro, Messnarz, and Davison (2002), national culture also affects the process improvement methods. Due to budget constraints, services of a consultant organization to improve the software quality is not possible; still the need for a good quality assurance program is becoming more evident, and managers are striving to achieve international quality standards that, in the long run, result in lower production cost (Herrera & Trejo Ramirez, 2003).