Software Process Improvement Methodologies for Small and Medium Enterprises

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Abstract. Today, the software industry is one of the most rapidly growing sectors and small software development companies play an important role in economy. Many such organizations have been interested in Software Process Improvement (SPI). It has been observed that the successful implementation of SPI methodologies is generally not possible within the context of small and medium-sized software enterprises (SMEs) because they are not capable of bearing the cost of implementing these software process improvement programs. Further the proper implementation of software engineering techniques is difficult task for SMEs as they often operate on limited resources and with strict time constraints. There are number of methodologies to address these issues. In this paper, various SPI methodologies for SMEs are discussed and compared. This will lead towards maturity of software process improvement in SMEs and also facilitates in development of automation tools for SPIs in future.

Keywords: process, software process improvement, software quality, small and medium enterprises, SME.

1 Introduction

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 [23]. Software processes play an important role in coordinating different teams in large organizations so that their practices don’t grow out of touch with one another [14]. Ideally, these processes should combine the need for flexibility and creativity, but that balance is hard to achieve [17]. 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 than companies that possesses a process improvement method [21]. 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. These models provide quality patterns that a company should implement to improve its software development process [21]. Unfortunately, it has been observed that the successful implementation of such models is generally not 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 [26, 53] and the proper implementation of software engineering techniques is difficult task for SMEs as they often operate on limited resources and with strict time constraints [53]. Dyba [14] indicated that SPI can be used as a competitive advancement strategy for both small and large organizations [14]. Today, the software industry is one of the most rapidly growing sectors and this situation stimulates especially the constant creation of small companies which play an important role in economy [53] and in the last few years, a great number of organizations have been interested in Software Process Improvement (SPI) [10]. A considerable amount of software is produced world-wide by SMEs ranging from 1 to about 50 employees [19]. In this context, German and Brazil software market of these companies was around 77% and 69% during 2001 [37]. Richardson [43] observed that there is need for small software companies in 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 [49]. As mentioned in the Software Engineering Institute 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, [49]. Brodman and Johnson define a small organization as fewer than 50 software developers and a small project as fewer than 20 developers [24].

2 Related Works and Rationale of SPI in SMEs

Existing software engineering and organization development literature acknowledges that there are fundamental operational differences between small and large organizations [14]. Small organizations seem more concerned about practice, while large organizations seem more concerned about formal process [14]. Russ and McGregor [45] observed that software development process can be just as critical to a small project’s success as it is to that of large one due to number of external dependencies per team member. They further argued that its goal is to produce the high quality and timely results for today’s market without imposing a large overhead on a small project. Larsen and Kautz [33] also viewed that these organizations are afraid of the initial expenses which they assume are large both with regard to direct costs for process assessment, training and tools, but also due to indirect costs for personal and time resources when implementing improvement actions. Kuvaja et al. [30] further supports that it is quite difficult for any SME to choose an improvement approach, and to apply it in their organization without help of external consultants or substantial investment in time of their software managers. Cultural issues like resistance to change from the employees or the management areas, who regard the extra work