

# Software Process Improvement: A Road to Success

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**Abstract.** Software process improvement (SPI) has received much attention in both academia and industry. SPI aims to improve the effectiveness of the software development process. Several different approaches have been developed for SPI, including the SEI's Capability Maturity Model (CMM), more recently the Capability Maturity Model Integration (CMMI) and ISO's SPICE. Research shows that the effort put into these approaches can assist in producing high quality software.

This paper has a two-fold objectives: first to review and summarise the empirical evidence thus far on the costs and benefits of SPI approaches; second to establish a relationship between different approaches to SPI and to seek and identify whether these approaches fulfil all the needs for an effective SPI initiative. The aim of this review is to analyse material about SPI approach and to set the scene for future research in the area of Software Process Improvement.

## 1 Introduction

Problems associated with software quality are widely acknowledged to affect the development cost and time [1]. The annual Standish Group report showed that on average the percentage of software projects completed on-time and on-budget was only 34% in 2003 [2]. A recent study, conducted by a group of Fellows of the Royal Academy of Engineering and British Computer Society, shows that despite spending 22.6 billions pounds on IT projects in UK during 2003/2004, significant numbers of projects still fail to deliver key benefits on time and to target cost and specification [3].

There have been increasing calls for the software industry to find solutions to software quality problems [4]. Software organizations are realizing that one of their fundamental problems is to have an effective software development process [5; 6]. In order to have an effective software development process different methods have been developed, of which Software Process Improvement (SPI) is the one mostly used.

The objective of this paper is to discuss and analyse different approaches to SPI in order to identify the issues that can undermine these approaches. The other objective is to analyse empirical evidence on the costs and benefits of SPI approaches. The overall aim is that SPI practitioners would utilise the results of this paper to support the business case for initiating SPI initiatives. To focus this study, I investigated the following research questions:

RQ1. Does SPI really impact on organizations' capabilities?

RQ2. What is missing in current SPI approaches?

The main purpose of addressing these research questions is to provide software practitioners with some insight into initiating SPI programmes. To answer these research questions, a literature review technique was adopted. Furthermore, results of the previously conducted empirical study were also used to answer these two research questions [7]. This two step process has given confidence that the findings of this paper are indeed important to provide some insights into initiating SPI initiatives.

## 2 Research Methodology

The SPI literature consists of case studies, experience reports and high-level software process texts. Most of the studies describe real life experiences of SPI implementation and provide specific guidelines and recommendations for SPI implementation. I have analysed these published experience reports, case studies and articles in order to answer research questions described in Section 1.

There were 3 categories of papers. Firstly, papers in which the authors have summarised the impact of SPI initiative on quality factors (time, cost, productivity and customer satisfaction). Secondly, papers in which SPI implementation was discussed but authors did not provide any summary of SPI impact on the quality factors. In this case, I have had to read each paper carefully to identify the SPI impact on any quality factor. Thirdly, I have also analysed a few papers in which the results of empirical studies were described.

In order to reduce researcher's bias I have conducted inter-rater reliability test in this process. Three research papers were selected at random and a colleague, who was not familiar with the issues being discussed, was asked to identify SPI impact on quality factors. In the end results were compared with previous results.

In this paper a literature review technique was adopted in order to analyse SPI impact on cost, time, productivity and customer satisfaction. This means that a secondary source was used to analyse SPI impact of quality factors. The primary data used in the literature was not verified directly.

Because this study is limited to the software industry, the gathered data reflects the perceptions of those individuals employed in this industry, and generalizations to other industries should be undertaken with extreme caution.

## 3 Does SPI Really Impact on Organizations' Capabilities?

In the previously conducted empirical study with 34 Australian practitioners [8], I asked SPI practitioners "Have SPI initiatives provided clear and expected benefits to the management?" Results show that 71% of the practitioners say that SPI initiatives provided clear and expected benefits to the management. Only 6% of the practitioners say SPI initiatives did not provide any benefits to the management. Conducting previous research has convinced me that the SPI impact on organizations capabilities would be best viewed in terms of cost, time, productivity and customer satisfaction.