# Implementing Software Process Improvement Initiatives: An Empirical Study

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**Abstract.** In this paper we present findings from our empirical study of software process improvement (SPI) implementation. We aim to provide SPI practitioners with insight into designing appropriate SPI implementation initiatives in order to achieve better results. Thirty-four interviews were conducted with Australian practitioners. Three SPI implementation issues were investigated: reasons for embarking on SPI initiatives, SPI benefits to the management, and factors that play a positive role in SPI implementation.

We have found that most common reasons for embarking on SPI initiatives are to: improve the quality of software developed, reduce software development cost, and increase productivity. Our results show that 71% of the practitioners said that SPI initiatives provided clear benefits to the management. We have also found that most frequently cited SPI implementation factors are: SPI awareness, defined SPI implementation methodology, experienced staff, staff time and resources, senior management commitment and training.

Our aim of conducting this study is to provide a SPI implementation framework for the design of effective SPI implementation initiatives.

## 1 Introduction

Information Technology failure has been a common topic in the literature over the last 25 or more years with the annual CHAOS Report [1] perhaps being the most cited regular report. These failures are often seen as being due to issues of software quality, which has accordingly received much attention in both academia and industry. Software quality problems are widely acknowledged to affect the development cost and time [1; 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]. In addition to such disappointing performance, some software projects result in operational failure (e.g. Airbus A320 [4], the London Ambulance Service [5], and the explosion of the Ariane 5 [6]) or even the demise of organisations (e.g. Greyhound's TRIPS System [7], FoxMeyer's ERP project [8], Oxford Health's 'computer glitch' [9] and One.Tel billing system [10]).

J. Münch and M. Vierimaa (Eds.): PROFES 2006, LNCS 4034, pp. 222 – 233, 2006.

There have been increasing calls for the software industry to find solutions to software quality problems [11]. Software developing organizations are realizing that one of their fundamental challenges is to effectively manage the software development process [12; 13]. In order to address the effective management of software process different methods have been developed, of which Software Process Improvement (SPI) is the one mostly used.

Different advances have been made in the development of SPI standards and models, e.g. CMM, CMMI, and ISO's SPICE. Despite the significant development of standards and models for SPI, the failure rate for SPI programmes is high. The recent report from the Software Engineering Institute puts the rate of failure at around 70% [14]. This may be due to the fact that not enough attention has been paid to SPI implementation issues.

In this paper we present empirical findings of a study into SPI implementation that points to the issues that have to be addressed when developing SPI implementation initiatives. Our study uses data from interviews of 34 Australian practitioners in 29 Australian companies. The objective of this paper is to provide insight to SPI practitioners into designing appropriate SPI implementation initiatives in order to achieve better results. Our overall aim of this study is to develop a SPI implementation framework in order to guide practitioners in designing effective SPI implementation strategies.

There are four research questions that have motivated our work:

RQ1. Why different companies embark on SPI initiatives?
RQ2. Have SPI initiatives provided clear and expected benefits to the management?
RQ3. What factors, as identified by mature companies, have a positive impact on SPI implementation?
RQ4. What factors, as identified by immature companies, have a positive impact on SPI implementation?

This paper is organised as follows. Section 2 describes the background. Section 3 describes the research design. In Section 4 findings are presented and analysed. Discussion is provided in Section 5. Section 6 provides the conclusion.

## 2 Background

McDermid and Bennet [15] have argued that the human factors in SPI have been largely ignored and this has damaged the effectiveness of SPI implementation programmes. Hall and Wilson [16; 17] have also suggested that the experiences, opinions and perceptions of software practitioners impact indirectly on the quality of software produced. This also implies that such attributes influence how software practitioners behave towards SPI implementation approaches. It is, therefore, very important to identify the views and perceptions of different practitioners about factors that play a positive role in the implementation of SPI initiative. These views, experiences and perceptions collectively may provide practitioners with sufficient knowledge about the nature of issues that play a positive role in the implementation of SPI programmes in order to assist them in effectively planning SPI implementation strategies.