Chapter 44

An Evaluation of Software Development Practices among Small Firms in Developing Countries:

A Test of a Simplified Software Process Improvement Model

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ABSTRACT

For software development firms to be competitive they must assure the quality of the software product. This has led many firms to adopt software process improvement (SPI) programs such as the capability maturity model integration (CMMI). However, for small software firms, especially those in developing countries with limited resources, these programs are often too cumbersome and costly to implement. To address this issue, this paper proposes a simplified SPI model for small firms (SPM-S) comprised of 10 key software development practices; with fewer practices, the proposed model should be more accessible and less costly to implement. Using data collected in four developing countries in the English-speaking Caribbean from 112 developer/user dyads, the model is evaluated with respect to its impact on software quality. The findings show that the software development process coupled with supporting technology (e.g. project management tools) significantly impact software product quality. Implications for software process improvement in small firms and future research are discussed.

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INTRODUCTION

The key to the survival of software development firms, both large and small, is to develop and market quality software products (Tan, 1996). One approach to achieving this goal is the use of software process improvement initiatives (Humphrey, 1989). Empirical studies have demonstrated the benefits of software process improvement (SPI) initiatives which include improvements in software product quality, project performance, software process management, and customer satisfaction (Niazi, Babar and Verner, 2010; Staples & Niazi, 2008; Subramanian, Jiang, Klein, Huang and Bramanian, 2007). These have alleviated some of the problems in what has been called the 'Software Crisis' which describes the high level of project failures, budget overruns and missed deadlines that often characterize software projects.

The 2013 Chaos report on software project success shows the rate of success increased to 39% in 2012 from 29% in 2004 and 16% in 1995, yet 18% of software development projects were still reported as failed and 43% as challenged, that is, as coming in late, over budget, or with less than the required features (Standish Group, 2013). With small firms in developing countries often having a lower capacity to absorb such failures when compared with large firms or their counterparts in developed countries, this can severely impede their competitiveness for software development contracts, and worse, have a devastating impact on the viability of the firm (Niazi et al., 2010). To address these challenges, this study suggests a simplified software process improvement model for small firms (SPIM-S). The aim is to identify a set of software development practices that are more feasible for small firms to implement and which can help them mature over time and attain the thresholds needed to compete more effectively in a global software market.

To address the problem of software project failure, many studies have been undertaken to identify effective ways to improve software quality. It is widely accepted that software quality is influenced by the *people* who are involved in the development and use of the system, the *technology* used to support development and the software development *process* that is adopted (Duggan & Reichgelt, 2006; SEI, 2010). Indeed, the improvements that have been noted in project success (Standish Group, 2013) are attributed to software development factors including processes, methods, skills, and tools, with the literature suggesting that process has the greatest impact in determining software quality (SEI, 2010).

The capability maturity model integration for development (CMMI) is one of the leading reference models for software process improvement (Niazi et al., 2010). It is a 'living model' that is actively supported by the Software Engineering Institute (SEI, 2010). Having been established with large projects in mind, the CMMI is applied mostly in large firms in developed countries (Niazi et al., 2010). However, it is often criticised for being cumbersome and costly to implement even in large firms (Niazi et al., 2010). For small firms, the challenge is even greater. With their limited resources, full-blown maturity models such as the CMMI are too difficult to implement due to their high implementation cost, limited available time and the small size of the firm (Staples & Niazi, 2008). Indeed, in a study of small software firms in developing countries Espinosa-Curiel, Rodriguez-Jacobo and Fernandez-Zepeda (2013) described CMMI-based SPI programmes and process assessment instruments as too cumbersome, time consuming, disruptive and costly for the firms to implement. Implementing a CMMI process and preparing for process appraisal can also be overwhelming due to the effort needed, time taken, and possible culture shock experienced. These challenges therefore limit adoption of full-blown SPI models such as the CMMI by small firms. Yet, the practices that these models embody are essential for producing high quality software products and so are important for small software firms which like their larger counterparts, experience pressure from clients to produce high quality systems. Furthermore, these firms need