7P. A Preliminary Study of the Use of Software Process Improvement Initiatives in Jamaica

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Abstract

Despite the acknowledged strides that information and communications technologies (ICT) have made, the information systems (IS) community has been plagued with the delivery of low quality information systems (IS). This phenomenon gave rise to a variety of software process improvement (SPI) interventions, aimed at reducing variability in the software production process, as a precursor to improving IS quality. However, SPI initiatives have targeted fairly large organizations and SPI research has been conducted mainly in developed countries, and very little in developing countries and smaller organizations such as those in Jamaica and the English-speaking Caribbean. We sought in this research to ascertain the level of awareness and intention to use SPI programs in Jamaican software development firms. Preliminary indications of our study revealed that a large majority of these firms are not aware of SPI programs; neither do they intend to adopt any form of SPI effort in the near future. Our findings provided the basis to support the claim for future research to explore the underlying causes for this lack of awareness and non-adoption of SPI programs among Jamaican firms.

Keywords
Capability maturity model integration, Jamaican software development firms, small organization and software process improvement.

1. Introduction

Researchers have long established that concerns related to the quality of information systems (IS) products, can be somewhat resolved by software process improvement (SPI) interventions. SPI methods include a set of established software development practices that are geared towards minimizing process variability under the premise, long established in the manufacturing arena, that the reduction in process variability can lead to improved product quality (Humphrey, 1989).

Most SPI initiatives, because of cost, complexity, and other reasons, have been conducted in developed countries with very few in developing countries such as those in the English-speaking Caribbean (ESC), including Jamaica. Researchers have identified several benefits of SPI programs, such as (1) IS quality improvement (2) cost and project cycle time reductions, (3) staff productivity improvement and (4) greater customer satisfaction (Dion, 1993; Dooley et al., 2001; Herbsleb et al., 1997; Johnson & Brodman, 1996; Krishnan & Keller, 1999). In

addition, Herrera & Ramirez (2003) have found that firms which have implemented neither quality nor SPI initiatives have incurred much higher costs for software development and system maintenance.

Organizations in developing countries, and Jamaica is no exception, have made significant investments in information and communications technologies (ICT) to help them improve profitability and in some cases competitive positioning (United Nations, 2003). However, these efforts are often undermined by poor quality systems (Garcia-Murillo, 2003; Herrera & Ramirez, 2003). We set out in this research effort, therefore, under the premise that (1) information systems deployment is the means by which ICT is implemented and (2) SPI implementations can assist with improving the quality of information systems, to determine to what extent organizations in Jamaica adopt practices such as those embraced by the capability maturity models, which are prevalent in applying SPI techniques.

An exploratory survey of randomly selected software development firms in Jamaica was conducted to determine the awareness and intention to use of SPI initiatives, as a precursor to a larger study. We applied Kasunic's (2006) definition of software developing firms as those that develop and maintain or acquire software products. Many Jamaican firms have aspirations of participating in the global software export market, in which, it may be inferred from Carmel (2003), that the ESC has no presence. The prospect of converting this ambition into reality, largely resides in these firms improving the maturity of their software development processes; that is the degree to which their processes are defined, managed, measured and continually improved (Dooley et al., 2001). They must also inculcate development practices that help to reduce the capability distance between themselves and the developed world (Duggan & Virtue, 2004).

In the remainder of this paper, we outline the importance of SPI as a quality enhancing mechanism as indicated by the relevant SPI literature, especially the benefits of the capability maturity model (CMM) and its successor, the capability maturity model integration (CMMI). We discuss the methodology, then present our findings, from the first stage of this research in progress and finally offer our conclusions and directions for the future.

2. Background

Over time, two distinct software development paradigms have emerged – agile (the new kid on the block) and structured development methods. Both have similar end goals - to overcome the challenges of low quality software; however, they are based on very different philosophies and assumptions. We selected the "structured" route to investigate SPI efforts in Jamaica because of the introspection it forces on software development processes before remedial efforts are prescribed.

Proponents of structured methods begin with the assumption, that is almost axiomatic in the quality literature in the manufacturing domain, that the quality of the product is highly influenced by the quality of the process used to generate it (Deming, 1986; Paulk et al., 1993). This premise has contributed to the core notions of SPI interventions, in which extensive focus is placed on establishing process stability, maturity and capability in an effort to reduce variability in the process, thereby increasing the likelihood of producing higher quality software products (Humphrey, 1989).

Empirical studies in developed countries with large firms (Dooley et al., 2001; Harter et al.,2000; Herbsleb et al., 1997; Johnson & Brodman, 1996; Krishnan & Keller, 1999) have corroborated the proposition that "A quality system is a desirable (though not sufficient) condition for achieving quality of the end product" (Bevan, 1995, p. 3).

There are numerous software process improvement frameworks. These include the software Capability Maturity Model, Software Process Improvement Capability dEtermination (SPICE), Bootstrap, Trillium, and Capability Maturity Model Integration (CMMI). However, it is felt that these frameworks were developed for large firms in developed countries embarking on large projects (Herrera & Ramirez, 2003). In this study, we have adapted the European Commission's definition of small enterprises as firms having ten to forty-nine employees or with annual turnover between EU$2 - 10 million. Based on this definition, most or all software development firms in Jamaica would be classified as small.

We assume that small software development firms in Jamaica, like larger firms in the developed world, would like to make information technology (IT) a factor in economic performance and as such strive to compete in the global software market. However, to be competitive in the global market and win contracts, firms must demonstrate that their software delivery processes are capable and mature (Turner, 2007).

For example, the CMMI has five maturity levels (levels 1 – 5) along a continuum in which each level indicates a progressively higher process capability. At level 1 there are no established practices, but from levels 2 – 5 there are established and prescribed practices. Firms are encouraged to progress along the continuum from level 1 in which the production process is described as chaotic to level 5 in which a culture of continuous improvement prevails. Firms should be assessed at maturity level 2 and above to be qualified as global competitors.

Research results have indicated several benefits of CMMI-based SPI efforts, such as improvements in software product quality and staff productivity, and reductions in project cycle time and cost (Krishnan & Kellner, 1999). These are benefits that Jamaican firms should seek to derive, in an effort to increase their efficiency and competitiveness and eventually increase the possibility of winning contracts in the global software export market. However, small firms in general have not embraced SPI programs mainly because of the perception that these initiatives are too cumbersome, disruptive, time consuming and costly (Buchman & Bramble, 1995). In addition, Staples et al. (2007) reinforced this notion in his findings that small firms shied away from CMMI efforts because they believed it was infeasible due to high implementation cost and their size, and because it was time-consuming. Based on the findings above, we conjectured that the use of SPI programs in Jamaica was almost non-existent, but that there may be some level of awareness and possibly interest in using these approaches. The preliminary, exploratory study confirmed that the use was effectively zero but we also collected data to test whether there was some level of (1) awareness of SPI initiatives and (2) if so, whether there was some intention to use SPI programs.

3. Methodology
In order to assess the awareness and intention to use SPI interventions by Jamaican firms, which were involved in IS development both for internal use and for sale, we first established a sampling frame by developing a database of these companies. The data base included

approximately seventy firms. We then captured a variety of information about these firms, including their names, addresses, telephone numbers as well as the names of, and contact numbers for Chief Information Officers (CIOs).In some cases referrals were given by CIO on the details regarding project managers, systems analysts, developers and systems administrators

Once the database of the seventy firms was established,, we used a random number generation technique to select twenty-eight firms for investigation in our preliminary study. The data collection instrument, which was administered to these firms by way of a telephone interview, contained both discrete and qualitative questions. Telephone interviews were used in order to expedite the data collection (Babbie, 2004) and to reduce the cost of reaching the firms selected. We were able to make contact and/or received feedback from twenty firms on the list. The questions were related to firm's awareness of SPI and its benefits, as well as firm's intention to adopt SPI programs. Responses to these questions were gathered from senior information systems personnel within each company. These included information systems project managers, systems analysts, developers and systems administrators. It was felt that these persons were qualified to represent their companies in the area of information systems.

Table 1 shows the composition of the firms that responded in the research, by industry type, and the number of firms who indicated an awareness of SPI techniques and any intention to adopt SPI programs. The result indicate that very few firms were aware of SPI and its benefits and only one firm in the insurance and finance sector intended to use SPI programs in the near future.

Type of Firm	Number of Firms	Number Aware of SPI	Number Intending to use SPI
Manufacturing	5	0	0
IT & Telecomm	4	1	0
Insurance & Finance	5	1	1
Other - Health, Education, Media & Port	6	1	0

Table 1: Organizations by Type

4. Findings

In an attempt to provide deeper insights, we used the binomial test of significance, typically employed with small samples, to test for significant difference between the sample proportion and a theorized proportion. In this particular case we estimated low levels of awareness and intention to use SPI initiatives and set the proportion (of nonuse) at .99 and tested for significance within the types of organizations from which we collected data (Table 2). The tests indicated that there was slightly higher than expected awareness of SPI techniques in IT and Telecoms and Finance and Insurance companies as well as for Intention to adopt these techniques in the latter.

In essence, these findings indicate that the knowledge of SPI technique is effectively non-existent in Jamaica organizations. These firms are not attuned to the benefits of SPI programs; it was simply not on their radar. We somewhat expected to find low adoption of SPI programs; however, we thought that awareness would have been higher. On further investigation we also learned that the single firm in the IT sector that was aware was a member of a multinational group, with Head Office in the United States. While this

subsidiary, on its own, could qualify as a small firm, its access to the IT capabilities and knowledge of its parent organization would disqualify it as a sample point in this research. .

Binomial Test of Significance – SPI Awareness			
Type of Firm	Number	Test Prop.	Sig (1-tailed)
Manufacturing	5	0.99	0.951
IT & Telecomm	4	0.99	0.039a
Insurance & Finance	5	0.99	0.049a
Other - Health, Education, Media & Port	6	0.99	0.059a
Binomial Test of Significance – Intention to use SPI			
Type of Firm	Number	Test Prop.	Sig (1-tailed)
Manufacturing	5	0.99	0.951
IT & Telecomm	4	0.99	0.961
Insurance & Finance	5	0.99	0.049a
Other - Health, Education, Media & Port	6	0.99	0.941

a. Alternative hypotheses states that the proportion of cases in the first group < 0.99

Table 2: Results of Binomial Test of Significance

The study suffered from at least two limitations: (1) No comprehensive listing of Jamaican software development firms existed and so the sample frame we established may not have been exhaustive; (2) the small sample size, while being representative, did not contain enough data points to allow for effective analysis. However, this was the first stage of a two-step approach to glean information that would inform the design of the next stage.

5. Conclusion

Although these are preliminary indications, they point to the need for further investigation to explore the underlying causes for the lack of awareness and non-adoption of SPI programs in Jamaica. One possible explanation was posited by Duggan & Virtue (2004), who stated that many Jamaican firms had dismantled their mainframe environments in the 1980s, and this might account for the lack of awareness of the range of currently available software production and quality improvement techniques, including SPI interventions. However, this inattention to SPI initiatives by Jamaican firms can have a negative impact on their capabilities and eventual competitiveness.

6. Next Steps

We are poised to conduct the second stage of this research to identify the precise reasons that Jamaica firms are not aware of and do not engage in SPI programs. This will involve a two-step approach involving qualitative research to obtain richer insights and design science research to establish and evaluate SPI-type frameworks that may be simpler and less costly but with the effectiveness to address the pervasive problem of low-quality software products.

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