Effects of Capability Maturity Model on Project Performance of Information and Communication Technology Projects

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Introduction

Organizations try to develop higher quality software products on time by using Software Process Improvement (SPI) which includes set of activities that lead to better software processes. Capability Maturity Model Integration (CMMI) is widely used SPI framework for software development industry (Pressman, 2005). The main purpose of CMMI is to provide an overall indication of the "Process Maturity". CMMI, SPI and Total Quality Management (TQM) are the key interest for improving the performance of software development projects and achieve higher returns on investment (ROI) for the practicing organization (Humphrey 1988; Jones 1998; McConnell 2002). By concerning above factors, CMMI is very popular and accepted by various local and international software development firms. This research study continues empirical study of software development process maturity and its impact on the performance of ICT Projects, it is expected to examine whether CMMI levels have an association or impact with software development project performance. The most important benefits of software process maturity model sand standards within organizations are often said to be customer satisfaction, reduce the costs associated with software maintenance, quality improvement and rework reduction (Pressman 2005).

It is argued that CMMI levels influence the performance of the project. It can be expected that some organizations having higher maturity level should have higher project performance. Currently, in Sri Lanka few ICT related organizations have assessed their process maturity with CMMI, most companies had not assessed their maturity level and they haven't clear idea about how Software Process Improvement indicated by CMMI effect on project performance. CMMI Levels can be defined as Level I: Initial, Level II: Repeatable, Level III: Defined, Level IV: Managed, Level V: Optimized. Basically, Project performance can be measured against triple constraints (Cost, Time, and Scope), If company A is performing well in level (II) and company B is having same performance. But, company B is in Level (IV), thus there is no point to achieve level (III) or level (IV) for company A. In this research, it is expected to test above mentioned problem. Organizations in different levels of CMMI (CMMI II, CMMI III, and CMMIIV) exhibit different levels of IT project outcomes as measured by project performance, so following objective is concerned in this study.
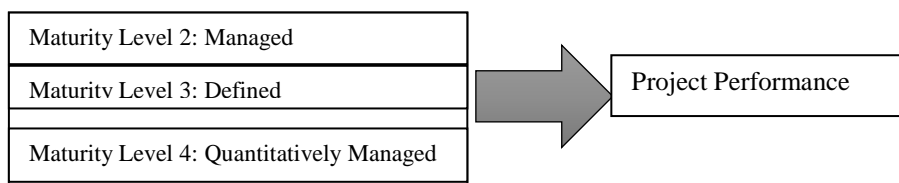
To identify whether there is a significant relationship between CMMI Levels and performance of ICT projects and measure how project performance varies with CMMI level.

Literature Review

The CMMI evaluation ranks software development organizations into one of the five levels. Empirical studies have evaluated the use of CMMI and its impact on the organization. In their empirical research on CMMI, higher levels of CMMI process maturity are shown to be associated with higher software product quality (Harter et al. 2000). The net effect of higher levels of CMMI process maturity is improved project performance as measured by reduction in cycle times and development effort (Harter et al. 2000). In the context of software development industries, project success measures literature offers some empirical research. Examples from the empirical research include measures such as: on time to market, on target to market (product meet needs of current customers), and schedule, cost, quality; quality of the project management process; customer satisfaction (Hartman 2002).Some literature examples point to schedule, budget, customer satisfaction (Shachtman1998).In addition, the measures can be grouped as (a) internal measures (e.g., cost, time, quality) and (b) external measures (market share, time to market, profitability index, customer satisfaction).

Methodology

The aim of this research was to compare CMMI Levels with project performance and identify impact of CMMI Level for project performance. Therefore, study was designed as Analysis of variance (**ANOVA**). One Way ANOVA is used in Analysis because, study was conducted for one mean (Project Performance) for more than two groups (CMMI Levels). Measurements were based on one interval variable (Project Performance) and one ordinal variable (CMMI II, CMMI III, CMMI IV) with three groups. CMMI Level I and Level V were not considered in this study because every organization in Level I deliver workable software solution so each and every organization can be considered in level I, moreover Level V was ignored because these organizations are in their mature stage and continuously improve their processes. Sample size was selected as 66 software professionals based on simple random sampling with support of G power software application. The method of data collection for this research was questionnaire.

| Maturity Level 2: Managed |
| Maturity Level 3: Defined |
| Maturity Level 4: Quantitatively Managed |

Project Performance

Figure 1 Conceptual Framework

The researcher has used Cluster Analysis in order to obtain natural groupings within collection of data. Therefore, variables were related to cluster analysis, measured in interval scale based on Software Process Maturity Questionnaire developed by Delkleva and Drehmer (1997).

HypothesisH1: Organizations in different levels of CMM (CMM II, CMMIII, and CMM IV) exhibit different levels of Information and Communication Technology project outcomes as measured by project performance.

Results and Discussions

49.25% (n=67) of organizations are adopted to Standardized project management practices Scrum practices (73 %) are mostly used in current software development than traditional methods like waterfall model (40 %).

Results suggest that higher levels of CMMI Level do have an effect on project performance. Specifically, our results suggest that when organizations are having higher maturity level, they achieve higher project performance.

Conclusion

These research findings are that CMMI levels do have different impacts on software project performance. Higher CMMI levels are associated improved software project performance. According to Davenport process standardization creates more opportunities to outsourcing and reduces the number of processes that organizations decide to perform for themselves.

According to the research done by Bradford, he analyzed how process maturity (CMMI levels) effect on effort and he identified increment of one CMMI level resulted in 4% to 11% reduction in effort.

Scrum methodology was the most widely used methodology which falls into the Agile project management methodology. A conventional methodology like waterfall methodology is having low popularity among industry.

Recommendations

According to results and evidences that CMMI based process improvement can result in better project performance and higher quality products. By adopting to CMMI they can have benefits in Cost, Schedule, Quality, Customer Satisfaction and Return on Investment. Therefore, organizations should practice process maturity model like CMMI.

PMO (Project Management Office) is a management structure that standardizes the project related governance processes and facilitates the sharing of resources, methodologies, tools and techniques and creates a uniform approach to project management within an organization. According to Analysis, most of the organizations having PMO and they are having higher rate of project performance.

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