HARMONIZING CMMI-DEV1.2 AND XP METHOD TO IMPROVE THE SOFTWARE DEVELOPMENT PROCESSES IN SMALL SOFTWARE DEVELOPMENT FIRMS

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Abstrak

Kebanyakan organisasi yang membangunkan perisian komputer adalah firma kecil, dan mereka telah menyedari akan keperluan untuk mengurus dan meningkatkan aktiviti pembangunan dan pengurusan perisian komputer. Model dan piawaian Penambahbaikan Proses Perisian (SPI) yang tradisional didapati tidak realistik bagi firma kecil kerana kos yang tinggi, sumber yang terhad dan tempoh serahan projek yang ketat. Oleh itu, firma kecil memerlukan kaedah pembangunan perisian yang mudah serta model SPI yang sesuai bagi mengurus dan meningkatkan proses pembangunan dan pengurusan perisian. Kajian ini bertujuan untuk membangunkan suatu rangka kerja proses penambahbaikan pembangunan perisian yang sesuai untuk Firma Pembangunan Perisian Kecil (SSDFs) berasaskan kaedah Pengaturcaraan Ekstrem (XP) dan model Model Integrasi Kematangan Keupayaan untuk Pembangunan versi 1.2 (CMMI-Dev1.2). Terdapat empat tahap dalam pembangunan rangka kerja ini iaitu: (1) menjajarkan setiap amalan XP dengan matlamat khusus Bidang Proses Utama (KPAs) CMMI-Dev1.2; (2) membangunkan rangka kerja proses penambahbaikan pembangunan perisian yang dicadangkan dengan mengguna pakai kaedah XP melalui pengadaptasian Pendekatan Berasaskan Penambahan (EBA), CMMI-Dev1.2 dan elemen generik daripada rangka kerja SPI; (3) mengesahkan kesesuaian rangka kerja yang dicadangkan dengan KPAs CMMI-Dev1.2 melalui kaedah kumpulan berfokus yang dipadankan dengan teknik Delphi; dan (4) mengesahkan rangka kerja yang telah diubah suai dengan menggunakan soal selidik CMMI-Dev1.2 sebagai item utama untuk mengesahkan kesesuaian rangka kerja tersebut untuk SSDFs, serta menjalankan dua kajian kes bagi mengesahkan kebolehlaksanaan dan keberkesanan rangka kerja ini bagi firma tersebut. Hasil menjajarkan amalan XP kepada KPAs CMMI-Dev1.2 menunjukkan bahawa dua belas KPAs disokong oleh amalan XP, lapan KPAs sebahagiannya disokong oleh amalan XP, dan dua KPAs tidak disokong oleh amalan-amalan XP. Sumbangan utama kajian ini adalah: penambahbaikan rangka kerja proses pembangunan perisian untuk SSDFs, mendapatkan lebih pemahaman tentang cara untuk membina rangka kerja, dan peningkatan kualiti bagi proses pembangunan perisian. Masih terdapat ruang untuk membuat kajian lanjutan iaitu dengan memenuhi beberapa lompong tertentu dalam amalan KPAs, meneliti amalan kaedah *agile* yang lain dan menggunakan CMMI-Dev1.3 untuk memperbaiki rangka kerja ini, serta menjalankan lebih banyak kajian kes.

Kata kunci: Penambahbaikan proses perisian, Pengaturcaraan ekstrem, Model integrasi kematangan keupayaan untuk Pembangunan versi 1.2, Firma pembangunan perisian kecil

Abstract

Most software development organizations are small firms, and they have realized the need to manage and improve their software development and management activities. Traditional Software Process Improvement (SPI) models and standards are not realistic for these firms because of high cost, limited resources and strict project deadlines. Therefore, these firms need a lightweight software development method and an appropriate SPI model to manage and improve their software development and management processes. This study aims to construct a suitable software development process improvement framework for Small Software Development Firms (SSDFs) based on eXtreme Programming (XP) method and Capability Maturity Model Integration for Development Version 1.2 (CMMI-Dev1.2) model. Four stages are involved in developing the framework: (1) aligning XP practices to the specific goals of CMMI-Dev1.2 Key Process Areas (KPAs); (2) developing the proposed software development process improvement framework based on extending XP method by adapting the Extension-Based Approach (EBA), CMMI-Dev1.2, and generic elements of the SPI framework; (3) verifying the compatibility of the proposed framework to the KPAs of CMMI-Dev1.2 by using focus group method coupled with Delphi technique; and (4) validating the modified framework by using CMMI-Dev1.2 questionnaire as a main item to validate the suitability of the modified framework for SSDFs, and conducting two case studies to validate the applicability and effectiveness of this framework for these firms. The result of aligning XP practices to the KPAs of CMMI-Dev1.2 shows that twelve KPAs are largely supported by XP practices, eight KPAs are partially supported by XP practices, and two KPAs are not-supported by XP practices. The main contributions of this study are: software development process improvement framework for SSDFs, elicit better understanding of how to construct the framework, and quality improvement of the software development processes. There are possible avenues for extending this research to fulfil the missing specific practices of several KPAs, examining other agile practices and using CMMI-Dev1.3 to improve the framework, and conducting more case studies.

Keywords: Software process improvement, eXtreme programming, Capability maturity Model integration for development Version 1.2, Small software development firms.

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List of Abbreviations

SPI	Software Process Improvement
SEI	Software Engineering Institute
CMM	Capability Maturity Model
CMMs	Capability Maturity Model & Capability Maturity Model Integration Versions
CMMI	Capability Maturity Model Integration
CMMI-Dev1.2	Capability Maturity Model Integration For Development Version 1.2
KPAs	Key Process Areas
SPA	Software Process Assessment
SPICE	Software Process Improvement and Capability Determination
ISO	International Organization for Standardization
IEC	International Electro-technical Commission
EIA	Electronic Industries Alliance
IEEE	Institute of Electrical and Electronics Engineers
SMEs	Small and Medium Enterprises
SME	Situational Method Engineering
SDP	Software Development Process
SDPI	Software Development Process Improvement

SSDFs	Small Software Development Firms
DSDM	Dynamic Systems Development Method
ASD	Adaptive Software Development
FDD	Feature-Driven Development
AM	Agile Modeling
SPM	Software Process Matrix
ASPE-MSC	An Approach for Software Process Establishment in Micro and Small Companies
PRISMS	An Approach to Software Process Improvement for Small to Medium Enterprises
iFLAP	Improvement Framework Utilizing Light Weight Assessment and Improvement Planning
MARES	A Methodology for Software Process Assessment in Small Software Companies
FAME	Fraunhofer IESE Assessment Method
TOPS	Toward Organized Process in SMEs
RAPID	Rapid Assessment for Process Improvement for Software Development
EPA	Express Process Appraisal
SPINI	Software Process Improvement Initiation Framework
S3mAssess	S3m Mini-Assessment Method
EBA	Extension-Based Approach
IPPD	Integrated Product And Process Development

M.V	Mean Value
S.D	Standard Deviation
C.V	Curriculum Vitae
SEPG	Software Engineering Process Group
Freq	Frequency
WCF	Widows Communication Foundation
UI	User Interface
BLL	Business Logic layer
DAL	Data Access Layer
LAN	Local Area Network
TCP	Transmission Control Protocol
VB	Visual Basic
TFS	Team Foundation Server
T	Task

CHAPTER ONE
INTRODUCTION

This chapter provides an overview of the research in this study. It presents the background of the research area and the problem statement of this study. The research question, research objectives, and the scope of this study are also highlighted in the chapter. The chapter also presents the research strategy of the study, followed by the expected contributions of the research. This chapter ends with an overview of the thesis structure.

1.1 Background

Software industry is considered as one of the most important and rapidly growing sectors all over the world. In this regard, software development firms need to be highly focused to be able to develop high quality software products, taking into account the time, cost, scope, and resources. Accordingly, these firms need to have a suitable software development process model to manage their processes in a systematic way. Somerville (2011) defines the software development process model as ”*a simplified representation of a software process. Each process model represents a process from a particular perspective, and thus provides only partial information about that process”.*

The quality of software development process directly affects the quality of the software product. In this respect, it is important for software development firms to improve their software processes to meet the challenges of continuously changing user requirements to satisfy the customer’s needs within the time constraints and maintaining high quality

The contents of the thesis is for internal user only

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