

**A PROCESS BASED APPROACH SOFTWARE CERTIFICATION
MODEL FOR AGILE AND SECURE ENVIRONMENT**

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Abstrak

Di dalam persekitaran perniagaan hari ini, proses perisian Agil dan selamat menjadi penting kerana kedua-dua proses ini dapat menghasilkan perisian yang berkualiti tinggi dan terjamin keselamatannya untuk dipasarkan dengan lebih cepat dan kos efektif. Malangnya, terdapat di kalangan para pengamal perisian yang tidak mengikuti amalan yang sesuai bagi kedua-dua proses ketika membangunkan perisian. Terdapat banyak kajian telah dijalankan untuk menilai kualiti proses perisian, walau bagaimanapun, tumpuan kajian tersebut hanya diberikan kepada proses perisian lazim. Tambahan pula, kajian yang sedia ada tidak mengambil kira nilai pemberat di dalam penilaian walaupun setiap kriteria penilaian mungkin mempunyai kepentingan yang berbeza. Oleh yang demikian, pensijilan perisian diperlukan untuk menjamin kualiti bagi proses perisian Agil dan selamat. Justeru, objektif tesis ini adalah untuk mencadangkan Model Pensijilan dan Penilaian Proses Perisian Lanjutan (ESPAC) yang memberi fokus kepada kedua-dua proses perisian ini dan mengambil kira nilai pemberat ketika menjalankan penilaian. Kajian ini telah dijalankan dalam empat fasa: 1) kajian teori untuk mengkaji faktor dan amalan yang mempengaruhi kualiti proses perisian Agil dan selamat serta teknik untuk memperuntukkan nilai pemberat, 2) kajian penerokaan yang disertai oleh 114 pengamal perisian untuk mengkaji amalan pembangunan perisian mereka, 3) pembangunan model pensijilan proses perisian lanjutan yang mengambil kira proses, manusia, teknologi, kekangan projek dan persekitaran serta menyediakan garis panduan pensijilan dan menggunakan Proses Hierarki Analitik (AHP) untuk memperuntukkan nilai pemberat dan 4) penentuan proses perisian Agil dan selamat serta AHP melalui kajian pakar, diikuti dengan pengesahsahihan terhadap tahap kepuasan dan praktikal model yang dicadangkan melalui perbincangan kumpulan berfokus. Keputusan pengesahsahihan menunjukkan bahawa Model ESPAC telah mencapai kepuasan pengamal perisian dan didapati praktikal untuk dilaksanakan di dalam persekitaran sebenar. Sumbangan kajian ini mencakupi perspektif Pensijilan dan Penilaian Proses Perisian dan Kriteria Berbilang Membuat Keputusan, serta perspektif praktikal dengan menyediakan satu mekanisme yang boleh digunakan oleh pengamal dan penilai perisian untuk menentukan tahap kualiti proses perisian dan membantu pelabur serta pelanggan dalam membuat keputusan pelaburan.

Kata kunci: Pensijilan proses perisian, Proses perisian Agil, Proses perisian selamat, Proses Hierarki Analitik, Model Pensijilan dan Penilaian Proses Perisian Lanjutan.

Abstract

In today's business environment, Agile and secure software processes are essential since they bring high quality and secured software to market faster and more cost-effectively. Unfortunately, some software practitioners are not following the proper practices of both processes when developing software. There exist various studies which assess the quality of software process; nevertheless, their focus is on the conventional software process. Furthermore, they do not consider weight values in the assessment although each evaluation criterion might have different importance. Consequently, software certification is needed to give conformance on the quality of Agile and secure software processes. Therefore, the objective of this thesis is to propose Extended Software Process Assessment and Certification Model (ESPAC) which addresses both software processes and considers the weight values during the assessment. The study is conducted in four phases: 1) theoretical study to examine the factors and practices that influence the quality of Agile and secure software processes and weight value allocation techniques, 2) an exploratory study which was participated by 114 software practitioners to investigate their current practices, 3) development of an enhanced software process certification model which considers process, people, technology, project constraint and environment, provides certification guideline and utilizes the Analytic Hierarchy Process (AHP) for weight values allocation and 4) verification of Agile and secure software processes and AHP through expert reviews followed by validation on satisfaction and practicality of the proposed model through focus group discussion. The validation result shows that ESPAC Model gained software practitioners' satisfaction and practical to be executed in the real environment. The contributions of this study straddle research perspectives of Software Process Assessment and Certification and Multiple Criteria Decision Making, and practical perspectives by providing software practitioners and assessors a mechanism to reveal the quality of software process and helps investors and customers in making investment decisions.

Keywords: Software process certification, Agile software process, Secure software processes, Analytic Hierarchy Process, Extended Software Process Assessment and Certification Model.

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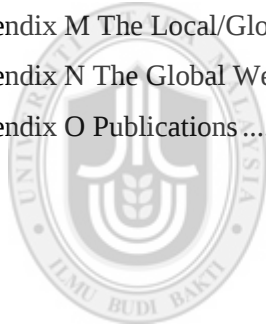
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List of Abbreviations

AHP	Analytic Hierarchy Process
AM	Agile Modeling
ANC	Average of Normalized Columns
ASD	Adaptive Software Development
CI	Consistency Index
CLASP	Comprehensive, Lightweight Application Security Process
CR	Consistency Ratio
CMMI	Capability Maturity Model Integrated
DSDM	Dynamic Systems Development Method
ESPAC Model	Extended Software Process Assessment and Certification Model
FDD	Feature-Driven Development
GQM	Goal Question Metric
HOQ	House of Quality
ISO	International Organization for Standardization
LSPCM	Laquso Software Product Certification Model
MCDM	Multiple Criteria Decision Making
MS SDL	Microsoft Security Development Lifecycle
NGM	Normalization of the Geometric Mean of the Rows
NRA	Normalization of Row Average
NRC	Normalization of the Reciprocal Sum of Columns
OWASP	Open Web Application Security Project
QFD	Quality Function Deployment
SCAMPI	Standard CMMI Appraisal Method for Process Improvement
SCM _{prod}	Software Product Certification Model
SEI	Software Engineering Insitute
SPAC Model	Software Process Assessment and Certification Model
SPSS	Statistical Package for Social Science
SSE-CMM	System Security Engineering CMM
TDD	Test Driven Development
TOPSIS	Technique for Order Preference by Similarity to Ideal Solution
WSM	Weighted Sum Method
XP	Extreme Programming

CHAPTER ONE

INTRODUCTION

1.1 Overview

This chapter provides an introduction to the study which begins with the background of the study, followed by the discussion on the problem. Then, research questions are provided and used to construct the objectives. Finally, this chapter presents the scope as well as the significance of the research. This chapter is concluded with an overview of the remaining chapters of this thesis.

1.2 Background

The use for software has become indispensable in today's world since its usage has become more and more critical in every domain of our life. Surprisingly, as indicated by Jones and Bonsignour (2012), even though software is among the most widely used product in human history, its failure rate is one of the highest among any other products in human history. Consequently, customers are always concerned with the quality of the software produced for them, whether the software meets their needs and follows certain standards. On top of that, in today's business environment, the customers expect that the software can be produced in the market faster and have good security features. Nevertheless, complains about customers' dissatisfactions on the software still exist even though the software developers claimed that the software they produced is in good quality (The Standish Group, 2013; Weber-Jahnke, 2011; Cerpa & Verner, 2009; Charette, 2005; Lindstrom & Jeffries, 2004).

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