A FRAMEWORK FOR COTS SOFTWARE EVALUATION AND SELECTION FOR COTS MISMATCHES HANDLING AND NON-FUNCTIONAL REQUIREMENTS

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Abstrak

Keputusan ketika membeli perisian *Commercial Off-The-Shelf* (COTS) memerlukan garis panduan yang sistematik supaya perisian COTS yang sesuai boleh dipilih bagi menghasilkan penyelesaian yang berdaya maju dan berkesan kepada organisasi. Walau bagaimanapun, rangka kerja penilaian dan pilihan perisian COTS yang sedia ada lebih menumpukan pada aspek kefungsian dan tidak memberi perhatian yang mencukupi untuk mengendalikan ketidaksepadanan antara keperluan pengguna dan spesifikasi perisian COTS, serta tidak mengambil kira keperluan bukan kefungsian. Oleh yang demikian, satu rangka kerja baharu bagi penilaian dan pemilihan perisian COTS dalam menyelesaikan ketidaksepadanan keperluan dan mengambil kira keperluan bukan kefungsian sangat diperlukan. Justeru itu, kajian ini bertujuan untuk membangunkan rangka kerja baharu bagi penilaian dan pemilihan perisian COTS yang memberi penekanan terhadap pengendalian ketidaksepadanan keperluan dan mengambil kira keperluan bukan kefungsian. Kajian ini telah dijalankan dengan menggunakan metodologi mod campuran yang melibatkan teknik kaji selidik dan temu bual. Kajian dilaksanakan dalam empat fasa: pelaksanaan kaji selidik dan temu bual di 63 buah organisasi untuk mengenal pasti kriteria penilaian COTS, pembangunan rangka kerja perisian COTS dengan menggunakan Teori Penilaian, pembangunan teknik membuat keputusan yang baharu dengan menerapkan Proses Analisis Hierarki dan Analisis Jurang bagi mengendalikan ketidaksepadanan perisian COTS, dan pengesahan kebolehlaksanaan dan kebolehpercayaan rangka kerja Penilaian dan Pemilihan perisian COTS (COTS-ESF) yang dicadangkan dengan merujuk kepada semakan pakar, kajian kes, dan pengesahan ukur takat. Kajian ini telah mengenal pasti lima kriteria penilaian bagi perisian COTS: Kualiti, Domain, Seni Bina, Persekitaran Operasi dan Reputasi Pembekal. Ia juga menyediakan teknik membuat keputusan dan proses lengkap untuk menjalankan penilaian dan pemilihan perisian COTS. Hasil kajian menunjukkan bahawa aspek-aspek rangka kerja tersebut yang dinilai adalah sesuai dan berpotensi serta praktikal untuk digunakan dalam persekitaran sebenar. Sumbangan kajian ini merentangi kedua-dua perspektif penyelidikan dan praktikal dalam bidang penilaian perisian dengan memperbaiki proses membuat keputusan dan menyediakan garis panduan yang sistematik untuk menangani isu pembelian perisian COTS berdaya maju.

Kata kunci: Penilaian perisian *Commercial Off-The-Shelf*, Pemilihan perisian *Commercial Off-The-Shelf*, Keperluan bukan kefungsian, Pengendalian ketidaksepadanan, Teori penilaian.

Abstract

The decision to purchase Commercial Off-The-Shelf (COTS) software needs systematic guidelines so that the appropriate COTS software can be selected in order to provide a viable and effective solution to the organizations. However, the existing COTS software evaluation and selection frameworks focus more on functional aspects and do not give adequate attention to accommodate the mismatch between user requirements and COTS software specification, and also integration with non functional requirements of COTS software. Studies have identified that these two criteria are important in COTS software evaluation and selection. Therefore, this study aims to develop a new framework of COTS software evaluation and selection that focuses on handling COTS software mismatches and integrating the non-functional requirements. The study is conducted using mixed-mode methodology which involves survey and interview. The study is conducted in four main phases: a survey and interview of 63 organizations to identify COTS software evaluation criteria, development of COTS software evaluation and selection framework using Evaluation Theory, development of a new decision making technique by integrating Analytical Hierarchy Process and Gap Analysis to handle COTS software mismatches, and validation of the practicality and reliability of the proposed COTS software Evaluation and Selection Framework (COTS-ESF) using experts' review, case studies and yardstick validation. This study has developed the COTS-ESF which consists of five categories of evaluation criteria: Quality, Domain, Architecture, Operational Environment and Vendor Reputation. It also provides a decision making technique and a complete process for performing the evaluation and selection of COTS software. The result of this study shows that the evaluated aspects of the framework are feasible and demonstrate their potential and practicality to be applied in the real environment. The contribution of this study straddles both the research and practical perspectives of software evaluation by improving decision making and providing a systematic guidelines for handling issue in purchasing viable COTS software.

Keywords: Commercial Off-The-Shelf evaluation, Commercial Off-The-Shelf selection, Non-functional requirements, Mismatches handling, Evaluation theory.

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List of Abbreviations

COTS	Commercial-Off-The-Shelf
CBS	COTS-Based Systems
CBD	COTS-Based systems Development
OTSO	Off-The-Shelf Option
PORE	Procurement-Oriented Requirements Engineering
CSSP	COTS Software Selection Process
CAP	COTS software Acquisition Process
PAREMO	Balanced Reuse Model
MiHOS	Mismatch handling aware COTS Selection
CRE	COTS-based Requirements Engineering
STACE	Social-Technical Approach to COTS Evaluation
DC	Developing Country
GUI	Graphic User Interface
IDC	International Data Corporation
CBA	COTS-based Application
USC	University of Southern California
TT&C	Telemetry, Tracking, and Control
CERES	Center for Research Support
WSM	Weighting Scoring Method
AHP	Analytical Hierarchy Process
IusWare	IUStitiasoftWAR
CISD	COTS-based Integrated System Development
PRISM	Portable, Reusable, Integrated Software Model
CEP	Comparative Evaluation Process
CF	Confidence Factor
IESE	Institute for Experimental Software Engineering
RCPER	Requirements-driven COTS Product Evaluation Process
CARE	COTS-Aware Requirements Engineering

PECA	Plan, Establish, Collect, and Analyze
CSCC	Combined Selection of COTS Components
GCS	General COTS Selection
unHOS	uncertainty Handling in COTS Selection
GQM	Goal Question Metrics
ISO	International Organization for Standardization
QFD	Quality Function Deployment
BBN	Bayesian Belief Network
SPA	Software Process Assessment
MCDM	Multi-Criteria Decision Making
ERP	Enterprise Resource Planning
KM	Knowledge Management
API	Application Programming Interface
CAR/SA	COTS-Aware Requirements and Software Architecture
NFR	Non-Functional Requirements
IRC	Identifying mismatches Resolution Constraints
CRC	Considered Resolution Constraint
SDMP	Systematic Decision Making Process
C-QM	COTS-Quality Model
ISO/IEC	International Organization for Standardization and international Electro technical Commission
UK	Unite Kingdom
SME	Small Medium Enterprise
SE	Software Engineering
SPSS	Software Package for Social Sciences
JAD	Joint Application design
ASP.NET	Active Server Pages.Net
VB.Net	Visual Basic.Net
IT	Information Technology
SD	Standard Deviation

CEC	COTS Evaluation Criteria
ANC	Average Normalized Column
CR	Consistency Ratio
CI	Consistency Index
RI	Random Index
FMML	Final Mismatching Level
ML	Matching Level
MML	Mismatching Level
FFS	Final Fitness Score
WBS	Work Breakdown Structure
SLA	Service Level Agreement
DM-PT	Decision Making- Prototyping Tool
ID	Identification number
COB	College Of Business
CAS	College of Art and Science
CLGIS	College of Low, Government, and International Studies
PCs	Personal Computers
SMIS	Student Management Information System
OSS	Open Source System
OTS	Off-The-Shelf

CHAPTER ONE
INTRODUCTION

1.1 Introduction

This chapter provides an introduction to the field of this research by describing the background of the study and discussing the research problem. The research questions are then presented and used to construct the research objectives. Finally, the chapter describes the scope of this research; as well as highlighting the significance of the research. The chapter concludes with an overview of the remaining chapters of this thesis.

1.2 Background

The world of software development has significantly evolved from development-centric to a procurement-centric approach. In other words, this new approach has been introduced as an alternative software development approach which focused on building systems through pre-packaged solutions assembling, usually known as Commercial-Off-The-Shelf (COTS) software, and migrating existing systems towards COTS-Based Systems (CBS) (Gupta et al., 2012). Nowadays, most organizations have decided to change from in-house development towards COTS software integration in order to reduce the maintenance cost, development time, and operating, testing, and validating efforts (Couts & Gerdes, 2010). Thus, COTS software has become strategic and economic way for building large and complex systems.

The contents of the thesis is for internal user only

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