UNIVERSITI PUTRA MALAYSIA

COMPREHENSIVE PROJECT MANAGEMENT MODEL TO ENHANCE SOFTWARE MANAGEMENT SUCCESS

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FSKTM 2020 25

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By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

June 2020

DEDICATION

Being the youngest in the family, this last journey and academic pursuit in this life is dedicated to my beloved siblings who have been the watchful eyes and strength in framing the character that has instilled me to take this philosophical path academically.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

COMPREHENSIVE PROJECT MANAGEMENT MODEL TO ENHANCE SOFTWARE MANAGEMENT SUCCESS

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June 2020

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The management of software projects success with current project management models formally based and developed with traditional or plan-based, agile and hybrid management methodologies in dynamic flexibility and size complexity environments have not worked to its expectation in increasing the success rates in software projects over the last two decades in Malaysia. Traditional project management methodologies were plan driven and rigid in the implementation of Information Technology (IT) projects. The birth of modern project management with the introduction of the Agile Manifesto in 2001 had promised to better manage IT projects with its 4 values and 12 principles, but increase in software management success still appears to be elusive. The Agile Manifesto promised an improvement in the management of software success while studies of critical success and failure factors have also been used as quick solutions and not long-term robust improvements. Hybrid project management methodologies, which combined traditional or plan-based and agile methodologies, are being used but its feasibility as suitable methodologies is unclear in dynamic flexibility and size complexity environments.

This scenario has created a need to review the software management success problem with more emphasis in the enhancement of software success management through studies on the management of traditional or plan-based, agile and hybrid models with dynamic flexibility and size complexity moderators to support contingency environments and close some of the gaps in current project management models.

A comprehensive Project Management Model was proposed and developed with significant characteristics in traditional or plan-based, agile and hybrid methodologies in project environments that required dynamic flexibility and size

complexity contingencies with an objective to enhance software management success.

An empirical research methodology was used with a quantitative approach to collect data using questionnaires provided to software management practitioners managing software projects in industry. The data collected was analysed using the Statistical Package for the Social Sciences (SPSS) and the Partial Least Squares (PLS) tools with the Structural Equation Modeling (SEM) technique.

The analysis from the tools and techniques assisted in evaluating the proposed comprehensive project management model with a set of software management characteristics that were significant in enhancing the management of success in software projects.

The comprehensive project management model was statistically validated and provided to practitioners in industries. The model was found to be effective as it enhanced the success management of their current software projects both in the usage of methodologies and in dynamic flexibility and size complexity environments as contingencies.

This study provided a major contribution to the software industry as previous studies of project management models were not comprehensive in integrating the various significant characteristics in software project management methodologies with dynamic flexibility and size complexity environments.

The empirical and industry validation of the comprehensive project management model resulted in an increase in percentage by 73.56% and 82.15% respectively in software management success.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

MODEL KOMPREHENSIF PENGURUSAN PROJEK UNTUK MENINGKATKAN KEJAYAAN PENGURUSAN PERISIAN

Oleh

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Kejayaan pengurusan projek perisian dengan model pengurusan projek semasa yang menggunakan metodologi tradisional atau 'plan driven', 'agile' dan 'hybrid' dalam persekitaran fleksibiliti yang dinamik dan kompleksiti saiz, adalah masih tidak memenuhi jangkaan dalam meningkatkan kejayaan projek perisian sepanjang dua dekad yang lepas di Malaysia. Metodologi pengurusan projek tradisional adalah berbentuk 'plan driven' dan 'rigid' dalam perlaksanaan projek-projek Teknologi Maklumat (TM). Kemunculan model pengurusan projek dengan pengenalan manifesto 'agile', pada tahun 2001, telah menjanjikan pengurusan projek-projek TM secara lebih baik menerusi 4 nilai dan 12 prinsipnya. Namun kejayaan sesebuah projek masih kelihatan agak sukar dicapai. Manifesto 'agile' telah menjanjikan satu pembaikan dalam kejayaan pengurusan perisian sementara kajian-kajian terhadap faktor kejayaan kritikal dan kegagalan telah digunakan sebagai penyelesaian jangka pendek sahaja dan bukanlah penambahbaikan jangka panjang. Metodologi pengurusan projek 'hybrid' yang menggabungkan metodologi tradisional atau 'plan driven' dan metodologi 'agile' telah digunakan namun kebolehlaksanaannya sebagai metodologi yang bersesuaian adalah tidak jelas dalam persekitaran fleksibiliti yang dinamik dan kompleksiti saiz.

Senario ini telah mewujudkan satu keperluan untuk menyemak halangan kejayaan pengurusan perisian dengan lebih menekankan dalam peningkatan terhadap pengurusan kejayaan perisian melalui kajian ke atas pengurusan model tradisional atau 'plan driven', 'agile' dan 'hybrid' model dalam persekitaran fleksibiliti yang dinamik dan kompleksiti saiz untuk menyokong persekitaran kontinjensi dan menutup kebanyakan jurang-jurang dalam model pengurusan projek semasa.

Satu model pengurusan projek komprehensif telah dikemukakan dan dibangunkan dengan menggunakan ciri-ciri signifikan dari integrasi metodologi tradisional atau 'plan driven', 'agile' dan 'hybrid' metodologi dalam persekitaran projek yang memerlukan fleksibiliti yang dinamik dan kompleksiti saiz dengan kontingensi bagi matlamat untuk meningkatkan kejayaan pengurusan projek.

Satu metodologi kajian empirikal secara pendekatan kuantitatif telah digunakan untuk mengumpul data dengan menggunakan kaedah soal selidik terhadap pengamal pengurusan perisian yang mengurus projek perisian dalam industri. Data yang terkumpul telah dianalisis dengan menggunakan Pakej Statistik untuk Sains Sosial (SPSS) dan alatan 'Partial Least Squares' (PLS) dengan teknik 'Sequential Equation Modeling' (SEM).

Analisa daripada alatan dan teknik membantu dalam menilai model pengurusan projek komprehensif yang dikemukakan dengan satu set ciri-ciri pengurusan perisian yang signifikan dalam meningkatkan kejayaan pengurusan projek perisian.

Model pengurusan projek komprehensif disahkan secara statistik dan kemudiannya diaplikasi kepada pengamal industri. Model ini adalah berkesan untuk meningkatkan kejayaan pengurusan projek perisian semasa untuk kegunaan sebagai kontingensi dalam persekitaran fleksibiliti yang dinamik dan kompleksiti saiz. Kajian ini menghasilkan satu sumbangan bermakna dalam industri perisian di mana kajian yang lepas terhadap model pengurusan projek adalah tidak komprehensif dalam mengintegrasikan pelbagai ciri penting dalam metodologi pengurusan projek perisian untuk persekitaran fleksibiliti yang dinamik dan kompleksiti saiz.

Kesahan empirikal dan kesahan industri terhadap model pengurusan projek komprehensif masing-masing menunjukkan peningkatan sebanyak 73.55% dan 82.15% bagi kejayaan pengurusan perisian.

ACKNOWLEDGEMENTS

My special thanks to my supervisor Associate Professor Dr. Marzanah A. Jabar and co-supervisors Associate Professor Dr.Yusmadi Yah Jusoh, Associate Professor Dr. Norhayati Mohd. Ali and Dr. Salfarina Abdullah for their valuable encouragement, guidance and continuous support during the journey in my doctoral research. The completion of this thesis could not have been possible without their constant participation and assistance. It is indeed a great opportunity and blessing for me to have such exemplary coaching and stupendous supervision.

I wish to acknowledge the Ministry of Higher Education (MOHE) for sponsoring my PhD study through an FRGS grant and their MyBrain15 programme.

My thanks to UPM as the university also provided me the opportunity to be a research assistant through an UPM-IPS grant.

… and lastly, I am also grateful to the 'Higher Powers' that establishes its Greatness by making all life and its achievements possible as we constantly struggle to attain them. As a senior and matured student approaching my late 60s, I am grateful my health and mental facilities have been good as I pursued this doctorate to its completion.

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:-

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LIST OF ABBREVIATIONS

ACM	Association of Computing Machinery
AD	Adaptive
AD01-AD09	Adaptive Indicators
AM	Agile Methodology
AM01-AM09	Agile Methodology Indicators (01-09)
APPA	Average Pairwise Percentage Agreement
AVE	Average Value Extracted
CA	Cronbach Alpha
CB-SEM	Covariance Based Structural Equation Modeling
CHAOS	Comprehensive Human Appraisal for Originating Software
CMMI	Capability Maturity Model Integration
CPX	Complex
CR	Composite Reliability
DAT	Dimensional Analytical Tool
DY01-DY08	Dynamic Flexibility Indicators (01-08)
DYN	Dynamic
HTMT	Heterotrait-Monotrait ratio of correlations
IEEE	Institute of Electrical and Electronic Engineers
IRR	Inter-Rater-Reliability
IS	Information Systems
IT	Information Technology
MOD	Moderation
OS	Operational Success
OS01-OS09	Project Success Operational Objectives (01-09)
PLS	Partial Least Squares
PLS-SEM	Partial Least Squares Structural Equation Modeling
PZ01-PZ14	Project Size Complexity Indicators (01-14)

SDLC	System Development Life Cycle
SEM	Structural Equation Modeling
SLR	Systematic Literature Review
SRMR	Standardized Root Mean Square Residual
TM	Traditional Methodologies
TM01-TM11	Traditional Methodology Indicators (01-11)
TRAD	Traditional
VIF	Variance Inflator Factor
XP	eXtended Programming
ZC01-ZC15	Size Complexity Criteria

CHAPTER 1

INTRODUCTION

1.1 Background

Project success is one of the most researched topics in project management (Hair, 2013; Joslin & Müller, 2015) but the criteria for success is rarely agreed upon (Davis, 2014, 2017). Project management is a discipline that is based on hard and soft aspects of the various project management skills which are successfully implemented in a project (Riol & Thuillier, 2015). Hard aspects refer to the tools and techniques used while soft aspects relate to the willingness to integrate with the various principles and practices. These tools, techniques, principles and practices are integrated together and prescribed as a methodology (Tripp & Armstrong, 2018). The software development industry uses methodologies introduced in the early 1900s which are often referred to as traditional methodologies or plan-driven methodologies. The current methodologies which were introduced in 1990s were referred to as agile or modern methodologies. Both have been adopted to manage a wide range of software projects (Papadopoulos, 2015) and the current focus on software management success is to move towards a suitable project management methodology that is current and not merely improving the use of processes (Chmielarz & Zborowski, 2018).

The birth of modern project management with the introduction of the Agile Manifesto in 2001 was to provide a platform to better manage software success with a set of values and principles that were 'agile' in nature to reduce formal and lengthy processes to quick and informal processes with a promise to reduce the current high failure rates in software development projects (Curcio, Navarro, Malucelli, & Reinehr, 2018). A variety of software agile methods was proposed and used with much interest (Senapathi & Drury-Grogan, 2017), but software success rates have not improved much. Statistically, the Standish Group Report 2016 (research on a database which analyses 50,000 projects covering 1,000 organizations) summarized there has been an average IT software success percentage of 27% - 31% with not much improvement over the years (Davis, 2017). Studies by the Project Management Institute (PMI) in 2017 on the insights of 3234 project management professionals identified 19% of IT projects fail outright and 52% have shown to have scope creep issues (Langley, 2017; Sanchez, Terlizzi, & de Moraes, 2017). The introduction and the promise that agile methodologies would increase the success in project deliveries has still not been met.

New critical success and failure factors have been identified by researchers to further improve the software success rates but these have had little success as project environments have become dynamic and complex with constant changes

(Ioana, Emil, & Nistor, 2015). These success and failure factors are static in nature and contributed to a little increase in software success and further extensive research in new success and failure factors is thus not encouraged (Lehtinen, Mäntylä, Vanhanen, Itkonen, & Lassenius, 2014). The weak perception on the usefulness and the poor acceptance to agile methodology changes by software management practitioners is apparent (Rakshith & Patil, 2013) and its use as an alternative to traditional methodologies is also not widely accepted (Binder, Aillaud, & Schilli, 2014). Traditional methodologies have also focused on the triple constraints such as scope, time and cost, to ensure quality, but have been slow to adapt to changes. Projects are considered a failure in scenarios where scope, time and cost criteria have been met (Harwardt, 2018) with these constraints being discouraged as it has not lived to companies expectations and strategies (Yassien, 2017).

Agile methodologies too have weakness as testing environments are not clearly defined with developers requiring talented skills and favouring a high degree of freedom. This can be challenging when project managers have to manage the skilled teams in projects with an absence of proper control and agreed monitoring processes (Tulnon, Jaen, & Coronado, 2005).

It is unclear too that traditional or agile methodologies without any combinations perform better in Information Systems projects and it gets more difficult to change when expertise in confined to a particular method (Cram & Marabelli, 2018).

The scenarios discussed above have provided an opportunity for hybrid project management methodologies to combine traditional and agile methodologies to be introduced as an alternative to traditional or agile methodologies to be used in isolation or independently.

Adoption of hybrid project management methodologies appear promising with a 16% increase in success rate using dynamic flexibility principles in agile methodologies (Carvalho et al., 2012). More studies on hybrids agile methods with particular emphasis for large and complex projects is suggested (Chuang, Luor, & Lu, 2014) and in particular, with the Scrum agile methodology, it is viewed as suitable for a wide range of software projects (Cho, 2009).

The hybrid project management approach is common with companies which have a history of traditional development in managing projects (Cram & Marabelli, 2018). Software companies too do not follow any one particular method (Rauf & AlGhafees, 2015) but use a combination and tailoring of agile methods (Tripp & Armstrong, 2018). Within the agile methods, the focus is not on Scrum or 'eXtended Programming' (XP) as research on commonalities on the characteristics of an agile mind-set is missing as to which can take precedence (Senapathi & Drury-Grogan, 2017).

The success in software management has not increased much as the transition from traditional methodologies to agile methodologies has been slow (Rakshith & Patil, 2013) and the trend to use hybrid project management methodologies is emerging although agile methodologies are rarely used in a way it was originally intended which indirectly introduces unintended combinations (Theocharis, Kuhrmann, Münch, & Diebold, 2016).

To strengthen project management success, dynamic characteristics (Serrador & Pinto, 2015) in management of software projects are required to provide for the non-routine and non-repeatable tasks where the outcomes are not predictable which is a common feature in agile methodologies (Tripp, 2012). As dynamic characteristics are not well studied in project management theory and models, further research would benefit from the development of an instrument to measure dynamic characteristics in projects. (Collyer & Warren, 2009). This is further emphasized as dynamic flexibility with adaptability have also been defined as one of the four main pillars of project success (Kafol, Gajić, Jovanović, & Lalić, 2013) with dynamism as a systematic approach to a model to manage projects. But the focus should not be only on scope, time and cost which cannot be tacked and studied independently (Lakey, 2003).

Characteristics of size complexity is another dimension in project management that assist in managing the diverse factors that affect project outcomes, disorder, instability, non-linearity, recursiveness, uncertainty, irregularity and randomness in projects (Nguyen, Mohamed, & Panuwatwanich, 2018).

In summary, enhancement to software success is viewed with a perspective that it is comprehensively managed with traditional, agile and hybrid methodologies together with dynamic flexibility and size complexity characteristics in future. More often than not, the methodologies refer to the agile scrum methodology and traditionally disciplined environments (Papadakis & Tsironis, 2018) with evidence that eventually companies end up using a hybrid project management methodology that have traces of agile and plan driven methodologies (Alahyari, Gorschek, & Berntsson Svensson, 2019). Current literature also supports two streams to attain software management success. One stream is to study factors of software success or software failures and the other stream is to study software success measures. The researcher selects success measures as it is a prerequisite to success factors and failure factors (Yassien, 2017).

1.2 Problem Statement

Current literature has provided a basis to support the adoption of traditional or plan-based, agile and hybrid methodologies as a challenge towards software management success but there is very little research on the integration of the characteristics and the benefits of a comprehensive use of the methodologies (Dhole, 2018). It is common for companies with a history of traditional

methodologies to adopt a more modern and flexible approach which is provided in the suite of agile methodologies (Cram & Marabelli, 2018). But the challenge is to reach a point where there is a fusion of traditional and agile approaches to work together effectively as a hybrid model (Boehm & Turner, 2005) with more agility (Papadakis & Tsironis, 2018; Rahmanian, 2014) and the characteristics of methodologies adequately assist the assessment of effectiveness (Soundararajan & Arthur, 2011).

Legacy systems using traditional methodologies require re-engineering to hybrid methods with changes to the internal attributes that are referred to as the characteristics. Change in mindset perceptions are vital for environmental behavior and attitudes are the external attributes that make the intended use of new methodologies more difficult to be accepted in a new project management environment (Curcio et al., 2018; Valverde, Toleman, & Cater-Steel, 2008). Project management model enhancements was a pre-requisite for legacy systems and were deficient of which characteristics were significant with dynamic flexibility with adaptability towards software management success (Glaiel, Moulton, & Madnick, 2014).

Migration of legacy systems using a cloud computing environment has its challenges too. While these refer to initiatives which are also hybrid in nature, the emphasis is not on methodology but on the migration approaches. It limits to the use of databases in clouds on a communicative interface but not on software management success and its related methodologies (Zalazar, Gonnet, & Leone, 2015). Clouds are used in replacing applications but not changing the methodologies used to develop them (Jun Feng & Zhou, 2014). Systems developed with agile methodologies reengineered the traditional characteristics (Curcio et al., 2018) into a modular approach in hybrid clouds (Zalazar et al., 2015).

Research also suggests a method where efficiency relate to the modification of development processes with hybrid methods used for more robust deliveries of software management success (Theocharis et al., 2016). Effectiveness in methodologies to attain software management success is based on flexibility and complexity (Serrador & Turner, 2014) which in turn also allows for contingency project environments (Aljawder & Davis, 2013). It is referred to as a blank 'canvas', that is dynamically flexible and agile with an accelerated system (Cooper, 2014). Moreover, the dynamic flexibility and project size complexity effects on project models are identified as gaps that are not currently being studied (Rahim, Shamsur, & Chowdhury, 2018).

A comprehensive approach for a project management model would encompass all the different types of project management methodologies and contingencies to manage software success. Hybrid clouds support reengineering for hybrid methodologies (Zalazar et al., 2015). In legacy systems, the comprehensive

model approach will fine-tune a methodology, but the cloud is just an interface or a platform to provide a working environment to work (Jun Feng & Zhou, 2014). Table 1.1 summarizes the software management success scenarios in cloud environments and the migration environments that support the reengineering requirements.

Table 1.1 : Software Management Success in Cloud environments

Comprehensive Project Management Model		Project Management Methodology in Cloud Re-Engineering	Migration Environment Requirement	Software Management Success Scenario
1)	**Traditionally Based (Planned-and linear**) – Predominantly Legacy Systems	Clouds are used in migrating applications but not changing the methodologies used to manage them.	Contingencies not considered	Migration of existing legacy systems – mere deployment of legacy systems – mere validation of implementation strategies to facilitate rollout
2)	**Agile Based (Component and Modular)** – Predominantly existing and new Systems	Clouds are used in migrating or creating applications and/or changing the traditional methodologies used to manage them.	Predominantly Dynamic Flexibility but not Size Complexity as contingency	Migrating and Creating new Systems – Managing in scalable and flexible environments
3)	**Hybrid Based (Planned, Component and Modular)** – Predominantly Existing and new Systems	Clouds are used in migrating applications and/or changing the traditional and agile methodologies into a hybrid methodology to manage them **(Hybrid cloud).**	Dynamic Flexibility and Size Complexity as contingencies	Migrating and Creating New Systems – Managing in scalable, flexible and complex environments

As the scenario for software management success appears to be diverse in approaching a solution with various requirements that will best suit the unique nature of projects, a comprehensive model approach which encompasses project management methodologies with dynamic flexibility and size complexity as contingencies would be the challenge in addressing the current problem of a dismal increase in software success rate. Thus a research problem is as follows:-

Project management models have used traditional or plan-based, agile, hybrid methodology characteristics and contingencies but software management success rate has not increased over the last two decades. This scenario has created a problem that is addressed by proposing a comprehensive project management model that incorporates the significant characteristics in the methodologies with dynamic flexibility for adaptability and size complexity for small, medium and large project

environments as contingencies to enhance software management success.

1.3 Research Question

In line with the background of the study and research problem that was identified, the study aims to answer the following three research questions.

RQ1: What significant characteristics in traditional, agile and hybrid methodologies are used in the proposed comprehensive project management model to enhance software management success?
RQ2: What significant characteristics in dynamic flexibility and size complexity are used in the proposed comprehensive project management model to enhance software management success?
RQ3: What relationships exist between dynamic flexibility and size complexity environments in the proposed comprehensive project management model to enhance software management success?

The research questions are concerned with analysing significant characteristics in the combined approach of the methodologies and contingencies and a proposed comprehensive project management model is to be used to enhance software management success. Research question three (RQ3) is of particular importance as the relationship address the 'one-size-fits-all' scenario due to the unique nature of projects.

1.4 Research Objectives

The main research objective of the study is ***'to propose a comprehensive project management model to enhance software management success.'***

The research objectives (RO1 to RO3) addresses the main objective as follows:-

RO1: To analyze the significant characteristics in traditional, agile and hybrid methodologies to enhance software management success.
RO2: To analyze the significant characteristics in dynamic flexibility and size complexity to enhance software management success.
RO3: To propose a comprehensive project management model that incorporates traditional methodologies, agile methodologies, hybrids methodologies, dynamic flexibility and size complexity to enhance software management success.

1.5 Research Scope

The primary intention of this study is to improve software management success. It is important to explicitly state the contents of a scope of any study as it defines a specific domain of the research and the contributions (Philip, 2014). This study, in the Malaysian software industry, focuses on a comprehensive project management model with traditional, agile and hybrid methodologies as software management methodologies that are directly involved in the management of the software success (Egorova, Torchiano, Torino, & Berntsson, 2010). Dynamic flexibility (Carvalho et al., 2012) and size complexity (Dao, Kermanshachi, Shane, Anderson, & Hare, 2016) environments are also required to be analysed as enhancement in the management of software success . The definitions of project methodologies and its environments is provided in Chapter 2, Section 2.2.

The management of tailoring strategies defines the criteria organisations use to mix the viable options (Campanelli, Camilo, & Parreiras, 2018). A flavour of this is seen in the analysis of significant characteristics adopted in the study. Two streams exist in software management studies. One is on the study of success and failure factors and the other is on the study of the measures of project success. This study focuses on the measures as it provides a basis to identify the success and failure factors (Yassien, 2017) in managing software success for future studies.

Secondly, the challenges in the boundaries of the scope refer to the management of projects, the stakeholders and the organisational objectives (Xu & Ramesh, 2008). Downsizing or expanding activities in projects are not included as it is not a software management activity and often leads to major scope changes and projects begin to look different. The emphasis is on traditional or plan-driven, agile and hybrid methods with its effects on dynamic flexibility and size complexity to improve the success of software projects. It is a comprehensive project management model for the enhancement of software management success. The model will be validated to provide evidence it has in fact enhanced software management success (Philip, 2014) in the software industry.

The scope excludes development processes, scheduling and cost management areas as it has little impact on the success of software projects (Frefer, Mahmoud, Haleema, & Almamlook, 2018). Meeting time and budget goals are also not significant in both traditional and agile methodologies due to its little contribution in achieving software project success (Serrador & Pinto, 2015). Modifications to processes too do not work as these are not practical and the complex nature of projects also do not work favourably with small process changes to add any value (Rahim et al., 2018).

Thirdly, clarity to the scope of this study is also seen through a categorization approach lens using the Four Dimensional Analytical Tool (4-DAT) scope and method analysis (Qumer, 2006). The first dimension provides for the distillation of the study from software processes to focus on the overall management of projects. The second dimension is the notion of that agility, which embraces changes, is invoked by environments that have a responsive mind-set that react and take an adaptive advantage. Key management areas which co-exist with complex categorization of projects is the third dimension and a precise definition of project success which embraces all the three dimension is the fourth dimension. Figure 1.1 provides a diagrammatic view of the scope of this study.

The theories and definitions for the scope of the study are provided in detail in Chapter 2, Section 2.2.

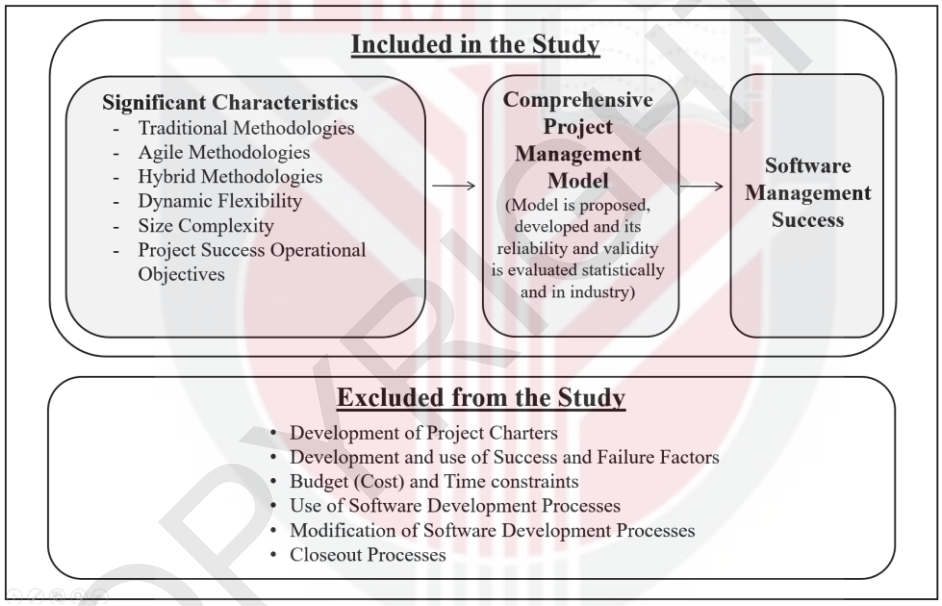

Figure 1.1 : Scope of the Study

1.6 Research Contribution

The research focus in on a comprehensive project management model to enhance software management success. Project success in the study is viewed in terms of its effectiveness which are long-term goals as flavors of management of methodologies, organizational objectives, adaptability, adoptability, dynamic flexibility and size complexity. Project efficiency, on the other hand, is a short-term goal perspective and is restricted by the use of development processes (Serrador & Turner, 2014).

The comprehensive project management model is developed with long-term goals and a contingency approach which could be used as a 'no-one-size-fits-all' (Aljawder & Davis, 2013) effective solution. This model is a contribution to the software management companies in industry to manage software projects successfully.

1.7 Thesis Organisation

This chapter provided an introduction to the background of the research area, identifying the problem and a brief discussion of the objectives with the contributions of the study. The remaining five chapters in this study is organised and presented as follows:-

Chapter 2 reviews the literature from pervious researches and identifies the research gap. The theories are discussed and a theoretical model is provided and the proposed variables and structure is presented.

Chapter 3 discusses the research method and the phases taken in the research.

Chapter 4 looks at the development of the proposed comprehensive project management model and focuses on the development the hypotheses.

Chapter 5 presents the findings, results and a discussion on the contributions and outcomes of the research.

Chapter 6 provides a summary, conclusion and recommendations for future work for other researchers.

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LIST OF PUBLICATIONS

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