

CHANGE MANAGEMENT CAPABILITY ASSESSMENT MODEL FOR
CONSTRUCTION ORGANIZATIONS

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Specially dedicated to the memory of my lovely late father Mr. Arowosegbe Rufus,
my loving late wife Mrs. Hellen Iyabode Arowosegbe, my mother Mrs. Arowosegbe
Florence, my lovely wife and my God-given children.

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ABSTRACT

The complexity of construction led to the fragmentation of design and construction process with different professionals independently handling each process. This characteristic triggers project changes. The inconsistent management of project changes, especially its implementation causes major risks of cost and time overruns, quality defects, conflicts, and safety issues. However, these challenges raise concerns about how diligently capable the construction organizations are in their work. Lack of management capability affects the performance of construction organizations in terms of project delivery within the constraint of cost and time. However, not much has been reported in the literature on management capability maturity of construction organizations, its assessment and impacts on cost and time performance of building projects in Nigeria. Supporting this claim is the agitations in construction cycle for a unique methodological approach that enables capability maturity assessment to improve performance in building projects. Against this background, this research therefore investigates the impact of change management capability maturity of construction organizations on cost and time performance of building projects in Nigeria. To accomplish this aim, specific objectives that addressed the identified problems includes; assessment of change management capability maturity level of construction organizations (CMCML), assessment of impact of CMCML on cost and time performance and development of a CMCML assessment model for construction organizations. Quantitative research approach that uses questionnaire survey mechanism was adopted for data collection. A total of 42 questionnaires were hand distributed to project managers, project quantity surveyors and contract managers, across construction organizations in southwest zone of Nigeria. The administered questionnaires retrieved revealed 95% response rate. Collected data were analysed using the following quantitative tools; frequency, Spearman's rank correlation, factor analysis, multiple regression and fuzzy synthetic evaluation techniques. The empirical research findings reveal that the overall CMCML of construction organizations is 'moderate' at 3.35 maturity rating and not far from maturity with a value of 1 indicating very low and 5 indicating very high. Findings further indicate poor management capability of contractors as the most prevalent contractor-related factors impacting project changes. The research findings also show that change management capability of construction organization has significant impact on cost and time performance of building projects. Finally, the research provide a CMCML assessment model capable of determining the capability maturity level of construction organizations as well as showing the cost and time performance of construction organizations in building projects.

ABSTRAK

Kerumitan pembinaan mengakibatkan pengasingan di antara proses reka bentuk dan pembinaan di mana setiap proses dikendalikan oleh pihak profesional yang berasingan. Kerekteristiki ini mencetuskan banyak perubahan dalam projek pembinaan. Pengurusan perubahan projek yang tidak konsisten, terutamanya dalam aspek pelaksanaan akan mengakibatkan pelbagai risiko utama seperti lebih kos dan masa, kecacatan kualiti, konflik dan isu-isu berkaitan keselamatan. Justeru, risiko-risiko ini telah menimbulkan kebimbangan tentang kapabiliti organisasi pembinaan dalam menguruskan tugas masing-masing. Kekurangan kapabiliti pengurusan akan memberi kesan terhadap prestasi organisasi pembinaan dalam aspek penyampaian projek dalam kekangan kos dan masa. Namun, tidak banyak kajian lepas berkaitan kematangan kapabiliti pengurusan organisasi pembinaan, penilaiannya dan impaknya dalam aspek prestasi kos dan masa terhadap projek-projek pembinaan di Nigeria. Kenyataan ini disokong oleh rungutan dalam kitaran projek untuk mewujudkan satu pendekatan metodologikal yang unik serta mampu untuk menilai tahap kematangan kapabiliti untuk meningkatkan prestasi projek pembinaan oleh itu. Kajian ini menyiasat impak kematangan kapabiliti pengurusan perubahan oleh organisasi-organisasi pembinaan dalam aspek prestasi kos dan masa terhadap projek-projek pembinaan di Nigeria. Dalam mencapai tujuan ini, objektif-objektif spesifik telah dikenalpasti termasuklah penilaian kematangan kapabiliti pengurusan perubahan oleh organisasi-organisasi pembinaan (KKPP), penilaian impak KKPP terhadap prestasi kos dan masa dan penyediaan model penilaian KKPP untuk organisasi-organisasi pembinaan. Kaedah penyelidikan kuantitatif menggunakan borang kaji soal selidik telah dipilih sebagai kaedah pengumpulan data. Sebanyak 42 borang kaji soal selidik telah diedarkan secara terus kepada pengurus-pengurus projek, juruukur bahan projek dan pengurus-pengurus kontrak di organisasi-organisasi pembinaan di zon barat daya Nigeria. Kaji selidik yang diperolehi menunjukkan kadar maklum balas sebanyak 95%. Data yang terkumpul telah dianalisis menggunakan kaedah-kaedah kuantitatif; kekerapan, Spearman's tahap korelasi, analisis faktor, regresi berganda dan teknik penilaian 'fuzzy synthetic'. Dapatan kajian empirikal mendedahkan bahawa pada keseluruhannya, KKPP organisasi-organisasi pembinaan adalah pada tahap 'sederhana' iaitu 3.35 kadar kematangan dan tidak jauh daripada tahap kematangan dengan nilai 1 mewakili sangat rendah dan nilai 5 mewakili sangat tinggi. Seterusnya, dapatan kajian telah menunjukkan keupayaan pengurusan yang lemah oleh kontrak adalah merupakan faktor utama yang berkait dengan kontraktor yang memberi impak terhadap perubahan projek. Dapatan kajian juga mendapati bahawa kapabiliti pengurusan perubahan oleh organisasi pembinaan mempunyai impak yang ketara terhadap prestasi kos dan masa projek pembinaan. Akhir sekali, penyelidikan ini menyediakan model penilaian KKPP yang mampu untuk mengenalpasti tahap kematangan kapabiliti organisasi-organisasi pembinaan serta dapat menunjukkan prestasi kos dan masa organisasi-organisasi pembinaan dalam melaksanakan projek pembinaan.

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LIST OF ABBREVIATIONS

AIA	-	American Institute of Architect
GDP	-	Gross Domestic Product
CMC	-	Change Management Capability
CMCML	-	Change Management Capability Maturity Level
CMCMM	-	Change Management Capability Maturity Model
CMMI	-	Capability Maturity Model Integration
CMCQI	-	Change Management Capability Quantitative Indicator
CII	-	Construction Industry Institute
CMM	-	Capability Maturity Model
ETF	-	Education Tax Fund
ISO	-	International Organization for Standardization
JCT	-	Joint Contract Tribunal
LOC	-	Library of Congress
NECA	-	National Electrical Contractors Association
OCMCL	-	Overall Change Management Capability Level
OPM3	-	Organizational Project Management 3
PMBOK	-	Project Management Book of Knowledge
PMI	-	Project Management Institute
PAG	-	Principal Attribute Group
QI	-	Quantitative Indicator
SPSS	-	Statistical Package for Social Science
USA	-	United State of America
UK	-	United Kingdom
WBS	-	Work Breakdown Structure.
WEF	-	World Economic Forum

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CHAPTER 1

INTRODUCTION

The context of this research is presented in this chapter. It commences with the general overview of the background to the research, statement of problem as well as the justification for the study. The aim and objectives of the research is equally highlighted in the chapter. Similarly, a brief summary of the research methodology was also presented. Moreover, the chapter concludes with the organisational structure of the thesis which explains the content of each chapter in the thesis.

1.1 Background of the Study

Construction industry is complex and wide in nature and it is generally compartmentalized unlike other industries. According to Egan, (1998) “a project is divided into many sequential and separate operations undertaken by different parties”. The separations of design process from construction process coupled with the uniqueness of each project are the factors responsible for a complicated and complex construction process. The complexity of construction has led to the design process to be handled separately by an independent professional and the construction process by another professional. The consequence of this is that designers are left with the option of producing construction designs without much consideration for buildability. This characteristic of construction has left construction projects to be considerably prone into many project changes mostly during construction stages. However, project changes are inevitable and very common. They occurred from different sources and by various causes in all stages of design and construction, (Motawa *et al.*, 2007). Project changes has been so prevalent that hardly can a

project be completed without witnessing changes to the design scope or method of construction, (Ssegawa, 2002). Even the most thoughtfully planned project may necessitate changes due to various factors (Ibbs *et al.*, 2001).

Traditionally, almost all project change and change orders issued during construction stage of a project are major drivers of cost overrun, schedule delays, conflicts, safety issues and project disruption. Project changes do occur and cause substantial adjustment to contract duration, total direct and indirect cost or both in project management (Ibbs *et al.*, 2001; Gray and Hughes, 2001). Zhao *et al.* (2010); Chen, (2007), identified project change and change orders as problematic and critical factors causing cost overrun of construction projects. Baloyi *et al.* (2011) revealed that changes to work initiated by the client are a critical factor responsible for cost and time overruns. Kumaraswamy *et al.* (1997) also identified client initiated change orders as one of the major causes of time overruns.

Changes are additions, or general revision made to the project goals and scope. They are regarded as changes not minding whether it leads to increase or decrease to the project cost and time. According to Tiong, (1990) and Ibbs, (1997), changes in projects cause critical adjustment to contract duration and cost. In this regard, project management team has a duty to respond effectively to project change in order to reduce the impact of change on the project.

Wallace (2007) examined that several reasons are responsible for change occurrence, and these reasons are to be known as change causes, or drivers. Generally different opinions have been stated by different researchers on the drivers of project change. However, two major classifications of external and internal were expressed by some of the authors. The sub-division given by these authors are responsible for differences in their view points. Table 1.1 and 1.2 represents the taxonomy of causes and impacts of changes in construction projects.

Table 1.1: Causes of Project Changes

Authors	Project related	Client related	Design related	Contractor related	Other factors
Hsieh <i>et al.</i> (2004)	<ul style="list-style-type: none">- complexity of projects- Safety facilities- Site security	<ul style="list-style-type: none">- Client initiated changes	<ul style="list-style-type: none">-Defects in designs-Poor estimation of Quantities-Design changes-Discrepancies between drawings and site conditions	<ul style="list-style-type: none">- Poor planning-Contractors inexperience	<ul style="list-style-type: none">-Unforeseen site conditions-Bad weather conditions-Change of regulations-Unstable decision-making authority
Wu <i>et al.</i> (2004)	<ul style="list-style-type: none">- Delay in securing site, equipment and materials- Site restriction	<ul style="list-style-type: none">-Changes in client's requirements	<ul style="list-style-type: none">-Changes in design-Poor site investigation-Incomplete design information	<ul style="list-style-type: none">-Poor scheduling-Poor workmanship-Changes in construction method	<ul style="list-style-type: none">-Policy changes-Political pressure-Force majeure-Local residents
Kumaraswamy <i>et al.</i> (1997)	<ul style="list-style-type: none">- Slow decision making by project teams.- Project complexity- Communication problem between client, consultant, & contractor- Disputes and conflicts.	<ul style="list-style-type: none">- Client initiated change- Client interference in fixing contract duration	<ul style="list-style-type: none">-Design error and omissions-Inexperienced design team-Delay in design information	<ul style="list-style-type: none">-Inadequate contractor's experience-Poor site management-Inadequate managerial skill- Delays in subcontractor's work.	<ul style="list-style-type: none">-unforeseen ground condition-Weather conditions

Table 1.2: Effects of Project Change

Authors	Time related	Cost related	Productivity related	Risk related	Other effects
Hanna <i>et al.</i> (2005, 2006)	<ul style="list-style-type: none">- Rework- Overtime- Extension of time	<ul style="list-style-type: none">- Increased cost- overtime cost- compensation	<ul style="list-style-type: none">-Schedule compression- over-manning- trade stacking	<ul style="list-style-type: none">-site congestion- acceleration- Interruption	<ul style="list-style-type: none">-Loss of morale- poor quality of work- Less qualified labour
Moselhi <i>et al.</i> (2005)	<ul style="list-style-type: none">-Time loss in stopping and restarting rework.-Subcontractors standing time	<ul style="list-style-type: none">- Loss of earnings- Increase overhead- Change in cash flow- Increase time	<ul style="list-style-type: none">-Reprogramming- Unbalanced gangs	<ul style="list-style-type: none">- acceleration- Loss of float- Increase sensitivity to delay	<ul style="list-style-type: none">-Revision of project reports and documents
Pheng <i>et al.</i> (2005)	<ul style="list-style-type: none">-Rework and demolition-Completion Delay.- payment delay-Material and equipment delay	<ul style="list-style-type: none">-Increase in overhead- Increase in cost-Additional payments to contractor	<ul style="list-style-type: none">-Productivity degradation	<ul style="list-style-type: none">-Affected progress of work	<ul style="list-style-type: none">- Claims and disputes- Damage to reputation- Poor safety conditions-Loss of quality

Project change management is an integral part of project management; hence it relates all the internal and external factors that influence project changes. The central idea of project change management process is to envisage possible changes, recognise changes that have occurred, evaluate it, approve the change, document and

improve from lessons learned to sustain the overall viability of the project (Ibbs *et al* 2001., Hao *et al* 2008., Motawa *et al.*, 2007). Learning from past mistakes is very significant because it affords members of the project team to enrich their experience and appropriately applying it in future projects (Motawa, 2007). Project change and change orders must be resolved through a formalised change management process in order to avoid delays and disruptions in the work program. By adopting systematic and sustain process of handling change orders, there is a high probability of optimising project success. Inconsistent management of the change process result in many disruptive effects. However, the need for mitigating project change negative effects and improving construction processes brought extensive research in the area of mapping and modelling of project change management process.

Ibbs *et al.* (2001) developed a change management system that was based on five principles of promote a balanced change culture, recognise change, evaluate change, implement change and continuously improve from lessons learned. Based on similar concept, Sun *et al.* (2004), developed a toolkits that supports project team's anticipation of changes and the evaluation of the impacts of these changes. Following the same perspective, the Construction Industry Institute decided to look for a way of minimising or reducing construction delays, increase costs, claims, and expensive litigations that usually accompany project change and established research team. Consequently the CII Research Team (1994) came up with the conclusion that significant savings in overall costs and schedule duration of construction projects are achievable by improving the management of project changes.

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However, capability and managerial strength of contractors is not commensurate with the extent of their involvement in construction projects. This fact becomes clear with respect to the extent of occurrence of cost and time overruns in construction projects which is attributable to project change and management incompetency of construction contractors. Capability is concerned with a specific competency which has to be present in an organisation so that such organization can effectively execute project management process. According to OPM3 (Organizational Project Management 3), capability involves incremental steps that usually lead to achieving one or more best practices. However, in OPM3 view, specific capability is adopted as a criterion for assessing organisational maturity. It exists when all the outcomes under the capability have been observed. Therefore, as most of contractors' works are managed as project, assessing and improving construction organisations' change management capability maturity will significantly contribute to the overall improvement of construction organizations' capability maturity to deliver successful projects.

The outcome of this research is capable of ensuring that, client and industry practitioners effectively pre-qualify construction organizations with adequate track record of performance in terms of cost and time. Hence, easy elimination of incompetent construction organizations is achievable and fairer competition among bidders is guaranteed. In addition, construction organizations can easily assess themselves individually in their various organizations before going for any outside bidding competition. The research outcome further provide major attributes for assessing construction organizations competency in managing project changes in construction. Consequently, the developed model in this research will create

opportunity for improvement in construction organization's performance in terms of completing projects to time schedule and cost budget.

In conclusion, the developed model is capable of strengthened clients' decision in given thorough consideration to the management capability maturity level as a major criterion for selecting contracting organizations for construction projects.

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Many projects failure are associated with the critical problem of project change and change orders in the industry today especially when change implementation is inconsistently managed. Motawa *et al.* (2007) argued that inconsistent management of project change can result in many disruptive effects of cost and time overruns. It is highly significant to identify and analyse potential project changes as early as possible to enhance the performance of project team. Early identification and analysis of project change is capable of facilitating both the assessment and implementation of projects (Ibbs *et al.*, 2001). However, changes in construction do occur, hence a robust change management process is a prerequisite for efficient project management. The negative effects of project change will be minimised if effective change management process are put in place for the management of project changes (Ibbs *et al.*, 2001; Motawa *et al.*, 2007).

Moreover, project change can originate from the client, user, design consultant, project manager and contractor, hence effective management process of

this change are based on the fundamental theory of identify change, evaluate change, approve change, implement change and continuously improve from lessons learned (Ibbs *et al.*, 2001; Hao *et al.*, 2008). Project management team should anticipate and identify potential changes and be ready to provide necessary proactive reactions to mitigate the effect of change. Knowledge learnt from the implementation of the change process is kept for all parties to learn from it. When knowledge about previous cases is expressed by professional team it reduces the disruptive effects of change (Motawa *et al.*, 2003).

Consequently, construction projects frequent changes coupled with inconsistent management prompted previous researchers into developing process-focused approaches (specific models and IT support systems) for managing project changes (Sun *et al.*, 2009). Ibbs *et al.* (2001) developed a systematic approach founded on five basic principles for managing project change. A project toolkit that supports project team in envisaging potential changes and evaluating their impacts was mapped out by (Sun *et al.*, 2004). Other change management tools developed for use in the management of project changes includes a fuzzy logic based change prediction model with the system dynamic model of the dynamic planning and control methodology (DPM) Motawa *et al.* (2007), development of a dynamics model of dynamic control methodology (DPM) for the management of unexpected events Park and Pena-Mora (2003), a change prediction framework for managing change scenarios Lee *et al.* (2005), and a generic procedure for issuing a change orders request (Cox *et al.*, 1999).

Certainly, many of these models enhance change management process in construction projects. Indeed, they have potentials for further development. Nevertheless, the agitations in construction cycle for a unique methodological approach and models that enables capability maturity assessment Sarhsar (2000); Sun *et al.* (2009) to improve performance in building projects necessitate this study that explored change management capability maturity assessment model for construction organizations. There are many studies in literature focusing on identification of project changes, causes and effects of changes in construction, and change management process in recent years, aiming at increasing the benefits and

supporting change management, very little or no effort of these are focused to research in the area of assessment and improvement of change management capability maturity level of construction organizations to effectively manage project changes in order to enhance good performance of construction projects. Similarly, there has not been much research reported in literature on the impact of change management capability maturity level of construction organisation on cost and time performance of building projects. Project change and change orders has been established to have it direct negative impacts on such issues associated with cost overrun and schedule delays, disputes and rework (Sun *et al.*, 2009). However, several of the generic models developed can facilitate change management process but cannot be adopted as a basis for systematic assessment and improvement (Sun *et al.*, 2009).

Against this background, these gaps in the literature are addressed in this research project. The study focuses on developing more efficient and effective methodology of assessment and improvement of the change management capability maturity level of construction organizations in the management of project changes. In addition, the study further focuses on evaluating the impact of change management capability maturity level of construction organization on cost and time performance of building projects. Determining the CMCML of construction organizations is considered together with the project needs, client requirements in terms of cost and time savings to develop a systematic model that can facilitate strategic planning and implementation of effective working practices. When carefully put into use in construction organisations and by industrial practitioners it is believed that it will help clients and other practitioners in pre-qualification and tender evaluation. In addition it will help organisations improve their performance by easily identifying their capability areas of strength and weaknesses which improvement needs to be prioritised. Learning from mistakes is highly significant in construction projects. Project team would utilise the advantage of lessons learned in the past to approach and manage problems associated with new projects (continuous improvement).

However, Nigeria construction practise is observed to still involve the use of ineffective traditional management system Ekundayo *et al.* (2013). There is currently no systematic approaches to managing project change and little or no empirical research has been conducted in the areas of assessment of the change management capability maturity level of construction organisations as well as evaluation of the impact of change management capability maturity level of construction organisation on cost and time performance of building projects. Therefore, there is need for awareness in the industry on the impact which either higher or low project change management capability maturity level of construction organisations can impose on proper performance of construction projects in terms of meeting the cost budget and schedule time. It is in this regard, that this study explored change management capability maturity model of construction organisations and its impacts on cost and time performance of institutional building projects in Nigeria.

Table 1.3: Gap Analysis Between Previous Studies and This Research

Previous studies focus		Present research focus	
Areas covered	Authors	Area focused	Gap identified
1. Identification of causes of change.	Naif <i>et al.</i> , (2011); Ghazal <i>et al.</i> , (2011); Sun and Meng, (2009); Hsieh <i>et al.</i> , (2004); Alnuaimi <i>et al.</i> , (2010).	1. Evaluation of change management capability maturity level (CMCML) of contracting organizations.	<p>Much of the previous studies discussion is presented in categorical ways with little or no attention being paid to evaluation and improvement of change management capability maturity of construction organizations and its subsequent impacts on project performance. Therefore, this study has measured the effectiveness of change management process as well as providing a clear evidence of the improvement of the change management capability maturity of construction organizations by specifically focusing on the following areas;</p> <p>(a). Assessment and improvement of CMCML of construction organizations.</p> <p>(b). Examine the correlation between the CMCML of contracting organization and cost – time performance of building projects.</p> <p>(c). Formulation of a methodological model that enhances assessment and improvement in the ability of construction organizations to effectively manage project change and thus mitigate the deleterious impact of it on project performance in terms of cost and time.</p>
2. Analysis of potential change effects on certain project elements.	Hester <i>et al.</i> , (1991); Ibbs <i>et al.</i> , (2001); Hanna <i>et al.</i> , (1999); William, (2000); Lee <i>et al.</i> , (2004); Moselhi <i>et al.</i> , (2005).	2. Impact of change Management capability maturity level of contracting organizations on cost and time performance of building projects	
3. Change management system (guidance for best practice in change management)	CII, (1994); Cox <i>et al.</i> , (1999); Stocks and Singh, (1999); CIRIA, (2001); Ibbs <i>et al.</i> , (2001); Motawa <i>et al.</i> , (2003, 2007); Hao <i>et al.</i> , (2008).		

1.3 Research Questions

The main research question for this study is “what is the impact of construction organization’s change management capability maturity on cost and time performance of building projects in Nigeria”. The research question is further broken into the following sub-questions:

CHAPTER 1

INTRODUCTION

The context of this research is presented in this chapter. It commences with the general overview of the background to the research, statement of problem as well as the justification for the study. The aim and objectives of the research is equally highlighted in the chapter. Similarly, a brief summary of the research methodology was also presented. Moreover, the chapter concludes with the organisational structure of the thesis which explains the content of each chapter in the thesis.

1.1 Background of the Study

Construction industry is complex and wide in nature and it is generally compartmentalized unlike other industries. According to Egan, (1998) “a project is divided into many sequential and separate operations undertaken by different parties”. The separations of design process from construction process coupled with the uniqueness of each project are the factors responsible for a complicated and complex construction process. The complexity of construction has led to the design process to be handled separately by an independent professional and the construction process by another professional. The consequence of this is that designers are left with the option of producing construction designs without much consideration for buildability. This characteristic of construction has left construction projects to be considerably prone into many project changes mostly during construction stages. However, project changes are inevitable and very common. They occurred from

different sources and by various causes in all stages of design and construction, (Motawa *et al.*, 2007). Project changes has been so prevalent that hardly can a project be completed without witnessing changes to the design scope or method of construction, (Ssegawa, 2002). Even the most thoughtfully planned project may necessitate changes due to various factors (Ibbs *et al.*, 2001).

Traditionally, almost all project change and change orders issued during construction stage of a project are major drivers of cost overrun, schedule delays, conflicts, safety issues and project disruption. Project changes do occur and cause substantial adjustment to contract duration, total direct and indirect cost or both in project management (Ibbs *et al.*, 2001; Gray and Hughes, 2001). Zhao *et al.* (2010); Chen, (2007), identified project change and change orders as problematic and critical factors causing cost overrun of construction projects. Baloyi *et al.* (2011) revealed that changes to work initiated by the client are a critical factor responsible for cost and time overruns. Kumaraswamy *et al.* (1997) also identified client initiated change orders as one of the major causes of time overruns.

Changes are additions, or general revision made to the project goals and scope. They are regarded as changes not minding whether it leads to increase or decrease to the project cost and time. According to Tiong, (1990) and Ibbs, (1997), changes in projects cause critical adjustment to contract duration and cost. In this regard, project management team has a duty to respond effectively to project change in order to reduce the impact of change on the project.

Wallace (2007) examined that several reasons are responsible for change occurrence, and these reasons are to be known as change causes, or drivers. Generally different opinions have been stated by different researchers on the drivers of project change. However, two major classifications of external and internal were expressed by some of the authors. The sub-division given by these authors are responsible for differences in their view points. Table 1.1 and 1.2 represents the taxonomy of causes and impacts of changes in construction projects.

Table 1.1: Causes of Project Changes

Authors	Project related	Client related	Design related	Contractor related	Other factors
Hsieh <i>et al.</i> (2004)	- complexity of projects - Safety facilities - Site security	- Client initiated changes	-Defects in designs -Poor estimation of Quantities -Design changes -Discrepancies between drawings and site conditions	- Poor planning -Contractors inexperience	-Unforeseen site conditions -Bad weather conditions -Change of regulations -Unstable decision-making authority
Wu <i>et al.</i> (2004)	- Delay in securing site, equipment and materials - Site restriction	-Changes in client's requirements	-Changes in design -Poor site investigation -Incomplete design information	-Poor scheduling -Poor workmanship -Changes in construction method	-Policy changes -Political pressure -Force majeure -Local residents
Kumaraswamy <i>et al.</i> (1997)	- Slow decision making by project teams. - Project complexity - Communication problem between client, consultant, & contractor - Disputes and conflicts.	- Client initiated change - Client interference in fixing contract duration	-Design error and omissions -Inexperienced design team -Delay in design information	-Inadequate contractor's experience -Poor site management -Inadequate managerial skill - Delays in subcontractor's work.	-unforeseen ground condition -Weather conditions

Table 1.2: Effects of Project Change

Authors	Time related	Cost related	Productivity related	Risk related	Other effects
Hanna <i>et al.</i> (2005, 2006)	- Rework - Overtime - Extension of time	- Increased cost - overtime cost - compensation	-Schedule compression - over-manning - trade stacking	-site congestion - acceleration - Interruption	-Loss of morale - poor quality of work - Less qualified labour
Moselhi <i>et al.</i> (2005)	-Time loss in stopping and restarting rework. -Subcontractors standing time	- Loss of earnings - Increase overhead - Change in cash flow - Increase time	-Reprogramming - Unbalanced gangs	- acceleration - Loss of float - Increase sensitivity to delay	-Revision of project reports and documents
Pheng <i>et al.</i> (2005)	-Rework and demolition -Completion Delay. - payment delay -Material and equipment delay	-Increase in overhead - Increase in cost -Additional payments to contractor	-Productivity degradation	-Affected progress of work	- Claims and disputes - Damage to reputation - Poor safety conditions -Loss of quality

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improve from lessons learned to sustain the overall viability of the project (Ibbs *et al* 2001., Hao *et al* 2008., Motawa *et al.*, 2007). Learning from past mistakes is very significant because it affords members of the project team to enrich their experience and appropriately applying it in future projects (Motawa, 2007). Project change and change orders must be resolved through a formalised change management process in order to avoid delays and disruptions in the work program. By adopting systematic and sustain process of handling change orders, there is a high probability of optimising project success. Inconsistent management of the change process result in many disruptive effects. However, the need for mitigating project change negative effects and improving construction processes brought extensive research in the area of mapping and modelling of project change management process.

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Against this background, these gaps in the literature are addressed in this research project. The study focuses on developing more efficient and effective methodology of assessment and improvement of the change management capability maturity level of construction organizations in the management of project changes. In addition, the study further focuses on evaluating the impact of change management capability maturity level of construction organization on cost and time performance of building projects. Determining the CMCML of construction organizations is considered together with the project needs, client requirements in terms of cost and time savings to develop a systematic model that can facilitate strategic planning and implementation of effective working practices. When carefully put into use in construction organisations and by industrial practitioners it is believed that it will help clients and other practitioners in pre-qualification and tender evaluation. In addition it will help organisations improve their performance by easily identifying their capability areas of strength and weaknesses which improvement needs to be prioritised. Learning from mistakes is highly significant in construction projects. Project team would utilise the advantage of lessons learned in the past to approach and manage problems associated with new projects (continuous improvement).

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2. Analysis of potential change effects on certain project elements.	Hester <i>et al.</i> , (1991); Ibbs <i>et al.</i> , (2001); Hanna <i>et al.</i> , (1999); William, (2000); Lee <i>et al.</i> , (2004); Moselhi <i>et al.</i> , (2005).	2. Impact of change Management capability maturity level of contracting organizations on cost and time performance of building projects	
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1.3 Research Questions

The main research question for this study is “what is the impact of construction organization’s change management capability maturity on cost and time performance of building projects in Nigeria”. The research question is further broken into the following sub-questions:

- (a) How can the change management capability maturity levels of construction organization be assessed on building projects?
- (b) What is the significant contractor-related factor(s) that contributes to project change and change orders on building projects?
- (c) How can the impact of change management capability maturity levels of construction organizations on cost and time performance of building projects be evaluated?
- (d) How can change management capability of construction organizations' be enhanced to improve time and cost performance of building projects in Nigeria?

1.4 Aim and Objectives of the Study

The aim of this research work is to investigate the impacts of change management capability maturity of construction organizations' on cost and time performance of building projects in Nigeria. The specific objectives are:

- (a) To examine change management capability maturity level of construction organizations on building projects.
- (b) To determine the significant contractor-related factors that contributes to project change and change orders on building projects.
- (c) To evaluate the impact of change management capability maturity levels of construction organizations on cost and time performance of building projects.
- (d) To develop a model for assessing and improving construction organisations' change management capability so as to enhance cost and time performance of building project.

1.5 Scope and Limitation of the Study

The research on change management capability maturity assessment model for construction organizations is limited in scope to the following:

- (a) The study is limited to investigating the impact of construction organization's change management capability maturity on cost and time performance of building projects in Nigeria.
- (b) The perspective of construction organization is only considered in this research, meanwhile, the impact of change management capability maturity on cost and time performance from the perspective of consultant and client could be totally different when examined.
- (c) The research has covered only institutional building grade 1 (one) construction organizations. Thus, the research outcome should be taken only as indicative of the impact of change management capability maturity of institutional building grade 1 (one) construction organizations.

Moreover, data collection in the research is limited to all building projects awarded and completed between 2009 and 2013 in all the Federal tertiary institutions located in the southwest geopolitical zone (i.e Ekiti, Ondo, Osun, Oyo, Ogun and Lagos states) of Nigeria, figure 1.1. The choice of south-west for the study was based on the fact that they are robustly developing economics zone in Nigeria which according to Dada (2005) has the highest concentration of construction activities. The constraints imposed by limited resources (cost and time) made available for the study as well as existing database not being readily available or accessible has made the onus of covering the entire country and long period of data storage very difficult for data collection. Similarly, the choice of educational building was further based on the premise that more newly completed building projects is available for investigation owing to the Federal Government new initiative of improving all tertiary institutions via ETF (Education Tax Fund) program of constructing new educational buildings such as Lecture theatre, classrooms, laboratories, libraries, computer lab and offices in all the tertiary institutions in the country.



Figure 1.1: The study areas for the research

1.6 Justification for the Study

In every completed project, persistent cost-time overruns due to project change and poor change management capability of contractors are experienced. Despite efforts geared towards implementing necessary control measures to stop this incessant occurrence in Nigerian construction industry, the problems still persist. Omoregie *et al.*, (2006) reported that the cost of project in Nigeria escalated by 14% and the period of projects similarly grown up by 188%. Oladapo, (2007) found variation orders as very significant factor regularly causing cost and time overruns in Nigeria construction industry.

While a body of research exists that identify major causes of change orders and further literature search identifies a couple of causes of change orders, no research was found to exist which tends to illustrate the reason for lack of construction organization management capability for managing change and change orders. Similarly relating change management capability of construction organizations' and cost-time performance was rarely researched by previous studies and having knowledge of these interactions may pave way for the delivery of more successful projects. Nigeria lacks empirical research in these areas of study however,

this study is the first that will quantitatively measure and rank these relationships in order to assist project parties reduce construction project problems.

This research therefore, forms a foundation on which further local and international research can be conducted. The outcome of the research will serve as evidentiary data from which other comparative studies could develop in terms of different cultural, social, political and environmental issues.

1.7 Contribution to Knowledge

This study evaluated change management capability maturity of construction organizations' with a view of improving their management capability levels in dealing with the issues of change and change orders in construction in order to reduce problem associated with cost and time overruns.

Principally, the research is considered capable of enhancing construction practitioners' ability via the proposed model which acts as a toolkit for assessment of construction organizations' change management capability maturity level particularly for pre-qualification and tender evaluation exercise. Furthermore the model can be used in improving construction organizations' management capability in dealing with the matters of change and change orders in construction projects.

Similarly, improvement of the change management capability maturity of construction organizations would have a direct impact on the issues associated with cost overrun, time delays, claims, disputes and rework since management of changes in construction is almost synonymous to management of risk. In addition, the propose model will guide contractors and other stakeholders in assessing organisational areas of strength as well as capability areas of weakness that needs improvement and urgent attention in their various organizations.

1.8 Research Methodology

In this research, quantitative research approach is adopted because of the nature of the objectives and data required. For explanatory research typical of this study, quantitative approach is mostly preferred because it is more focused with precise research question, comparative large sample size as well as testing the theory (Neuman, 2006). However, adopting quantitative approach is based on the need to obtain quality data from large participants without bias.

To accomplish the aim and objectives of the research, questionnaire survey design was adopted based on the fact that it is faster when compared with other methods and is comparatively less expensive. The targeted population for the research was categorised into two comprising: principal group of respondents (Clients, Contractors, Consultants) and the completed building projects that experienced cost and time overruns between 2009 and 2013. However, because of the specific nature of this project, all the respondents were considered to be directly related with the project and were all chosen as the research population. Therefore, because the population is sufficiently small, they were all considered as sample size for the research (Fellow and Liu, 2008).

The instrument adopted for data collection is the self-administered five-point Likert scale questionnaire which literature review forms the basis for its development. The questionnaire consists of two (Two) sets (A & B). Details of the format of the questionnaire are as described in chapter three of the research. The questionnaire was piloted among 10 construction experts and academia before it went into industry wide survey. Each set of the questionnaire was developed based on the nature of the research questions and set objectives for the research. A total of 42 questionnaires of set "A" was hand distributed to project managers, contract managers, project quantity surveyors of construction organization and 95% of these questionnaires were returned. Similarly, a total of 126 questionnaires of set "B" was administered face-to-face among consultants, contractors and clients and 80 95% response rate was recorded. However, all validly completed questionnaires returned were used for the analysis that followed.

The collected data were analysed using different statistical methods namely: descriptive analysis, correlation analysis, and fuzzy system analysis. Before adopting these methods for the analysis, collected raw data from the questionnaire were translated into numbers and arranged them into a statistical software package of “SPSS version 21” database. The developed change management capability maturity (CMCM) assessment model was validated via descriptive analysis. Details of the methodology approach is described in chapter five.

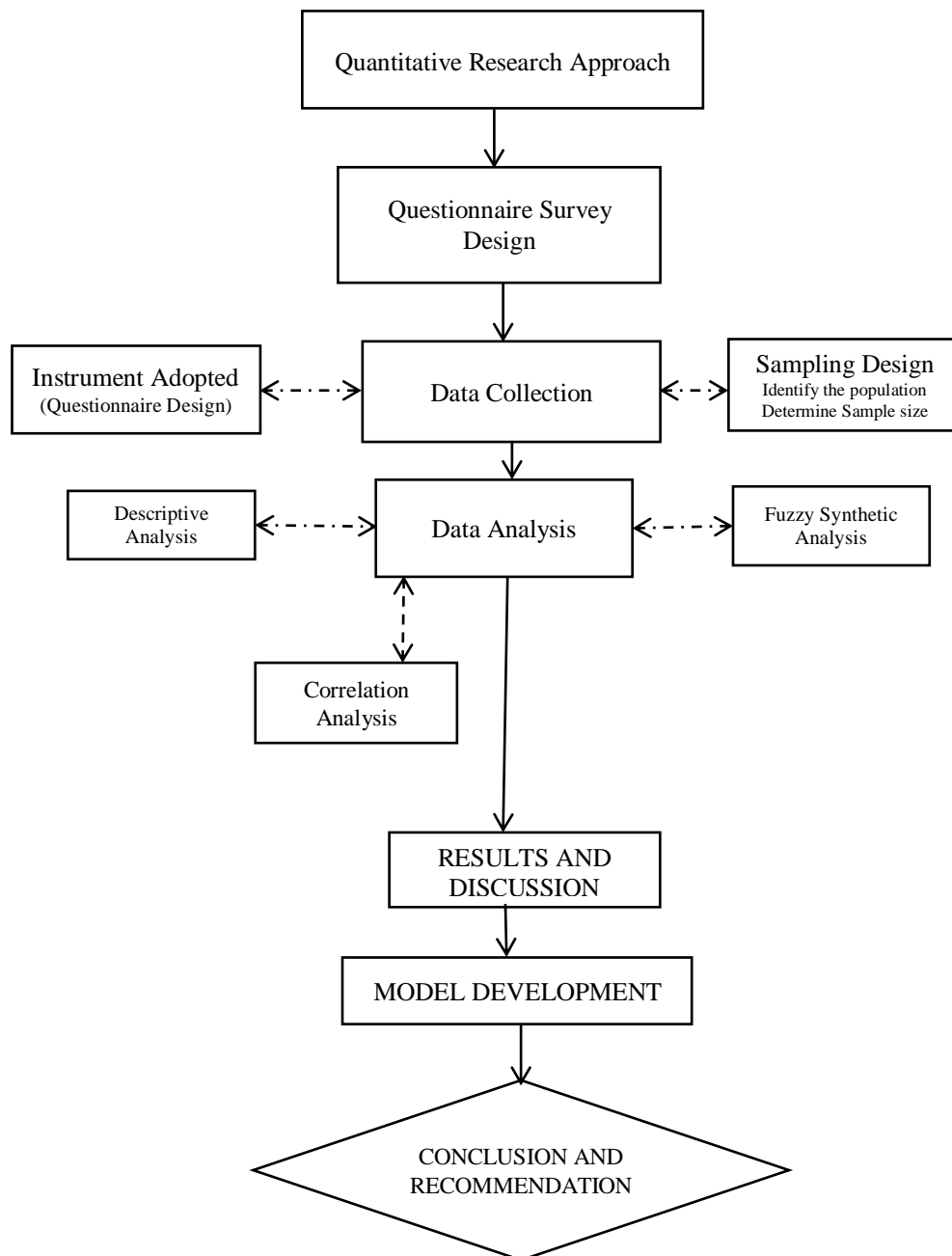


Figure 1.2: Research methodology flowcharts

1.9 Research Structure and Contents

The outline of the research can be previewed in two basic phases of pre-field and post-field activities. The pre-field phase includes those activities carried out prior to collection of data from the field. However, a post-field phase involves all the activities carried out right from the data collection stage, data analysis presentation and discussion up till conclusion and recommendation. Figure 1.3 shows the overall outline of the research which is structured into six chapters briefly described below.

(i) Chapter One: Introduction

The chapter provides general information about the research. It mainly focused on the introduction to the research topic, statement of problem, research proposition and questions, aim and objectives. Similarly, a brief description of research methodology adopted was provided.

(ii) Chapter Two: Change Management in Construction

This chapter present a review of literature on Nigeria construction industry, issue of construction project change and change orders, its causes, impacts and control measures to reduce the impacts on construction projects. Issues of change management in construction, change management processes; critical success factors in change management, and change management models in construction was also presented. In addition, the chapter discussed the management capability maturity of construction organisations to determine the influence of this factor on cost and time performance of building projects in Nigeria.

(iii) Chapter Three: Research Methodology

This chapter reports forms part of the pre-field activities, it provide necessary information on how the aim and objectives of the research was achieved. It reveals the procedures followed in the course of conducting the research. This involves decision taking in selecting the appropriate research approach, research tools,

population of the study, sampling techniques and sample size and taking final decision as to the method of analysing the data collected.

(iv) Chapter Four: Data Analysis, Presentation and Discussion

This chapter entails post-field activities. It involves the actual data collection and presentation of the data collected. Proper analyses of the data collected using appropriate analytical tools such as correlation; fuzzy synthetic evaluation and multiple regression analysis were carried out. In addition, findings from the study analysis were systematically reported and related to those from previous studies.

(v) Chapter Five: Model Development

Chapter five presents the systematic model purposely developed for the assessment and improvement of change management capability maturity level of construction organizations in Nigeria as well as guiding potential industry practitioners. The model was developed base on the theory of change management process and concept of capability maturity models (CMM).

(vi) Chapter Six: Conclusion and Recommendations

The chapter draws relevant conclusion from the findings as they relates to the objectives of the research as well as endeavour to answer the research questions posted. It also presents necessary recommendations for further studies. The thesis finally presents the references and appendices.

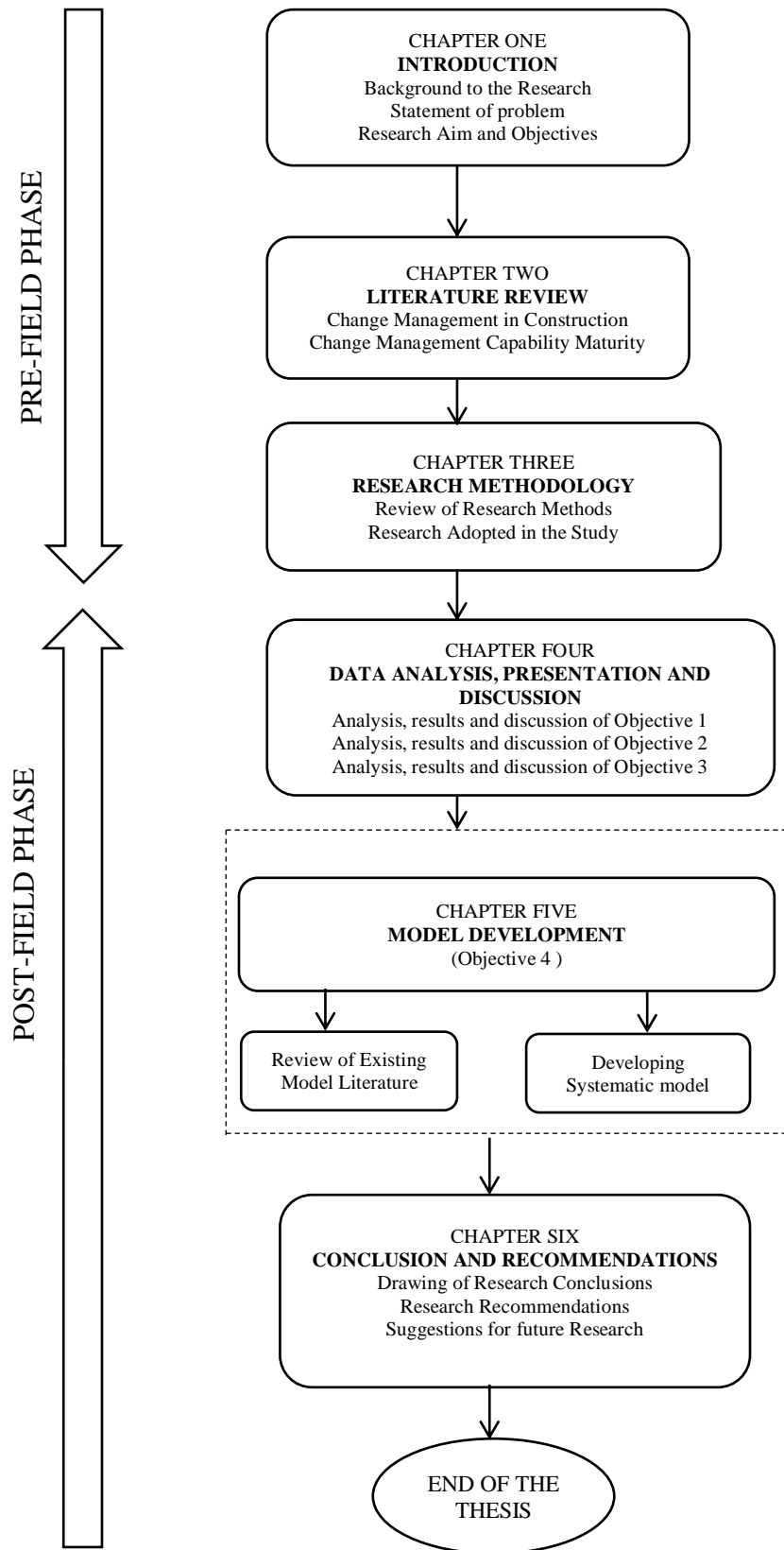


Figure 1.3: Research structure and contents flow chart

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