DEVELOPING A PREDICTIVE CONTRACTOR SATISFACTION MODEL (CoSMo) FOR CONSTRUCTION PROJECTS

By

Md Asrul Nasid Masrom
B.Sc Building (Hons), M.Sc Construction Contract Management (UTM)

A thesis submitted in partial fulfilment of the requirements for the degree of

Doctor of Philosophy

SCHOOL OF CIVIL ENGINEERING AND BUILT ENVIRONMENT
FACULTY OF SCIENCE AND ENGINEERING
QUEENSLAND UNIVERSITY OF TECHNOLOGY
2012
ABSTRACT

Over the last few decades, construction project performance has been evaluated due to the increase of delays, cost overruns and quality failures. Growing numbers of disputes, inharmonious working environments, conflict, blame cultures, and mismatches of objectives among project teams have been found to be contributory factors to poor project performance. Performance measurement (PM) approaches have been developed to overcome these issues, however, the comprehensiveness of PM as an overall approach is still criticised in terms of the iron triangle; namely time, cost, and quality. PM has primarily focused on objective measures, however, continuous improvement requires the inclusion of subjective measures, particularly contractor satisfaction (Co-S). It is challenging to deal with the two different groups of large and small-medium contractor satisfaction as to date, Co-S has not been extensively defined, primarily in developing countries such as Malaysia. Therefore, a Co-S model is developed in this research which aims to fulfil the current needs in the construction industry by integrating performance measures to address large and small-medium contractor perceptions.

The positivist paradigm used in the research was adhered to by reviewing relevant literature and evaluating expert discussions on the research topic. It yielded a basis for the contractor satisfaction model (CoSMo) development which consists of three elements: contractor satisfaction (Co-S) dimensions; contributory factors and characteristics (project and participant). Using valid questionnaire results from 136 contractors in Malaysia lead to the prediction of several key factors of contractor satisfaction and to an examination of the relationships between elements. The relationships were examined through a series of sequential statistical analyses, namely correlation, one-way analysis of variance (ANOVA), t-tests and multiple regression analysis (MRA). Forward and backward MRAs were used to develop Co-S mathematical models. Sixteen Co-S models were developed for both large and small-medium contractors. These determined that the large contractor Malaysian Co-S was most affected by the conciseness of project scope and quality of the project
brief. Contrastingly, Co-S for small-medium contractors was strongly affected by the efficiency of risk control in a project.

The results of the research provide empirical evidence in support of the notion that appropriate communication systems in projects negatively contributes to large Co-S with respect to cost and profitability. The uniqueness of several Co-S predictors was also identified through a series of analyses on small-medium contractors. These contractors appear to be less satisfied than large contractors when participants lack effectiveness in timely authoritative decision-making and communication between project team members. Interestingly, the empirical results show that effective project health and safety measures are influencing factors in satisfying both large and small-medium contractors.

The perspectives of large and small-medium contractors in respect to the performance of the entire project development were derived from the Co-S models. These were statistically validated and refined before a new Co-S model was developed. Developing such a unique model has the potential to increase project value and benefit all project participants. It is important to improve participant collaboration as it leads to better project performance. This study may encourage key project participants; such as client, consultant, subcontractor and supplier; to increase their attention to contractor needs in the development of a project. Recommendations for future research include investigating other participants’ perspectives on CoSMo and the impact of the implementation of CoSMo in a project, since this study is focused purely on the contractor perspective.

**Keywords:** performance, satisfaction measurement, construction, contractor, prediction model.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>INTRODUCTION</td>
<td>1-9</td>
</tr>
<tr>
<td>2</td>
<td>THE PHENOMENON OF SATISFACTION MEASUREMENT IN CONSTRUCTION INDUSTRY</td>
<td>11-35</td>
</tr>
<tr>
<td>3</td>
<td>DEVELOPMENT OF PRELIMINARY CONTRACTOR SATISFACTION MODEL (COSMO)</td>
<td>37-42</td>
</tr>
</tbody>
</table>

---

**ABSTRACT** ..........................................................................................................................i

**TABLE OF CONTENTS** ........................................................................................................... iii

**LIST OF FIGURES** .................................................................................................................. vi

**LIST OF TABLES** .................................................................................................................... vii

**LIST OF ABBREVIATIONS** ..................................................................................................... ix

**DEFINITION OF TERMS** ....................................................................................................... x

**STATEMENT OF ORIGINAL AUTHORSHIP** ........................................................................... xi

**ACKNOWLEDGEMENTS** ......................................................................................................... xii

**CHAPTER 1: INTRODUCTION** .............................................................................................. 1

1.1 Background to the research .............................................................................................. 1

1.2 Research question ............................................................................................................. 5

1.3 Objectives of the study ..................................................................................................... 5

1.4 Scope and Definitions ....................................................................................................... 6

1.5 Significance of study ........................................................................................................ 6

1.6 Organisation of the thesis ............................................................................................... 7

1.7 Chapter summary ............................................................................................................. 9

**CHAPTER 2: THE PHENOMENON OF SATISFACTION MEASUREMENT IN CONSTRUCTION INDUSTRY** .................................................................................. 11

2.1 Introduction ..................................................................................................................... 11

2.2 Overview of performance measurement ...................................................................... 11

2.3 The concept of satisfaction as performance measurement .............................................. 14

2.3.1 Satisfaction from different perspectives .................................................................. 15

2.3.2 Components of satisfaction measurement ............................................................... 19

2.4 Trend of satisfaction measurement in the construction sector ........................................ 20

2.4.1 Satisfaction measurement (SM) and its application in construction projects ............... 21

2.4.2 Current SM models in the construction industry ......................................................... 23

2.4.3 Limitations of existing SM in terms of contractor satisfaction (Co-S) ................. 33

2.5 Chapter Summary ........................................................................................................... 35

**CHAPTER 3: DEVELOPMENT OF PRELIMINARY CONTRACTOR SATISFACTION MODEL (COSMO)** ................................................................. 37

3.1 Introduction ..................................................................................................................... 37

3.2 Conceptual Model ......................................................................................................... 37

3.3 Co-S Dimensions ....................................................................................................... 38

3.3.1 Cost performance .................................................................................................. 38

3.3.2 Time performance ................................................................................................. 39

3.3.3 Product performance ............................................................................................ 39

3.3.4 Design performance ............................................................................................. 40

3.3.5 Safety performance .............................................................................................. 40

3.3.6 Profitability ........................................................................................................... 41

3.3.7 Business performance .......................................................................................... 41

3.3.8 Relationship performance ..................................................................................... 42

3.4 Co-S Contributory factor ............................................................................................... 42
REFERENCES

APPENDIX A: Questionnaire ........................................................................237
APPENDIX B: List of Publications ..............................................................237
LIST OF FIGURES

Figure 2.1 Performance measurement approaches (Adapted from Chan and Chan, 2004a) ...............12
Figure 2.2 The evolution concept of performance measurement (Adapted from Love and Holt, 2000) ........................................................................................................12
Figure 2.3 A framework for performance measurement system (Adapted from A. Neely et al. 1996) ..................................................................................................................13
Figure 2.4 Satisfaction measurement concept from different perspectives (Adapted from Nerkar et al., 1996) .................................................................15
Figure 2.5 Diagram of satisfaction construct (Adapted from Nerkar et al., 1996) .................20
Figure 2.6 Oliver’s Model (Adapted from Soetanto and Proverbs, 2004) ........................................21
Figure 3.1 Performance measurement evolution (Adapted from: Love and Holt, 2000) ............43
Figure 3.2 Preliminary Contractor Satisfaction Model (CoSMo) ...........................................62
Figure 4.1 Research approach .................................................................................................64
Figure 4.2 The three phases of the research process .................................................................66
Figure 4.3 Principles of questionnaire design (Cavana, 2001) ............................................74
Figure 4.4 Questionnaire development process ........................................................................75
Figure 4.5 The pilot test process ..............................................................................................82
Figure 6.1 Statistical analysis process ....................................................................................100
Figure 6.2 Normal P-P plot of regression standardised residual for contractor satisfaction on Cost .................................................................130
Figure 6.3 Scatterplot of regression standardised residual for contractor satisfaction on Cost ....130
Figure 7.1 Normal P-P plot of regression standardised residuals for contractor satisfaction on Cost ........................................................................................................164
Figure 7.2 Scatterplot of regression standardised residual for contractor satisfaction on Cost ....164
Figure 8.1 Large contractor satisfaction model (LCo-SMo) ..................................................199
Figure 8.2 Small-medium contractor satisfaction model (SMCo-SMo) ....................................200
Figure 8.3 A New Co-S Model ...............................................................................................201
LIST OF TABLES

Table 2.1 Satisfaction measurement studies for client (Cl-S) ......................................................... 24
Table 2.2 Satisfaction measurement studies for customers (Cu-S) .................................................. 27
Table 2.3 Satisfaction measurement studies for home-buyer .......................................................... 28
Table 2.4 Satisfaction measurement studies for participants in project development .................... 30
Table 3.1 The ten SERVQUAL criteria (Parasuraman et al., 1985) .................................................. 47
Table 3.2 Five dimensions of the SERVQUAL model (Parasuraman et al., 1985 and Cronin and Taylor, 1994) .................................................................................................................. 48
Table 3.3 Co-S contributory factors .................................................................................................. 51
Table 3.4 Characteristic of project (Belassi and Tukel, 1996) ............................................................. 59
Table 4.1 Contractor registration grades ............................................................................................ 65
Table 4.2 Distribution of respondents ............................................................................................... 79
Table 4.3 Detail profile of contractor/practitioner ............................................................................... 79
Table 4.4 Pilot test results .................................................................................................................. 83
Table 5.1 Position .............................................................................................................................. 91
Table 5.2 Academic Background ...................................................................................................... 91
Table 5.3 Professional Background .................................................................................................. 92
Table 5.4 Duration of respondent involvement in the construction industry .................................... 92
Table 5.5 Duration of respondent involvement in current organisation ......................................... 93
Table 5.6 Longevity of organisation ................................................................................................. 93
Table 5.7 Nature of Business ............................................................................................................ 94
Table 5.8 Grade of Registration ........................................................................................................ 95
Table 5.9 Project Type ......................................................................................................................... 95
Table 5.10 Project Size ....................................................................................................................... 96
Table 5.11 Project Clients .................................................................................................................. 96
Table 5.12 Previous Procurement Routes .......................................................................................... 97
Table 6.1 Reliability test (Cronbach’s Alpha) ..................................................................................... 101
Table 6.2 Variables Codes ................................................................................................................. 102
Table 6.3 Correlation analysis between large contractor satisfaction dimensions and contributory factors .......................................................... 105
Table 6.4 Analysis of Variance (ANOVA) on seven characteristics .................................................. 112
Table 6.4 Analysis of Variance (ANOVA) on seven characteristics .................................................. 113
Table 6.5 Summary of t-tests ............................................................................................................ 115
Table 6.5 Summary of t-tests ............................................................................................................ 116
Table 6.6 Regression Results for Forward Method (Stage1) ............................................................... 121
Table 6.7 Regression Results of Forward and Backward Analysis (Stage 2) ..................................... 124
Table 6.8 Description of predictors for large contractor .................................................................... 126
Table 6.9 Residuals Statistics ............................................................................................................ 131
Table 6.10 Details of the model parameters ................................................................. 132
Table 6.11 Diagnostic test of the regression model ...................................................... 133
Table 7.1 Reliability test (Cronbach’s Alpha) .................................................................. 142
Table 7.2 Correlation Analysis between small-medium contractor satisfaction dimensions and contributory factors ................................................................. 143
Table 7.3 Summary of Analysis of Variance (ANOVA) on seven categories ................. 148
Table 7.4 The significant T-Tests results ...................................................................... 151
Table 7.5 Regression Results for Forward Method (Stage1) ......................................... 155
Table 7.6 Regression Results of Forward and Backward Analysis (Stage 2) ............... 158
Table 7.7 Description of small-medium contractor satisfaction predictors ................ 161
Table 7.8 Residuals Statistics ...................................................................................... 165
Table 7.9 Details of the model parameter ..................................................................... 166
Table 7.10 Diagnostic test of the regression model ..................................................... 167
Table 8.1 The comparison of predictors between Large and Small-Medium Contractors .... 178
Table 8.2 Comparison of the predictors between Large and Small-Medium contractor .......... 186
Table 8.3 Groups of significance predictors .................................................................. 187
**LIST OF ABBREVIATIONS**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
</tr>
<tr>
<td>BPM</td>
<td>Business Performance Measurement</td>
</tr>
<tr>
<td>BWD</td>
<td>Backward</td>
</tr>
<tr>
<td>CIDB</td>
<td>Construction Industry Development Board</td>
</tr>
<tr>
<td>CIMP</td>
<td>Construction Industry Malaysia Plan</td>
</tr>
<tr>
<td>CI-S</td>
<td>Client Satisfaction</td>
</tr>
<tr>
<td>Co-S</td>
<td>Contractor Satisfaction</td>
</tr>
<tr>
<td>Cu-S</td>
<td>Customer Satisfaction</td>
</tr>
<tr>
<td>FWD</td>
<td>Forward</td>
</tr>
<tr>
<td>Ho-S</td>
<td>Home-buyer Satisfaction</td>
</tr>
<tr>
<td>ICT</td>
<td>Information Communication Technology</td>
</tr>
<tr>
<td>KM</td>
<td>Knowledge Management</td>
</tr>
<tr>
<td>LC</td>
<td>Large Contractor</td>
</tr>
<tr>
<td>Oc-S</td>
<td>Occupant Satisfaction</td>
</tr>
<tr>
<td>PM</td>
<td>Performance Measurement</td>
</tr>
<tr>
<td>PO</td>
<td>Project Owner’s Performance</td>
</tr>
<tr>
<td>POE</td>
<td>Post-Occupant Evaluation</td>
</tr>
<tr>
<td>SERVQUAL</td>
<td>Service Quality</td>
</tr>
<tr>
<td>SM</td>
<td>Satisfaction Measurement</td>
</tr>
<tr>
<td>SMC</td>
<td>Small-Medium Contractor</td>
</tr>
<tr>
<td>SPM</td>
<td>Stakeholder Performance Measurement</td>
</tr>
</tbody>
</table>
DEFINITION OF TERMS

**Performance measurement** – Performance measurement refers to a strategy used to attain organisational goals including objective and subjective measures.

**Satisfaction measurement** – Satisfaction measurement considers subjective matters to measure performance by using perceptions and expectations.

**Contractor satisfaction dimension** – Co-S dimension involves performance-based dimensions, which are used as indicator to determine Co-S levels.

**Contributory factors** – Contributory factors refers to performance of project and participants at the operational levels that may potentially affect Co-S.

**Project participants** – Project participants are individuals, persons, groups, experts, or key players that are involved in the development of a project.
Chapter 1: Introduction

1.1 BACKGROUND TO THE RESEARCH

Construction project performance has been criticised in many areas over the last few decades. The problems involved are due to the separation of design (which is commonly undertaken by architects prior to the full commencement of projects), lack of integration between key participants (client, consultants, contractor), inadequate effective communication, uncertainty, changing environments and increased project complexity (Shamil, 1994).

From a global perspective, problems relating to construction performance have been identified, particularly in the United States of America (USA), through an increased amount of variations work due to design changes in construction projects. This has significantly impacted on the participants as well as project productivity (Wambeke, Hsiang & Liu, 2011). In Middle Eastern countries, a number of time overrun causes, such as financial difficulties and substantial changes in the scope of work, have been found to contribute to extensive delays in project completion (Sweis, Sweis, Abu Hammad & Shboul, 2008). Several infrastructure projects in Jordan have also suffered in terms of delays due to client-related factors, including finance, payments for completed work, slow decision making and insufficient project delivery. These factors have affected the project consultants in terms of: contract management; preparation and approval of drawings; and factors associated with materials (Odeh & Battaineh, 2002). Similarly, massive changes in project scope have caused up to 70% poor time performance in Saudi Arabian projects (Assaf & Al-Hejji, 2006). Furthermore, human factor issues, such as lack of qualified and experienced personnel, are also recognised as major causes of poor time performance in this country, particularly in public projects (Adel & Skitmore, 2009).

Despite a number of cost control techniques that have been developed, project cost overruns continue to occur in many countries. The issues involved are primarily
in terms of over-budget, insufficient cost savings, late progress payments and a lengthy claims process (Benjaoran, 2009). Numerous causes of poor project cost performance, including; inaccurate evaluation of project time and cost by key participants, increased complexities of project design, design changes, and non-performance of subcontractors; have contributed to poor project cost performance in developed countries such as the United Kingdom (UK) (Olawale & Sun, 2010). The increasing number of project uncertainties has had a fundamental effect on project performance in the UK, mainly associated with project estimates, project participant characteristics, and stages in the project life cycle (Atkinson, Crawford & Ward, 2006). These pitfalls have led to negative relationships between parties, conflicts, mismatched objectives and adversarial relationships (Harmon, 2003). Also contributing to poor project performance is the demand by clients for faster completion of work with minimal costs by speeding the process to produce a satisfactory quality of work (Love, Mandal & Li, 1999). Consequently, the needs and requirements of clients are not well satisfied, as insufficient time is allocated by the contractor for project planning.

The inefficiency and ineffectiveness of key project teams (namely clients, consultants and contractors) have been determined by several researchers as the main challenge construction projects must overcome to obtain high quality performance. This issue has been addressed globally, including in developing countries such as Malaysia. The Construction Industry Malaysian Planning (CIMP), produced by the Construction Industry Development Board (Plan, 2006), reported that project failures are not solely caused by contractors, but by other participants, such as the architect, engineer, subcontractors and suppliers. In terms of overall project performance, 50% of quality failures can be attributed to design faults, 40% to construction faults, and only 10% to material faults. Furthermore, delayed government projects in Malaysia have been due, not only to poor performance by contractors, but also to the lack of communication between participants, inadequate client finance and late issuance of construction drawings by consultants (Sambasivan & Soon, 2007).

Recently, performance measurement studies undertaken in Hong Kong addressed this issue by developing a number of approaches to improve time, such as
construction time performance (CTP) (Walker & Shen, 2002), project management performance (PMP) (Luu, Kim & Huynh, 2008) and contractor quality performance (CQP) (Yasamis, Arditi & Mohammadi, 2002). Cheng et al. (2006) posited that project performance can be evaluated according to two measures: objective and subjective. However, performance measurement based on objective measures, also known as the iron triangle (of time, cost, quality), has been criticised in terms of its effectiveness in measuring the performance of large development projects (Toor & Ogunlana, 2010). Therefore, other performance indicators such as ‘satisfaction’ have received increasing attention and become more significant in terms of improving existing objective performance measurement and project outcomes. Satisfaction studies have also been evolving as they promise benefits in terms of construction quality, increasing profits, enhanced relationships within project teams, and increased business opportunities. Therefore, this development underlines the desirability of a diversion from pure focus on business performance to a greater emphasis on stakeholder performance measurement (Love & Holt, 2000).

The concept of customer satisfaction emerged in the early 1980s in the USA and was implemented in China in the mid 1990s (Liu & Leung, 2002). At the international level, this approach is mostly used to examine satisfaction levels in marketing or business and rarely in the construction industry. However, in the past decade this concept has become progressively used in the construction industry. Several studies have stated that satisfaction measurement in construction investigates a spectrum of areas, including: client satisfaction levels with contractors’ and consultants’ performance (Cheng et al., 2006; Mbachu & Nkado, 2006; Siu, Bridge & Skitmore, 2001); customer satisfaction with product and service of construction (Maloney, 2002; Yang & Peng, 2008); and home buyer and occupant satisfaction measured in terms of comfort (Liu, 1999; Paul & Taylor, 2008; Torbica & Stroh, 2001). These considerations indicate that the acceptance of satisfaction measurement by key players has increased in construction projects, as it promises benefits not only to the project but also to key participants. Satisfaction measurement would further lead to harmonious working relationships between participants, support continuous improvements in projects, improve mutual understanding, and support the development of high satisfaction levels and long term relationships between key

To date, the contractor satisfaction (Co-S) model is used to identify problems early in a construction project (Soetanto & Proverbs, 2002). Having a comprehensive Co-S model seems significant to develop a close relationship between contractor and other participants involved in a project. The extensive use of Co-S model may also important to help client to be more understandable on contractor needs in a better manner which is not only in terms of technical but emotional perspectives. This strongly indicates that a clear definition of performance at project level highlighted through a Co-S model could possibly promote a systematic way for client to fulfill basic contractor requirements which may result to a better project performance.

The existing Co-S approach is also beneficial for contractors in improving project performance to achieve project objectives in terms of time, cost and quality, as required in the contract. However, differences in terms of finance, capability, and experience among contractors is still debatable because it may lead to different competitiveness, performance and competencies levels possibly impacting the effectiveness of CoSMo implementation. Due to the limitation of existing research on this issue, there is a need to identify other factors that potentially influence contractor satisfaction levels in construction projects, particularly at operational levels, since the existing Co-S model focuses primarily on client performance. The identification of relationships between Co-S dimensions, Co-S contributory factors, and the impact of Co-S measurement on construction performance also needs further work. Since early 2000, little attention has been paid to the application of Co-S measurements in evaluating project performance, particularly in developing countries such as Malaysia.

Therefore, this research aims to develop a predictive Co-S model for the Malaysian construction industry to enhance project performance by examining the Co-S of large and small-medium contractors independently. The differences between
these contractors’ perceptions regarding project performance are still largely unreported. This research will comprehensively predict contractor needs, which are useful as a platform on which improved understanding between project participants can be based.

1.2 RESEARCH QUESTION

Based on the background of the research, the following research questions are posed:

1. What are the dimensions and factors influencing contractor satisfaction (Co-S) in the development of a construction project?

2. Which contributory factors in the development of a construction project may affect the large and small-medium contractor satisfaction (Co-S) dimension?
   - To what extent do the contributory factors influence Co-S dimension?
   - Which contributory factor greatly influences large and small-medium Co-S?
   - Which contributory factor inversely influences large and small-medium Co-S?
   - Which contractor and project characteristics influence the measurement of Co-S levels?

3. What are the differences and similarities between the contributory factors to the large and small-medium Malaysian Co-S?

1.3 OBJECTIVES OF THE STUDY

The following four objectives satisfy the above research questions:

1. identify the Co-S dimensions that potentially contribute to large and small-medium contractors in the development of a construction project.
2. identify the key Co-S contributory factors that potentially influence large and small-medium contractors in the development of a construction project.

3. investigate the relationships between Co-S dimensions and contributory factors influencing large and small-medium contractors in the development of a construction project.

4. develop a contractor satisfaction (Co-S) model in the development of a construction project to enhance project outcomes by considering the relationships between Co-S elements.

1.4 SCOPE AND DEFINITIONS

This research focuses on the development of a predictive contractor satisfaction model aimed at improving long-term project performance in Malaysia. The data derived from Malaysian contractors includes construction contractors of different sizes including large, medium and small companies but excludes sub-contractors from the population of study. The results are applicable to Malaysia only, although they could be generalised to apply to other developing countries. Therefore, changes would be necessary if this Co-S model is applied to another specific country in terms of its cultural and political measures.

1.5 SIGNIFICANCE OF STUDY

This research is expected to contribute to the body of knowledge and industry by:

- identifying new Co-S dimensions and factors based on Malaysian construction project management.
- proposing a new Co-S model by improving the existing model and integrating new factors relating to contractors at the operational level in construction projects.
• exploring issues of satisfaction performance measurement by examining the relationship between Co-S dimension and contributory factors empirically through quantitative methods in the field of construction management.

• helping to develop an understanding the concept of Co-S measurement and how it can motivate project stakeholders to maintain relationships, improve communication, and enhance project performance.

• by enabling other key participants to use the new comprehensive Co-S model as a checklist to ensure high levels of project performance. This research will also benefit contractors by increasing competitiveness in the construction market, profitability, and future business opportunities.

1.6 ORGANISATION OF THE THESIS

This thesis consists of nine chapters. A summary of each is as follows.

Chapter 1 develops the direction of this investigation. This chapter also describes the research background, problems and objectives, scope of study, research significance, and the thesis organisation.

Chapter 2 identifies the research gap, which collates the current state of knowledge by reviewing different streams of the performance measurement (PM) concept. The different perspectives of satisfaction measurement (SM) are examined along with the trend of satisfaction measurement in the construction sector, the application of SM in the construction industry and the limits of existing SM studies.

Chapter 3 examines the relevant literature to develop a contractor satisfaction (Co-S) model. The Co-S model specifically focuses on the key dimensions of contractor satisfaction and the contributory factors of performance that enable the contractors to address their needs and deliver the project. The Co-S model was examined according
to the research questions and explores the relationship between the Co-S dimensions, contributory factors and the characteristics at the operational level.

Chapter 4 outlines the methodology employed to answer the research questions. The chapter describes the development of appropriate strategies and approaches, including the research process used to develop the questionnaire and model development.

Chapter 5 describes the questionnaire results and presents these in tables with profiles of contractors and projects. Conclusions are then presented.

Chapter 6 evaluates the survey constructs from large contractors (LC). Relationships between Co-S dimensions, contributory factors and characteristics are examined using the statistical technique of correlation (Spearman-rho and Pearson), analysis of variance (ANOVA), T-tests, and multiple regression analysis. The chapter reviews the statistical analysis and the validity tests of the eight models to answer the research questions. It also discusses the results and implications derived from the findings.

Chapter 7 describes the same procedures as conducted in Chapter 6, examining the data from the small-medium contractors (SMC). The results and their implications are also presented.

Chapter 8 analyses the significant results presented in Chapter 6 and Chapter 7. The final regression models compare the two groups, large (LC) and small-medium contractors (SMC). It also compares the predictors of satisfaction models between large and small-medium contractors by highlighting the similarities and differences between the two. This chapter presents a new Satisfaction Predictive Model for large (LCo-SMo) and small-medium (SMCo-SMo) contractors and summarises the findings.
Chapter 9 concludes the research in terms of the research questions, the contributions and implications of the research. Finally, the chapter addresses some limitations of this research and provides recommendations for possible future research.

1.7 CHAPTER SUMMARY

This chapter outlined the thesis. It indicated the research background, highlighted the current issues of measuring the performance of construction projects and established the research problems and objectives. The research scope and its significance were addressed before the thesis organisation was outlined.
Chapter 2: The Phenomenon of Satisfaction Measurement in Construction Industry

2.1 INTRODUCTION

This chapter reviews literature relevant to the research objectives of Section 1.3, as well as establishing the scope of knowledge in the area of construction performance measurement and satisfaction measurement. The literature review identifies the key dimensions and factors influencing contractor satisfaction with project development. This literature was used as the platform to the development of the conceptual framework for Co-S.

The following sections firstly deal with an overview of performance measurement in construction before presenting the evolution of the satisfaction concept used in construction performance measurement. An overview of the application of satisfaction measurement in construction projects is also discussed, followed by a review of current satisfaction measurement models and the limitation of existing SM studies in terms of contractor perspectives. Finally, the research gap in the literature is identified and forms the research question.

2.2 OVERVIEW OF PERFORMANCE MEASUREMENT

The evolution of performance measurement has seen a shift in focus from objective means of measurement to subjective means (Chan & Chan, 2004a), as illustrated in Figure 2.1. It should be noted that the objective approach uses mathematical calculations based on construction time, speed of construction, cost, and accident rate, while the subjective approach uses participant opinions and personal judgement.
The literature highlights the fact that the orthodox paradigm of performance measurement (PM) has broadened from being purely profit-oriented and project-specific to involve focus on stakeholder issues (Love & Holt, 2000), which is more comprehensive than the original. This PM evolution is demonstrated in Figure 2.2.

![Figure 2.1 Performance measurement approaches (Adapted from Chan and Chan, 2004a)](image)

![Figure 2.2 The evolution concept of performance measurement (Adapted from Love and Holt, 2000)](image)
The traditional measures of the iron triangle (time, cost, quality) are no longer applicable for measuring performance due to economic changes, large and complex projects, rapid changes in technology and the increasing number of participants in a project (Bryde & Robinson, 2005; Chan, Scott & Chan, 2004; Ling, Low, Wang & Egbelakin, 2008; Toor & Ogunlana, 2010; Wang & Huang, 2006). To achieve the full benefits of performance measurement approach, consideration on internal and external measures have to be addressed (Neely, Mills, Platts, Gregory & Richards, 1996). Additionally, combination of objective and subjective factors in developing an effective PM is also needed to facilitate the revolution of business process (Gunasekaran & Ichimura, 1997; Waggoner, Neely & P Kennerley, 1999). Although, there are several factor force changing in PM namely stakeholders, information technology, the marketplace, policies, and future uncertainties, but three main levels as shown in Figure 2.3 should consider when designing a performance measurement system (Neely et al., 1996).

![Figure 2.3 A framework for performance measurement system (Adapted from A. Neely et al. 1996)](image)

Therefore, to improve existing methods, construction project measurement has come to include measurements that consider participant satisfaction (Forsythe, 2007;
Kärnä, Sorvala & Junnonen, 2009; Yang & Peng, 2008). This change in approach is significant because it brings the following benefits:

- boosting repeat business and increasing long-term profitability (Wirtz, 2001),
- measuring customer perceived value and identifying any customer complaints to improve product and service quality (Kondo, 2001),
- measuring the health of marketer relationships with customers (Rossomme, 2003),
- benchmarking an organisation and its performance (Gupta & Zeithaml, 2006),
- developing closer relationships between customer and service provider by sharing information and creating customer retention (Ennew, Reed & Binks, 1993), and
- predicting the quality of service delivery and perceived value (Gil, Berenguer & Cervera, 2008).

The above benefits indicate that satisfaction plays an important role in measuring outcome performance and the definition of satisfaction is provided from different perspectives.

### 2.3 THE CONCEPT OF SATISFACTION AS PERFORMANCE MEASUREMENT

Psychologists and philosophers refer to ‘satisfaction’ as discrepancy between a goal and performance levels (Hamner and Harnet(1974). According to Oliver (1980) the word ‘satisfaction’ is a combination of the Latin words, satis (enough) and facere (to do or make). However, differences in satisfaction levels also can be defined as a feeling, which may be influenced by a number of factors (Wanous and Lawler, 1972). According to these definitions, satisfaction could be best defined as an outcome of judgement made between individual expectations and expectations of performance.
2.3.1 Satisfaction from different perspectives

While the above definition is debatable, the concept of satisfaction is still an essential factor in many areas of performance studies. The concept of satisfaction applies to psychological, business, marketing and economic areas in the measuring of performance outcomes (Nerkar, McGrath & MacMillan, 1996). The concept of satisfaction measurement from different perspectives is illustrated in Figure 2.4.

![Satisfaction measurement concept from different perspectives](Adapted from Nerkar et al., 1996)

Many years ago, satisfaction in psychology was used mainly to measure job satisfaction (Clay Hamner & Harnett, 1974; Locke, 1970; Locke & Latham, 1990; Sheridan & Slocum, 1975). Nerkar et al. (1996) agreed that an individual assessment of job satisfaction is a function of the discrepancy between what an individual expects from the job and what the individual actually receives. Wanous and Lawler (1972) offered another perspective on ‘satisfaction’ when they defined it as the difference between responses to a ‘How much is there’ item and a ‘How much should be there be’ item. The differences between these two types of items are summed up across job facets to yield a measure of overall satisfaction. Satisfaction in
the context of psychology is defined as the result of a comparison between fulfilsments of desires, where unfulfilled desires may cause dissatisfaction.

Locke (1970) stressed that satisfaction levels can be measured by value judgment. Satisfaction is a distinct, pleasurable emotion when an individual who sets a goal succeeds in achieving that goal. Conversely, failing to reach the goal is expressed as unpleasant (Locke, 1970). It is important to emphasise that individual knowledge, beliefs and methods of thinking influence chances of achieving goals successfully. Preference is another significant factor needed to measure satisfaction levels, particularly before, during and after the decisions are made (Simon et al, 2004). Success in a challenging task produces satisfaction and a feeling of increased competence or efficiency. Locke (1970) believed that satisfaction is different from happiness, which is the successful state of existence.

Measurement of satisfaction levels have also been used as the basis for marketing surveys. Measurement commonly involves several antecedents - such as product and service quality, cost management and timeliness - to identify levels of client satisfaction (Nowak & Washburn, 1998). Consumer expectations are additionally determined by the implicit comparison between expected and actual outcomes. However, Czepiel and Rosenberg (1977) argue that customer satisfaction is a complex evaluative attitude. Satisfaction measurement is used as a marketing benchmark of an organisation’s performance (Eggert & Ulaga, 2002), but most studies of customer satisfaction measures have concentrated on the objective aspects rather than feelings such as expectations and perceptions. According to Oliver (1980), ‘expectation’ creates a frame of reference about which one makes a comparative judgment. He explains that expectation is influenced by other factors such as the product itself (including one’s past experience), brand connotation and symbolic elements, the context (including the context of communication from sales people and social referents), and individual characteristics including persuasion and perceptual distortion. Expectation is measured as the perceived belief attributes and the total or overall beliefs about evaluation of the product.
Expectation is an important element in satisfaction measurement, Woodruff et al. (1983) emphasise that ‘expectation’ is a prediction of the nature and level of preference the user will secure. In their research, Woodruff et al. (1983) highlighted three comparisons used to compare the expectation, expected deserved, ideal, and minimum tolerable performance. The basis of comparison is the degree of equity between what is achieved and what the other person achieved. Therefore, satisfaction is conceptualised as an additive function of positive and negative disconfirmation of perceived attribute levels and the corresponding comparisons levels of those attributes.

It is important in conducting satisfaction measurement to identify the difference between satisfaction and dissatisfaction regarding performance in order to derive an area of improvement. These results can be used as indicators of performance levels. There are many schools of thought regarding satisfaction, such as Oliva et al. (1992) who assert that consumer satisfaction and dissatisfaction can be developed in terms of the relationship between satisfaction and a repeat-buying measure of loyalty. Grigoroudis and Siskos (2004) also agree that satisfaction occurs as a result of three elements: perceived quality; expectations; and perceived value.

Evaluation of satisfaction is important from a business perspective as it encourages service providers to maintain a high quality of service and also assists buyers in determining the level of employee performance and efficiency (Liu & Walker, 1998). Babin and Griffin (1998) describe customer satisfaction as being used to evaluate the surprise inherent in a product acquisition and consumption experience. On the other hand, Smith (2001) emphasised that customer satisfaction can be obtained from service quality. Recently, numerous business studies agreed that product quality, perceived value, service quality and service delivery are among the dimensions to be considered when examining satisfaction levels (Gil et al., 2008; Gupta & Zeithaml, 2006; Lai & Lam, 2010).

Satisfaction can also be formed by the performance of one party at a certain standard. Levels of satisfaction with a product refers to an individual’s subjective
evaluation of the various outcomes (Babin & Griffin, 1998). The generic concept of satisfaction is usually concerned with human behaviour, such as being goal-oriented. The ultimate outcome of satisfaction is complex to study as it is subject to the fulfilment of goals, desires, and motivations (Czepiel & Rosenberg, 1977). However, the study of satisfaction is necessary in order to help service providers understand customer expectations and to improve areas of weakness.

Another perspective of satisfaction was provided by Johnson et al. (2001) who stressed that customer satisfaction based on economic factors is synonymous with the concept of consumption utility. Satisfaction is also a form of consumption utility in determining economic well-being. Several factors are considered when studying economic well-being, such as evaluation of individual health, socio-cultural context, political freedom and stability (Johnson et al., 2001).

Geysken et al. (1999) emphasised that if satisfaction focuses on the economic aspects of a ‘relationship’, it is known as economic satisfaction. On the other hand, satisfaction that is more concerned with non-economic aspects of the relationship is called non-economic satisfaction. Economic satisfaction channels a member’s positive affective response to the economic rewards that flow from the relationship, such as sales volume and margins. Economic satisfaction is satisfied with the general effectiveness and productivity of the relationship between partners, as well as the resulting financial outcomes. By contrast, non-economic satisfaction is defined as the psychosocial aspects of a relationship and interactions between partners. A member satisfied with the non-economic aspects of a relationship appreciates the contact with a partner on a personal level and enjoys working with them because they believe the partner is concerned, respectful and willing to exchange ideas.

The definition of ‘satisfaction’ remains debatable as a result of the inconsistencies and differences discussed in several studies conducted over the years. Notwithstanding the inconsistencies and differences in the definitions, satisfaction can loosely be defined as an outcome of product or service in the form of feelings or emotions derived from the differences of expectations and perceptions of individual.
2.3.2 Components of satisfaction measurement

In general, the measurement of satisfaction has five determinants, namely expectancy, disconfirmation, performance, attribution and equity (Oliver & DeSarbo, 1988). Several scholars emphasise that the theory of job satisfaction, such as expectancy theory, is important for satisfaction measurement as it presents a baseline for judgments. Woodruff et al. (1983) specified that expectation is an important determinant when comparing perceived brand performance. This means that satisfaction could be influenced by the results of comparison between products of different brands. Furthermore, disconfirmation also has a significant influence on satisfaction levels as Patterson et al. (1997) believed that disconfirmation is the difference between what is received and what is expected. It is important to highlight that disconfirmation is affected by associated emotional experiences and enhances a satisfaction judgment.

Another important determinant of satisfaction measurement is performance. Rossome (2003) emphasised that performance is the degree to which the fundamentals of a business transaction meet the business performance expectations. The study also recognised that attribute satisfaction is the fourth important determinant and can be seen as a specific subjective satisfaction judgment resulting from observations of product performance, service feature or dimension. Based on this, the outcomes of the product and services can be construed as successes or failures.

Despite the use of these four components to gauge satisfaction levels, Nerkar et al.’s (1996) concept, as illustrated in Figure 2.5, suggests that satisfaction measurement can be made more comprehensive than Rossome’s theory by including three main components: facet (performance); context; and type of satisfaction. The output can be measured according to three different kinds of satisfaction: instrumental (needs, motivation); social (vision, relations, and interactions); and egocentric (benefit, objectives). This idea of satisfaction helps other industries, such
as construction, to increase their understanding of satisfaction concepts throughout a project’s development.

![Diagram of satisfaction construct](image-url)

**Figure 2.5 Diagram of satisfaction construct (Adapted from Nerkar et al., 1996)**

### 2.4 TREND OF SATISFACTION MEASUREMENT IN THE CONSTRUCTION SECTOR

The concept of satisfaction measurement has been developed in the construction industry as a performance measurement tool only in recent years. It has been used increasingly as an indicator of performance level, particularly to measure project and participant performance.

The concept of satisfaction is still new in the construction industry and the basic model used is Oliver’s model (Oliver, 1997). For example, Soetanto and Proverbs (2004) adopted Oliver’s model in their study by suggesting that satisfaction and performance are related as performance outcomes. The authors of the study agree that performance is known as an input and levels of satisfaction or dissatisfaction as an output (Figure 2.6). The model also purports that psychological processing or a ‘black box’ exists that requires rational consideration in making
decisions. The next section explains the application of satisfaction in construction projects from the different perspectives of project participants.

2.4.1 Satisfaction measurement (SM) and its application in construction projects

There are numerous conceptual models that have been developed to measure satisfaction levels in the construction industry. The extensive review of satisfaction measurement provides a complete picture of its application in the construction industry. It is notable that satisfaction has been widely used in performance studies, particularly in investigating different key participant satisfaction levels in the construction industry, such as client satisfaction (Cl-S), customer satisfaction (Cu-S), home-buyer satisfaction (Ho-S), participant satisfaction (Pt-S) and contractor satisfaction (Co-S). This demonstrates that performance measurement, using the satisfaction perspective, is becoming essential in construction as it has been broadly accepted to identify areas of improvement that may lead to project success.
In the late 1990s, researchers in the area of satisfaction focused on Cl-S in terms of service quality (Al-Momani, 2000), project profit maximization and home-buyer satisfaction. This concept of satisfaction has been widely used in determining Ho-S, particularly with respect to quality of life determined through residential satisfaction (Amerigo & Aragones, 1997). The same concept has also been applied to improve occupant satisfaction by developing both the Post-Occupant Evaluation (POE) (Liu, 1999) and Total Quality Method (TQM) (Torbica & Stroh, 1999).

The satisfaction concept has progressively evolved in the construction industry since the early 2000s. Several client satisfaction measurements have been undertaken by investigating client satisfaction (Cl-S) with construction project, participant performance, building development process, dispute resolution process, performance of functional brief, and quality management. It should be noted that the development of this concept has been extended to assess customer satisfaction, particularly with a construction product and with product quality.

Home-buyer satisfaction (Ho-S) is the approach used to evaluate buyer perceptions using the concept of satisfaction to identify levels of product quality. Home-buyer satisfaction method (HOMBSAT) is a tool to assess the building quality, green building and indoor environmental quality of a design. However, to achieve a better construction project performance, a comprehensive satisfaction approach is needed that focuses on all key project participants. That is, it must focus on individual key project participants such as the architect, engineer, and supplier.

The satisfaction concept developed further in late 2000. During this period, the project stakeholder perspective with project and participant performance was investigated. Leung et al. (2004) asserted that participant satisfaction maybe useful in improving project performance as it assesses key participants’ satisfaction level with construction conflict, such as issues related to payment. This indicates that subjective measures such as satisfaction are becoming significant tools for the client, consultant and supplier to increasing their understanding levels and thus maintain their performance throughout project.
The satisfaction literature review identified that the measurement of satisfaction levels based on key project participants seems to be insufficient. This is because concern for contractor (the party responsible for delivering the project according to the contract) satisfaction has been neglected. It is noted that, in academia, there is limited research on contractor satisfaction particularly regarding project performance. Although Soetanto and Proverb (2002) examined contractor satisfaction in developed countries, and suggested that the concept might be helpful as a predictor of early problems in a project, no research has been undertaken to extend the contractor satisfaction study, especially for developing countries.

The review of the satisfaction literature in construction indicates that the application of satisfaction measurement varies as it depends on the objectives of assessment and type of participants. The following section uses conceptual and mathematical models to discuss the application of satisfaction measurement from the different perspectives of key project participants.

2.4.2 Current SM models in the construction industry

A review of the satisfaction literature provided a clear understanding of the significant satisfaction models in the construction industry. This section examines the satisfaction models of client (Cl-S), customer (Cu-S), home-buyer (Ho-S), and project participant (Pt-S) and highlights factors that may potentially influence satisfaction levels within projects from different perspectives. It is important to highlight that although a number of existing studies are applying the satisfaction concept, they differ in terms of approaches and application as they depend on location, types of participants and projects.
### Table 2.1 Satisfaction measurement studies for client (Cl-S)

<table>
<thead>
<tr>
<th>Code</th>
<th>Purpose</th>
<th>Findings</th>
<th>Author/s (Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Developed methodology to assess the performance of construction contractors by using service quality gap analysis</td>
<td>• Closer working relationships and meaningful collaboration among all contract teams is necessary to optimise construction performance and efficient contracting procedure</td>
<td>Al-Momani (2000) (Jordan)</td>
</tr>
<tr>
<td></td>
<td>• Studied contractor performance based on clients needs, expectations and desires in building projects</td>
<td>• Client demands much more than quality, finishing on time and within budget which means their satisfaction can be achieved by a combination of personnel relationships and reputations of contractor in a project</td>
<td>Egemen (2006) (Northern Cyprus)</td>
</tr>
<tr>
<td></td>
<td>• Examined client satisfaction based on overall contractor performance in different countries</td>
<td>• Contractor need to improve their overall performance by focusing on construction time, reducing delays, maintaining a stable workforce and establishing partnerships with subcontractors</td>
<td>Xiao and Proverbs (2004) (Japan, the UK, the USA)</td>
</tr>
<tr>
<td></td>
<td>• Examined the project service quality of Design and Build contractor in undertaking projects for public clients</td>
<td>• Service quality of Design and Build contractor is below expectations as the contractor lacks service quality in terms of competency and capability as a project manager, and also lacks design management expertise</td>
<td>Ling and Cheng (2005) (Singapore)</td>
</tr>
<tr>
<td></td>
<td>• Developed a model for predicting client satisfaction from the contractor performance in a project</td>
<td>• Long–term relationships may encourage higher satisfaction levels for clients</td>
<td>Soetanto and Proverbs (2004) (UK)</td>
</tr>
</tbody>
</table>


