CRITICAL SUCCESS FACTORS MODEL FOR RESIDENTIAL BUILDING MAINTENANCE IN LIBYA

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Especially dedicated to:

my Mother and Father,

Words cannot express everything you have done for me ... thank you

For all of your love and support.

Brothers, sisters, wife, friends and all those who have been a great

help in the completion of this thesis

My love for you all remains forever...

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ABSTRACT

Libya faces challenges in its effort to provide adequate maintenance for residential buildings. Presently, more maintenance work is required in order to cope with huge construction growth in Libya. However, the growth of maintenance industry is not expanding as it should. Despite government's best efforts to address this problem, little success has been recorded for maintenance of residential buildings. Literature attributed the low success rate due to issues such as no proper guidelines and enforcement on delay payment of maintenance work, poor customer service provided by property management organization, design deficiency and defects in residential unit, deferred maintenance and poor management. Maintenance of residential building is not only essential for the general well-being of individuals, but an effective implementation of building maintenance will promote socio-economic development of individuals and a nation. However, there is still lack of studies on critical success factors for residential building maintenance. Therefore, the aim of this research is to establish the critical success factors (CSFs) that influence the success of residential building maintenance in Libya. The data collection was carried out in Libya, and it included of expert judgment, pilot study and questionnaire survey. The expert judgment survey were conducted with experts in order to check the relevance of the variables identified from the literature review with respect to Libyan context, and to identify additional variables not listed in the questionnaire form. Based on the results of the expert judgment survey, the variables were modified and used in the development of questionnaire. A pilot survey was conducted to expose problems or weaknesses in the questions and to pre-test the clarity and comprehensibility of the questionnaire. A questionnaire survey was then conducted with a total of 350 questionnaires were administered by self-administered questionnaire survey to consultants, contractors, clients and those working in handling residential building maintenance. A total of 327 completed questionnaires were returned. The data collected were analyzed by means of Partial Least Square technique based on Structural Equation Modeling (PLS-SEM), in order to test the relationship between CSFs and residential building maintenance success. The results established eight (8) factors which are critical to the success of residential building maintenance in Libya: project management factor, project participants factor, environment and site factor, health and safety factor, time factor, quality factor, financial factor, and other factors. The critical success factors established in this study can guide project managers and policy makers in the planning and implementation of adequate maintenance for residential buildings in Libya.

ABSTRAK

Libya kini menghadapi cabaran dalam usaha menyediakan penyelenggaraan yang mencukupi bagi bangunan kediaman. Pada masa kini, kerja penyelenggaraan yang lebih banyak diperlukan bagi mengatasi pembinaan yang semakin berkembang di Libya. Walau bagaimanapun, industri penyelenggaraan tidak berkembang sebagaimana yang diperlukan. Meskipun kerajaan berusaha untuk menangani masalah ini, hanya kejayaan kecil sahaja mampu direkodkan untuk penyelenggaraan bangunan kediaman. Kajian literatur mendapati kadar kejayaan yang rendah adalah disebabkan isu-isu seperti, tidak ada garis panduan yang tepat dan penguatkuasaan kelewatan pembayaran penyelenggaraan, perkhidmatan pelanggan yang tidak memuaskan disediakan oleh pihak pengurusan, kecatatan rekabentuk dan kecacatan dalam unit kediaman, penyelenggaraan yang tertunda dan pengurusan yang lemah. Penyelenggaraan bangunan kediaman bukan sahaja penting untuk kesejahteraan penduduk awam, tetapi pelaksanaan penyelenggaraan bangunan yang berkesan akan menggalakkan pembangunan sosio-ekonomi individu dan negara. Walau bagaimanapun, masih terdapat kekurangan dari segi kajian terhadap faktor kejayaan kritikal untuk penyelenggaraan bangunan kediaman. Oleh itu, tujuan penyelidikan ini adalah untuk mewujudkan faktor kejayaan kritikal (CSFs) yang mempengaruhi kejayaan penyelenggaraan bangunan kediaman di Libya. Pengumpulan data dilakukan di Libya, ianya termasuk kajian penilaian daripada pakar, kajian rintis dan kajian soal selidik. Kajian penilaian daripada pakar telah dijalankan untuk mengenalpasti pembolehubah daripada kajian literatur yang bersesuaian dengan konteks Libya, dan untuk mengenal pasti pembolehubah tambahan yang tidak tersenarai dalam borang soal selidik. Berdasarkan hasil Kajian penilaian daripada pakar, pembolehubah telah diubahsuai dan digunakan dalam pembikinan borang soal selidik. Kajian rintis dijalankan untuk mendedahkan masalah atau kelemahan dalam borang soal selidik dan bagi menguji kesesuaian borang soal selidik. Kajian soal selidik kemudian dijalankan dengan jumlah 350 borang soal selidik diedarkan kepada perunding, kontraktor, pelanggan dan mereka yang mengendalikan penyelenggaraan bangunan kediaman. Sebanyak 327 soal selidik yang lengkap telah dikembalikan. Data soal selidik telah dianalisis dengan menggunakan Partial Least Square (PLS) berdasarkan Structural Equation Modeling (PLS-SEM), untuk mengkaji hubungan antara CSF dan kejayaan penyelenggaraan bangunan kediaman. Hasil kajian menetapkan lapan (8) faktor penting yang kritikal bagi menjayakan penyelenggaraan bangunan kediaman di Libya iaitu: pengurusan projek, penyertaan projek, alam sekitar dan tapak, kesihatan dan keselamatan, masa, kualiti, kewangan, dan lain-lain faktor. Faktor kejayaan kritikal yang diketengahkan dalam kajian ini boleh menjadi panduan pengurus projek dan penggubal dasar perumahan dalam perancangan dan perlaksanaan bagi penyelenggaraan yang mencukupi untuk bangunan kediaman di Libya.

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LIST OF SYMBOLS AND ABBREVIATIONS

AVE	Average Variance Extracted
BMS	Building Maintenance Success
BMPS	Building Maintenance Project Success
CA	Cronbach's Alpha
CSFs	Critical success factors
CB-SEM	Covariance-based SEM
CR	Composite Reliability
ESF	Environment and Site related factors
EFA	Exploratory factor analysis
ES	Extremely Significant
f^2	Effect size of
FF	Financial related factors
GDP	The gross domestic product
HSF	Health and Safety related Factors
KPIs	Key performance indicators
MS	Moderate Significant
NS	Not Significant
OF	Other related factors
PLS	Partial Least Squares
PLS-SEM	partial least squares SEM
PMF	Project Management related Factors
PPF	Project Participants related Factors
Q^2	Predictive Relevance
q^2	Effect size of Predictive Relevance
QF	Quality related factors
R^2	The coefficient of determination

SEM	Structural Equation Modeling
SS	Slightly Significant
SSE	Sum of Squared Predictive Errors
SSO	Sum of Squared Observations
TF	Time related factors
UNIDO	United Nations Industrial Development Organization
VS	Very Significant

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CHAPTER 1

INTRODUCTION

1.1 Background

Building is an essential element which provides people of the nation with shelter and facilities to carry out daily task. However, buildings deteriorate and dilapidate during their service lives (Arditi & Nawakorawit, 1999b; Williamson *et al.*, 2010; Rodrigues *et al.*, 2011; Femi, 2014; Zaki *et al.*, 2017). Buildings need maintenance to retain structural safety and aesthetic appearance in order to ensure that the occupants of the building are comfortable, well facilitated to work and the services and amenities can be used optimally (Yik & Lai, 2005).

Maintenance is very crucial part in every life of the building. The building maintenance practice is needed in every development. It is because the building needs to be well maintained in order to retain the value of the property itself (Zawawi & Kamaruzzaman, 2009; Essays, 2013). Most developed countries and some ambitious developing countries have observed the roles of maintenance and now allocate roughly 50% of annual expenditure to industry to the maintenance sector (Olanrewaju & Abdul-Aziz, 2014). For example within the construction output value of Great Britain was worth nearly 164 billion British pounds in 2017, which was more than double the value which had been recorded in 2000. Of construction work carried out in the UK in 2016, 35 percent of it was repair and maintenance (Statista, 2018). In the developing world, building maintenance has become an important aspect to be considered (Ishak et al., 2007; Olagunju, 2012; Tan et al., 2012), even at the pre-construction stage (Arditi & Nawakorawit, 1999a; Lam, 2007; Al Rubaiey et al., 2014). Since most developing countries lack proper and effective organizational

setup, the cost of building maintenance has significant detrimental concerns on future developments in terms of safety, finance, time and other factors (Ishak et al., 2007).

Libya is no exception, the problems of maintenance will continue to increase, while the available financial resources allocated to maintenance are greatly diminished (Mohamed, 2005). This is in addition to the problem increasing housing demand, and subsequently, building projects are becoming much more difficult and complex. Thus, leading to high unprecedented problems and challenges to building maintenance program in Libya (Grifa, 2006; Salah & Bloomer, 2014). In view of this, an effective maintenance management is required to tackle this problem (Mohamed, 2005). Thus, Libyan government should take all appropriate measures to ensure that all it citizens have access to decent and safe housing.

Various studies have recognized the importance of building maintenance not only to retain the value of the property but also for individual and national development (Akasah *et al.*, 2011; Zuraidi *et al.*, 2011). For instance, it has been noted that, the success of building maintenance generates economic growth (Lam *et al.*, 2010b). The success of building maintenance contributes to the attainment of good health, comfort, social behavior, and general well- being of individuals. The study of critical success factors (CSFs) is very important to improve the effectiveness of projects (Chan et al., 2004b). Various attempts have been made by several researchers to determine the critical success factors in construction projects and some variables influencing project success have been proposed (Chan et al., 2004b; Silva et al., 2015; Lindhard & Larsen, 2016). Generally, the variables considered showed that some variables are mutual in the list provided by different researchers, however, there is no general agreement on these variables (Chan & Chan, 2004a; Chan et al., 2004b; Ahadzie et al., 2008; Alzahrani & Emsley, 2013; Khan et al., 2013; Jain & Pathak, 2014; Silva et al., 2015).

From the foregoing discussion it can be argued that, building maintenance is an important component for national development and for the advancement of quality of life or high standard of living. Despite these important roles of building maintenance in the life of every individual and nation in general, government and contractors in Libya faces with immense challenges in respect to the success of building maintenance. In Libya, Building maintenance are works provided by government or private sector for public building or residential buildings which are subsidized by public fund. Libyan Government provides building maintenance to

assist people who have residential buildings damaged from the war (Shebob, 2012; Salah & Bloomer, 2014; Gherbal, 2015). This is essential in Libya since majority of its population are low income earners who experience difficulties in maintaining residential buildings at market conditions after war.

Therefore, there is a need to find a way to improve the performance of residential building maintenance in Libya. It is of interest to note that until now little effort if any has been made by researchers to towards that direction. Thus, this motivates the conduct of this study to establish factors that have strong influence on the success of residential building maintenance. The finding of this study will act as a tool to guide the project participants to select the most suitable and appropriate method which will improve the maintenance of residential buildings in Libya.

1.2 Problem Statement

Maintenance is an essential to ensure that buildings and other built assets present a good appearance and operate at optimum efficiency. Apart from decay and degradation of the building itself, inadequate maintenance can reduce performance and can affect heath and threaten the safety of users, occupants and others in the vicinity. Hence, building maintenance has been identified as an important component of the post-occupancy life of the building structure (Horner et al., 1997; Akasah et al., 2011; Zuraidi et al., 2011).

Effective maintenance of buildings not only improves the quality of living environment but is also a vital means to uphold or even raise the value of properties. Thus, building maintenance should possess all significant elements to provide adequate housing. In this regard, previous research (Omar, 2003) reveals that proper maintenance and the continuous care of the existing resource of residential buildings in Libya are essential to prevent rapid physical and environment deterioration. However, residential buildings in Libya are often developed of poor quality standard and are designed without consideration of life styles of the residents (Alhemri et al, 2008).

Residential buildings in Libya are faced with maintenance challenges resulting in deterioration and ultimate defects of various degrees. Furthermore, there is lack of proper maintenance of the existing stock which were in reasonably good

condition, shortage and high cost of building materials, and severe shortage of technical and skilled labor (Omar, 2003). Tarhuni (2013) observed that technical employees are leaving the Libyan public sector with knowledge gained from years of practical experience. This leads to knowledge leakage and a lack of experts within the public sector who could conduct maintenance work correctly, in addition to the extra time and money spent on training new employees.

Reviews of residential buildings maintenance in Libya show that, the performance of the maintenance program was very poor as little success have been recorded. For instance, (LAB, 2016) reported that between 2011 – 2016 the civilian administration has planned to do maintenance for 1752 projects in Libya at over LYD 40 billion, however, it only allocated 11,450,857,145 LYD for building maintenance during this period and most of these projects have been suspended. In Libya, it can further be demonstrated that there is very little achievement towards the success of building maintenance, where only 30% percent of the total allocated projects in the building maintenance where implemented successful. (LAB, 2016) it was found that 75% of these projects were completed with more than 50% cost overrun. Whereas the analyses of projects completion time performance of the same study indicate that half of the projects have more than 300% time overrun.

Therefore, from the foregoing discussions it can be argued that there are number of problems and challenges hindering the government effort towards the maintenance of residential buildings in Libya. Considering the fact that residential building maintenance involved many stakeholders and series of activities, the management of this type of project is complex. Thus, successful implementation and management of residential building maintenance depends on a number of factors. It is imperative to identify those factors that strongly influence the success of residential building maintenance in Libya.

Earlier Pinto and Covin (1989) argued that, the presence or absence of many CSFs can result in success or failure of a project. Similarly, Chan et al (2004b) opine that, the effectiveness of project can be improved by studying its CSFs. However, an examination of the relevant recent literature indicated that many researchers highlighted the critical success factors in construction projects and a few efforts to identify the critical success factors in building maintenance (Chan et al., 2007; Lam et al., 2010a). Lam, Chan & Chan (2010b), assert that identifying the critical factors can be enhanced the success level of building maintenance. Every type of project has

its specific success factor which may be different with other projects. Thus, considering the various government' efforts in the past seven years towards the maintenance of residential buildings in Libya recorded little success (LAB, 2017). There is need to identify factors that are critical or strongly influence the success of these projects.

An excellent practice of residential building maintenance is greatly needed to increase the life cycle of the property and to minimize unexpected breakdowns or deterioration effects. In this respect, identifying CSFs for residential building maintenance will assist developers and contractors in the selection of project personnel and in the planning and management of those projects. Understanding of the CSFs will also assist policy makers in the formulation and implementation of residential building maintenance policies. All these can lead to success of building maintenance in Libya, and ensure building owners have access to adequate accommodation which has a strong positive impact on their health. This situation calls for the investigation of the current situation for the success of residential building maintenance in Libya and gives rise to the research questions.

Thus, based on the above discussion it can be concluded that, to ensure the success of residential building maintenance in Libya it is imperative to establish the critical success factors (CSFs) that affect the success of building maintenance with the view to proffering relevant solutions. Therefore, the gap identified in this research work has motivated the conduct of the present study.

1.3 Research Questions

In order to establish the CSFs, the following research questions have been formulated to guide this study:

1. What factors determine the success of residential buildings maintenance in Libya?
2. What factors strongly influence the overall success of residential buildings maintenance in Libya?
3. Are the CSFs of equal importance on the residential buildings maintenance success in Libya?

The first research question was aimed to investigate factors that are critical to the overall success of residential building maintenance in Libya. The second research question was aimed to identify factors that strongly influence the achievement of the success of the residential building maintenance. The third research question was aimed to establish the impact of each CSF on residential building maintenance success.

1.4 Research Aims and Objectives

The aim of this research work is to establish CSFs model for residential building maintenance in Libya. The achievement of the research's aims can be accomplished by attaining the following objectives:

1. To identify and rank the important factors affecting the success of residential building maintenance in Libya.
2. To examine the causal relationships between CSFs and residential building maintenance success in Libya.
3. To develop a conceptual model of CSFs for residential building maintenance success in Libya.
4. To validate the CSFs model for residential building maintenance success.

1.5 Research Scope

This research is mainly focusing on identifying CSFs for residential building maintenance in Libya. The study covers the building maintenance phases, which include conceptualization, planning, execution, termination, and occupation stages. That is, it aimed to identify both the critical success factors and the residential building maintenance success. This is because it is necessary to take a holistic approach in the identification and application of CSFs in order to achieve building maintenance success. The focus of this study is on residential building maintenance provided by government or private sector to low income earners which are subsidized by public funds.

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