

# Using Structural Equation Modelling (SEM) to Understand the Relationships among Critical Success Factors (CSFs) for Stakeholder Management in Construction

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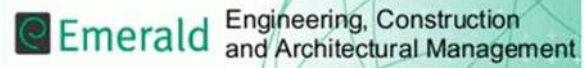
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**Using Structural Equation Modelling (SEM) to Understand  
the Relationships among Critical Success Factors (CSFs) for  
Stakeholder Management in Construction**

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1       **Using Structural Equation Modelling (SEM) to Understand the Relationships among**  
2               **Critical Success Factors (CSFs) for Stakeholder Management in Construction**

3       **ABSTRACT**

4       **Purpose** – Stakeholder management plays a significant role in the successful delivery of  
5 construction projects. However, being able to carry out effective stakeholder management in  
6 construction is contingent upon understanding the interrelationships among the critical  
7 success factors (CSFs) for stakeholder management in construction and how they are related  
8 to project success. This would enable the persons responsible for stakeholder management to  
9 know the logical process for addressing the critical success factors in order to get stakeholder  
10 management right. The understanding of this relationship has not been addressed. This  
11 research aimed to investigate the interrelationships between the CSFs for stakeholder  
12 management and project success in construction.

13       **Design/Methodology/Approach** – From an extensive literature review, 23 critical success  
14 factors for stakeholder management in construction were identified. A conceptual structural  
15 equation model (SEM) of the relationships between critical success factors was developed  
16 (including measurement and structural models) using the groupings of the critical success  
17 factors for stakeholder management in construction. A questionnaire survey was used to  
18 collect data from construction industry practitioners. The data so collected were analysed  
19 using SEM in Analysis of Moment Structures (AMOS).

20       **Findings** – The SEM analysis of data collected resulted in the best fitting measurement  
21 model comprising 16 critical success factors as indicators of four latent variables namely,  
22 stakeholder characteristics and project characteristics; stakeholder analysis; stakeholder  
23 dynamics; and stakeholder engagement/empowerment. Furthermore, it was found that only  
24 stakeholder engagement/empowerment has direct positive impact on project success. The

other three constructs stakeholder characteristics and project characteristics, stakeholder analysis and understanding stakeholder dynamism collectively impact on project success through the construct, stakeholder engagement/empowerment.

**Research Limitations/Implications** – The research reported in this paper was carried out in the UK hence the findings may have portrayed the UK construction professionals' opinion. However, the theoretical principles on which the research was based are general and similar research could be replicated in different countries whose construction procurement processes and industries are structured like those of the UK or otherwise.

**Originality/Value** – ~~The paper contributes to theory by empirically identifying the interrelationships among the critical success factors for stakeholder management linking to project success which will serve as a guide to construction professionals.~~ The main contribution of this study to existing knowledge is an empirical evidence of the interrelationships among the CSFs for stakeholder management in construction through their latent variables which is portrayed in the best fitting structural model showing the relationships between the constructs of CSFs for stakeholder management and project success. This should serve as a guide to construction project management team or responsible professionals for undertaking stakeholder management in construction projects.

**Keywords** – construction, stakeholder management, Critical success factors, Project success, Relationship, structural equation modelling

**Paper type** – Research paper

## INTRODUCTION

Despite continuous efforts aimed at improving project success in the construction industry, it has seldom been a common occurrence for construction projects to be

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7 48 successfully delivered. Construction projects are generally unique in nature due to their  
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9 49 processes and interaction with numerous parties within and around them. Construction  
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11 50 projects are traditionally divided into a series of activities undertaken by different individuals  
12  
13 51 or groups who may have different levels of interest and or involvement in the project (Egan,  
14  
15 52 1998). Just like any other venture, they are constrained by time and resources which are  
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17 53 needed for the projects to be delivered successfully (Ibrahim and Nissen, 2003; Bourne,  
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19 54 2005). The lengthy process of design and execution of construction projects constitutes a  
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21 55 complex system which involves interactions, collaboration and negotiations among many  
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23 56 stakeholders which include but are not limited to the clients, designers, contractors, local  
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25 57 authorities and the general project environment (Cheeks, 2003; Winch 2010). Some  
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27 58 individuals or groups (such as labour unions, employers' association, general public, the  
28  
29 59 media, and institutional forces/nationalised industries (professional bodies) etc) may not be  
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31 60 directly involved in the project but may have interest in and could have the power and be  
32  
33 61 capable of influencing the project delivery process (Leung and Olomolaiye, 2010). All parties  
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35 62 involved directly or indirectly in the project are referred as the project stakeholders.  
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37 63 Satisfying the dynamic expectations of project stakeholders throughout the life cycle of the  
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39 64 project is instrumental to the successful completion of construction projects (Atkin and  
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41 65 Skitmore, 2008). This can be achieved through stakeholder management. Stakeholder  
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43 66 management on projects should be carried out in order to obtain the support and contributions  
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45 67 of stakeholders as much as possible towards the project and achieve the best possible results  
46  
47 68 and project success (Black, 1995; Akintoye *et al.* 2003; Bourne, 2005; Olander and Landin,  
48  
49 69 2008; Jepsen and Eskerod, 2009). In the UK, client and stakeholder satisfaction is considered  
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51 70 as one of the main performance indicators of construction projects and construction projects  
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53 71 are now expected to be delivered to meet social value, sustainability and consideration of all  
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55 72 stakeholders' interests and needs (Winch, 2010).  
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7 73 The origin of stakeholder management theory has been attributed to Freeman's (1984)  
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9 74 book – "*Strategic Management: A Stakeholder Approach*". Stakeholder management is  
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11 75 concerned with the interrelationships between organisations and their diverse stakeholders  
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13 76 which can impact the project as well as individual parties and organisations associated with  
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15 77 the project both positively and negatively. Hence the aim of stakeholder management is for  
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17 78 organisations to identify, analyse, understand and effectively manage their stakeholders  
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19 79 (Chinyio and Olomolaiye, 2010). Although it started as a business management concept, the  
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21 80 theory of stakeholder management has been increasingly applied across different fields  
22  
23 81 including construction management. However, due to the peculiarity of construction projects  
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25 82 and process, it is necessary to device construction specific stakeholder management  
26  
27 83 principles.

28 84 Previous research efforts have investigated how stakeholder management in  
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30 85 construction projects can be improved focusing on different aspects of stakeholder  
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32 86 management in construction projects (Bourne and Walker, 2005; Chinyio and Akintoye,  
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34 87 2008). Most recently, Yang *et al.* (2009) and Yang and Shen (2014) developed a framework  
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36 88 for successful stakeholder management in construction projects based on the exploratory  
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38 89 groupings of the CSFs for stakeholder management. However, the exploratory groupings of  
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40 90 CSFs in Yang *et al.*'s, framework did not measure the interrelationships among the  
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42 91 constructs, the knowledge of which is needed to inform a logical stakeholder management  
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44 92 process in construction projects. Factor analysis is used to reduce a large number of related  
45  
46 93 variables into a manageable number of factors but to understand the interrelationships among  
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48 94 the factors, other more advanced multivariate analyses techniques need to be used as factor  
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50 95 analyses is not able to do so (Pallant, 2007). Furthermore, among the CSFs used in Yang *et*  
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52 96 *al.*'s framework, CSFs such as the use of appropriate procurement routes and adoption of  
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54 97 flexible project organisation were not considered. Therefore, there is need to empirically  
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7 98 investigate the interrelationships among the CSFs for stakeholder management in  
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9 99 construction. Moreover, how the CSFs for stakeholder management in construction projects  
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11 100 are related to project success is yet to be understood. Understanding these will enable project  
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13 101 management team to effectively carry out stakeholder management and achieve project  
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15 102 success. But what is project success?

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17 103 The primary aim of carrying out stakeholder management in construction projects is  
18  
19 104 to deliver projects successfully. However, the perception of project success may not be that  
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21 105 straight forward. The word success can mean different things to different individuals and to  
22  
23 106 the same people in different circumstances or at different times (Bryde and Brown 2005;  
24  
25 107 Toor and Ogunlana 2008). The traditional perception of project success being judged based  
26  
27 108 on cost quality and time has changed over time to include stakeholder satisfaction, reduced  
28  
29 109 conflicts and disputes and environmental friendliness (Lim and Mohamed, 1999; Cookie-  
30  
31 110 Davies, 2002; Takim and Akintoye, 2002; Bryde and Brown 2005; Jugdev and Muller, 2005;  
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33 111 Toor and Ogunlana 2010). It now requires that KPIs are set and achieved through the project  
34  
35 112 in order for success to be attained (Chan and Chan 2004; Glenigan, 2011). Project success  
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37 113 (PS) factors therefore, encompass achieving the key success indicators of the project which  
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39 114 include: Timely completion of projects (PS1); on budget completion of projects (PS2);  
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41 115 completion to specified quality (PS3); and completion to stakeholders' satisfaction (PS4)  
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43 116 (Long *et al.*, 2004; Chan *et al.*, 2004; Jugdev and Muller, 2005).

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45 117 The ~~level and effectiveness~~undertaking of stakeholder involvement at the inception of  
46  
47 118 the project and how it is sustained through the project life cycle has a big role in achieving  
48  
49 119 the KPI's of projects. An effective stakeholder management process depends on the  
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51 120 understanding of the CSFs for stakeholder management in construction projects (Yang *et al.*,  
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53 121 2009) as this will enable the project management team to ~~effectively~~successfully carry out  
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55 122 stakeholder management and achieve project success. Therefore, the research questions to be  
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7 123 answered in this study are: 1) How are the CSFs for stakeholder management in construction  
8 124 projects interrelated? and 2) How are the CSFs for stakeholder management in construction  
9 125 projects related to project success.  
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13 126 The research presented in this paper focussed on investigating the interrelationships  
14 127 among the CSFs and aims to conceptualise and empirically test the measurement and  
15 128 structural models of CSFs for stakeholder management in construction and how they are  
16 129 related to project success. While, the measurement model is a representation of the  
17 130 relationships between the CSFs and their constructs as well as the correlations/co-variations  
18 131 among the constructs; the structural model is a representation of the causal interrelations  
19 132 among the constructs of CSFs for stakeholder management in construction projects and how  
20 133 they are related to project success. This paper presents reviews of CSFs for stakeholder  
21 134 management in construction, the conceptual models (including measurement and structural  
22 135 models) of CSFs for stakeholder management in construction, and presents the methodology  
23 136 of the research, results and discussion before drawing conclusions.  
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## 36 137 **CRITICAL SUCCESS FACTORS (CSFS) FOR STAKEHOLDER MANAGEMENT** 37 38 138 **IN CONSTRUCTION**

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40 139 For effective stakeholder management in construction projects, it is necessary to  
41 140 identify and understand the interrelationships among the CSFs for stakeholder management.  
42 141 Therefore, CSFs should be given constant and careful attention in stakeholder management in  
43 142 construction being enablers of the process Critical success factors according to Rockart,  
44 143 (1979) are “*areas, in which results, if they are satisfactory, will ensure successful competitive*  
45 144 *performance for the organisation; they are the few key areas where things must go right for*  
46 145 *the business to flourish*”. In other words, CSFs are actions, decisions, conditions or  
47 146 circumstances in which the right things have to be done in order for the desired goals to be  
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7 147 achieved in a project. A very important step for the study reported in this paper is the  
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9 148 identification of CSFs for stakeholder management in construction as they constitute the  
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11 149 measured attributes (indicators for the measurement model). . Past studies (Jepsen and  
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13 150 Eskerod, 2009; Olander and Landin, 2008; Chiyio and Akintoye, 2008; Jerges *et al.*, 2000)  
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15 151 have focused on identification of the factors which are critical to the success of stakeholder  
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17 152 management in construction projects. For example Olander and Landin, (2008) identified  
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19 153 four factors affecting stakeholder management process: Analysis of stakeholders' concern  
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21 154 and needs; communication of both potential benefits and negative impacts to stakeholders;  
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23 155 evaluation of alternative solutions; project organisation and relationship with the media.  
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25 156 Similarly, (Jerges *et al.*, 2000) suggested effective communication with stakeholders and  
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27 157 setting common goals and priorities among them for the project will improve stakeholder  
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29 158 management. Providing top level management support; responding to power interest  
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31 159 dynamism; maintaining existing relationship; being proactive with decisions; negotiations  
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33 160 and tradeoffs among others were considered necessary for successful stakeholder  
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35 161 management/engagement in construction projects (Chinyio and Akintoye, 2008).  
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37 162 Furthermore, Jepsen and Eskerod, (2009) found; stakeholder identification and classification  
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39 163 as well as predicting the expectations of stakeholders through stakeholder analysis to be  
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41 164 critical to stakeholder management process. The extensive literature review resulted in 23  
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43 165 critical success factors for stakeholder management in construction projects, which are  
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45 166 presented in Table 1 including the specific actions and decisions. These are all encompassing  
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47 167 factors which can vary from project to project and as the project progresses as a result of  
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49 168 which some CSFs may be omitted during some projects. Deciding which CSFs to omit, will  
50  
51 169 depend on project's organisation and mission among other things. These CSFs for  
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53 170 stakeholder management in construction were used to develop the conceptual model used in  
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55 171 this study based on the groupings by Molwus, *et al.* (2013) with slight modifications.  
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<Table 1>

**CONCEPTUAL MEASUREMENT AND STRUCTURAL MODELS OF CRITICAL  
SUCCESS FACTORS FOR STAKEHOLDER MANAGEMENT IN CONSTRUCTION**

Identifying the critical success factors for stakeholder management in construction and grouping them are good initial steps towards successful stakeholder management in construction projects (Yang *et al.*, 2009). However, in order to further equip industry practitioners and ensure successful stakeholder management, the relationships between these success factors and their groupings should be clearly understood. This section presents a conceptual (theoretical) model of the interrelationships among the CSFs for stakeholder management in construction and their latent variables (constructs) drawn from the extant literature. The following underlying principles were used for development of the conceptual model:

1. Obtaining detailed information about the projects and its stakeholders is considered the first major step of stakeholder management which in turn informs stakeholder analysis (Chinyio and Akintoye, 2008; Yang *et al.*, 2009).
2. It is assumed being able to obtain such information entails knowing the characteristics of the project and its stakeholders.
3. The outcome of an informed stakeholder analysis/estimation would lead to the understanding of possible stakeholder dynamism and prediction of their likely behaviours on the basis of which appropriate stakeholder management/engagement strategies can be decided (Jepsen and Eskerod, 2009).

The measurement model consists of four constructs which were obtained by grouping the CSFs for stakeholder management grouped based on their related actions and the

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196 stakeholder issues they aim to address (Molwus, *et al.*, 2013): Stakeholder characteristics and  
197 project characteristics (SCPC); Stakeholder analysis (SA); Stakeholder dynamics (SD);  
198 Stakeholder engagement/ empowerment (SE). The four constructs are individually and  
199 collectively considered as enablers of stakeholder management and are measured by the CSFs  
200 for stakeholder management in construction projects as shown in Table 2. The measurement  
201 model proposes a positive correlation between the four constructs and direct positive  
202 measurement of each construct by their indicators (Figure 1). The constructs and the  
203 hypothesized relationships in the structural model are explained in the following subsections.

204 **Stakeholder Characteristics and Project Characteristics (SCPC)**

205 Clear understanding of projects' and stakeholders' characteristics would avail the  
206 project management team sufficient information concerning the project and its stakeholders.  
207 Project characteristics include size, location, type of client, funding source, procurement  
208 issues, and objectives of the projects. Project characteristics as well as its potential impact  
209 should be clearly identified and documented at the early stages of the project in order to  
210 inform adequate stakeholder identification and analysis (Olander and Landin, 2005; Aaltonen  
211 *et al.*, 2008; Jepsen and Eskerod, 2009). Stakeholder characteristics refer to stakeholders'  
212 stakes and interests, bases of involvement (direct or indirect), sources of power and other  
213 attributes (Mitchell, *et al.*, 1997; Winch, 2010). Without such information, it would be very  
214 difficult to proceed with stakeholder management (Mitchell *et al.*, 1997; Bourne and Walker,  
215 2005). Therefore, the conceptual measurement model hypothesised that stakeholder  
216 characteristics and project characteristics is dependent upon the project management team's  
217 ability to clearly formulate the project mission; adopt a favourable procurement route for the  
218 project; carefully identify and list the project stakeholders; ensure the use of flexible project  
219 organisation; and identifying and understanding stakeholder areas of interest.

220 Under this construct, the following hypotheses are stated:

221 *Hypothesis 1:* Obtaining adequate information on stakeholder characteristics and  
222 project characteristics (SCPC) influences the impact of stakeholder management on  
223 construction project success (PS).

224 *Hypothesis 2:* Obtaining adequate information on stakeholder characteristics and  
225 project characteristics (SCPC) enables stakeholder analysis (SA).

226 *Hypothesis 3:* Obtaining adequate information on stakeholder characteristics and  
227 project characteristics (SCPC) enables the understanding of stakeholder dynamism (SD).

## 228 **Stakeholder Analysis (SA)**

229 Stakeholder analysis consists of systematically determining stakeholders' areas and  
230 levels of interests; expected contributions; expected levels of power and influence; and level  
231 of importance; with respect to the project (Karlsen, 2002; Jepsen and Eskerod, 2009). It is  
232 important for project managers or responsible professionals to analyse the powers, needs and  
233 concerns of all project stakeholders, both internal and external to the project. If the needs and  
234 concerns of project stakeholders are not carefully analysed and addressed, conflicts and  
235 confrontations can arise among the stakeholders or between the stakeholders and the project  
236 and consequently hamper the successful delivery of the project (Aaltonen *et al.*, 2008;  
237 Olander and Landin, 2008; Li *et al.*, 2012). The results of stakeholder analysis will inform  
238 and shape decisions on stakeholder management for the project hence will enhance the  
239 likelihood of achieving success (Jepsen and Eskerod, 2009; Yang, 2014). Therefore, this  
240 construct (latent variable) is hypothesised to be indicated by the project management's ability  
241 to determine and assess stakeholders' attributes; appropriately classifying stakeholders  
242 according to their attributes; predicting and mapping stakeholders' behaviours; predicting  
243 stakeholders' potential influence on each other and on the project; and identifying and  
244 analysing possible conflicts and coalition among stakeholders.

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245           Under this construct, the following hypotheses are stated:

246           *Hypothesis 4:* Stakeholder analysis (SA) influences the overall impact of stakeholder

247 | management on construction project success (PS).

248           Hypothesis 5: Stakeholder analysis (SA) enables effective stakeholder

249 engagement/empowerment (SE).

250   **Stakeholder Dynamics (SD)**

251           The stakes and interests of construction stakeholders can be as diverse as the

252 stakeholders themselves and these are dynamic over the life cycle of projects (Chinyio and

253 Akintoye, 2008). For example the primary interest of local residents is how the project affects

254 their amenity and immediate environment; local land owners are interested in making sure

255 that their interest will not be hurt by the project; the environmentalists are interested in

256 protecting the environment from pollution and or destruction; the competitors try to gain

257 competitive advantage by their actions; the media influence the perception of people about

258 the reputation of the project; and others include those whose connection to the project is not

259 immediately clear but whose support may be helpful to the success of the project (Leung and

260 Olomolaiye, 2010). These interests can change as the project progresses because

261 stakeholders’ ability to influence and control project decisions and actions depend on their

262 | level of power and other associated attributes in the project. ~~These~~ Furthermore, stakeholder

263 interests can change from stage to stage and even from time to time within the same stage

264 during the projects’ life cycle (Nash *et al.*, 2010). Unless appropriate strategies are adopted

265 for engaging and managing stakeholders based on their prevailing stance throughout the

266 project’s life cycle, they can spring up with surprises and hinder the progress of the project

267 (Olander and Landin, 2005). In order to adopt the appropriate strategy for engaging

268 stakeholders, it is necessary to understand the changing (dynamic) nature of stakeholders’

attributes during the project. It should be noted that understanding stakeholders' dynamism depends largely on careful stakeholder analysis (Aaltonen *et al.*, 2008). Therefore, this construct is indicated by project management's ability to effectively resolve conflicts among stakeholders; manage change of stakeholders' interest and influence; manage change of stakeholders' attributes; manage change of relationships among stakeholders; predict stakeholders' likely reaction for implementing project decisions and manage how project decisions affect stakeholders.

Under this construct, the following hypotheses are stated:

*Hypothesis 6:* Understanding stakeholder dynamism (SD) influences the overall impact of stakeholder management on construction project success (PS).

*Hypothesis 7:* Stakeholder analysis (SA) enables the understanding of stakeholder dynamism (SD).

*Hypothesis 8:* Understanding stakeholder dynamism (SD) enables effective stakeholder engagement/empowerment (SE).

### **Stakeholder Engagement/Empowerment (SE)**

Given their dynamic nature and lengthy process of construction, stakeholders adopt different strategies at different stages of project to exert their interests on the project (Aaltonen *et al.*, 2008), hence different appropriate strategies should be used for engaging/managing stakeholders at different stages of the project depending on the prevailing circumstances. Using the most appropriate strategies for engaging project stakeholders will enable project success to be achieved (Chinyio and Akintoye, 2008). For instance, while some stakeholders can be communicated to using letters/flyers about project decision others must be contacted directly through meetings/workshops or project website to get their inputs

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7 292 about the project depending on their classification in the project. Therefore, this construct is  
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9 293 indicated by the project management’s ability to involve relevant stakeholders in refining  
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11 294 project mission whenever necessary; formulate appropriate strategies to manage/engage  
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13 295 different stakeholders; keep and promote positive relationships among the stakeholders;  
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15 296 communicating with stakeholders properly and frequently with feedback mechanisms; and  
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17 297 considering all social responsibility issues surrounding the project.  
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19 298 Under this construct, the following hypotheses are stated:  
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22 299 *Hypothesis 9:* Effective stakeholder engagement/empowerment (SE) influences the  
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24 300 impact of stakeholder management on construction project success (PS).  
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26 301 *Hypothesis 10:* Obtaining adequate information on stakeholder characteristics and  
27  
28 302 project characteristics (SCPC) enables effective stakeholder engagement/empowerment (SE).  
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30  
31 303 <Table 2>  
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33 304 <Figure 1>  
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36 305 Based on the hypotheses stated under the four constructs of CSFs for stakeholder  
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38 306 management in construction projects, adequately obtaining information on stakeholder  
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40 307 characteristics and project characteristics (SCPC); carrying out informed stakeholder analysis  
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42 308 (SA); understanding stakeholder dynamics (SD); and effective stakeholder  
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44 309 engagement/empowerment (SE),, a structural model is developed (portrayed in Figure 2) to  
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46 310 further investigate the interrelationships among the critical success factors for stakeholder  
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48 311 management in construction and how they relate to project success:  
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50 312 <Figure 2>  
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## RESEARCH METHODS ADOPTED TO TEST THE CONCEPTUAL MEASUREMENT AND STRUCTURAL MODELS

### Data collection and screening

A quantitative approach was adopted to empirically test the conceptual model of the interrelations among CSFs for stakeholder management in construction. A questionnaire was designed to investigate 23 CSFs grouped under four latent variables (constructs) to elicit responses from construction professionals within United Kingdom. Professionals in architecture, construction management, quantity surveying, engineering, facility management, including clients' representatives and designers etc with at least five years of relevant professional experience working on large construction projects with multiple stakeholder issues were targeted to participate in the survey. The survey respondents were asked to rate their agreement with the CSFs as indicators of stakeholder management decisions/actions and their influence on stakeholder management and project success based on a five point Likert scale in which 1 = strongly disagree and 5 = strongly agree. The questionnaire also gathered background information of the respondents in order to ensure that they have the required background and years of professional experience to take part in this survey before their responses are used for analyses. A minimum of 5 years relevant professional experience was set for the respondents to ensure they have participated in some projects up to completion so that they can have practical knowledge of stakeholder management issues.

Stratified random sampling was used to select respondents from construction professionals practicing in the UK the entire population of which could not be ascertained. The respondents were selected through the website/company profiles of construction organisations delivering construction services. According to Saunders, et al. (2009) if the size of population is not known the following formula can be used to determine the sample size



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7 338 | for survey research: Sample size = [(minimum sample size required × 100) ÷ Average  
8 339 | percentage response rate expected]. For the purpose of ~~sampling analysis~~, a minimum of 50  
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10 340 | responses was required to achieve the objectives of the current study (Iacobucci, 2010).  
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12 341 | Using an estimated response rate of 25% based on the average response rate obtainable in  
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14 342 | similar research in construction management, the sample ~~population size~~ for the current study  
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16 343 | was determined as follows: [(50 × 100) ÷ 25] = 200 (Saunders, et al. 2009). The survey link  
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18 344 | was therefore sent to 200 professionals practicing within the United Kingdom. After two  
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22 346 | 37% of the total number of respondents to whom the link to the survey was emailed. Out of  
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24 347 | the 74 responses received, 13 were rejected for having less than 5 years of professional  
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28 349 | respondents contacted) were found suitable and accepted for analysis;

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30 350 | **Data Analysis**

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32 351 |       Several statistical tools have been considered when selecting the appropriate analysis  
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34 352 | tool for the current study. To examine the groupings of the critical success factors for  
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36 353 | stakeholder management in construction, confirmatory factor analysis (also known as the  
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38 354 | measurement component of SEM) can be used. Whereas, to investigate the interrelationships  
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42 356 | in a step by step fashion. However, the hypothesised models in the current study require the  
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46 358 | measurement can be adequately taken into account. To achieve this objective, structural  
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48 359 | equation modelling (SEM) was considered the most appropriate. SEM was chosen over other  
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50 360 | multivariate statistical analysis methods due to its ability for the simultaneous examination of  
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52 361 | relationships among a number of dependent (latent) and independent (observed) variables  
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54 362 | (Hair *et al.*, 1998). Another reason for choosing SEM was its ability to take into account the

measurement errors inherent in subjective operational measurement and to define and explain the entire set of relationships in the hypothesised model (Byrne, 2010).

The development of SEM usually goes through some basic stages (Hair *et al.*, 1998) which include:

1. Identify and define (operationally) the model components (which include latent variables, measured variables and any other variables) based on theory.
2. Set up a hypothetical model (model specification) which sometimes may involve setting up more than one model (competing models) depending on the theoretical bases and aim of the research;
3. Assess the validity of the model using data collected based on the operationalised components (variables) of the model by evaluating model estimates and goodness of fit indices; and
4. Identify potential model changes and modify the model with theoretical justification.

The first two stages were achieved using literature review to identify the model components and set up hypothetical models (including measurement and structural models) and the last two stages were achieved during the data analysis stages of the study presented in this paper. In this study, no alternative models were developed as the aim was to investigate the interrelationships among CSF for stakeholder management in construction and how they are related to project success rather than comparing candidate theories and choose from. Competing models are used only when there are well established alternative/competing theories to be tested in the study (Kline, 2005). The conceptual structural model in this study includes all possible hypotheses on the relationships between the constructs and tests the validity of each hypothesis on a single model.

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SEM analysis comprise of two components; the measurement component and the structural components. While the measurement component enables analysis of relationships between the latent variables (constructs) and their indicators (observed variables); the structural component is used to analyse interrelationships among the latent variables. The measurement model also takes into account the measurement errors associated with the indicators which are measured operationally.

There is no consensus on the acceptable thresholds for sample sizes among researchers that used SEM. One group of researchers recommend large sample sizes (from 100 to 400) whereas construction management researchers (for example; Doloi *et al.*, 2012; Doloi, 2009; Erikson and Pesamaa, 2007; Ozorhon *et al.*, 2007; Islam and Faniran, 2005, Mohammed, 2000) have used smaller sample sizes, giving different reasons for doing so. The 61 responses in the current study having been collected from well experienced respondents with relevant professional backgrounds working on large projects with demanding stakeholder issues to whom the research objectives were clearly explained are considered reliable. Furthermore, the spread across construction professionals among the respondents, adds to the reliability of the data for investigating critical success factors for stakeholder management in construction. Table 3 presents the respondents' profiles in terms of their years of professional experience and professional field of practice with all of them, having relevant experience of at least 5 years and over 78% of them having 10 years and above experience. Moreover, all the targeted respondents are known to have worked on projects with multi parties and had to collaborate or engage with all or most of the parties. It was ensured during sampling that the respondents with the professional fields of architecture, construction management and engineering; include clients' representatives and designers. Given the inherent difficulty to collect questionnaire data in construction management research and coupled with the characteristics sought in the targeted respondents which limit the number of

eligible respondents, 61 is a good sample size for this study. If the model to be tested using SEM is not overly complex and source of data is very reliable, sample size of 50 can be enough (Iacobucci, 2009).

<Table 3>

#### **Preliminary Analysis for Consistency Checks**

Preliminary (consistency) analyses including mean ratings of the CSFs, un-rotated principal component factor analysis and standardised Cronbach's alpha coefficient were performed using IBM SPSS 20. The mean ratings of the CSFs were obtained to check for acceptance of the CSFs by the respondents; un-rotated principal component factor analysis was performed to check for commonality within the data set; and standardised Cronbach's alpha coefficient was used to check for reliability of measurement within the data set. Finally, structural equation modelling with IBM AMOS 20 software was used to test the hypothesised measurement model of the interrelations among the CSFs and their latent variables. The results are presented in the subsequent sections.

#### **ACCEPTANCE, COMMONALITY AND RELIABILITY TESTS RESULTS**

It was necessary to carry out consistency tests to make sure that there are no issues of consistency associated with the data set. These tests include the mean ratings and ranking of all CSFs by the survey respondents to ascertain the acceptance of the CSFs by the respondents; un-rotated principal component analysis to check for commonality; and Cronbach's alpha coefficient test to check for reliability of the measured variables scale (Hair *et al.*, 2008). All of these tests were done using IBM SPSS 20 software.

The result of mean rating presented in Table 4 reveals high level of agreement that the CSFs are important for stakeholder management in construction projects. The factor with the

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7 434 highest rating by all respondents is “involving relevant project stakeholders at the inception  
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9 435 stage and whenever necessary to refine project mission” (SE1) with mean rating of 4.43 and  
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11 436 the factor with the lowest rating is “ensuring the use of flexible project organisation”  
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13 437 (SCPC4) with mean rating of 3.85.

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15 438 The result of un-rotated principal component analysis revealed the existence of more  
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17 439 than one factor (up to 6 possible factors) as shown in Appendix A, indicating that  
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19 440 commonality is not an issue within the data. If the results of un-rotated principal component  
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21 441 factor analysis reveal the existence of only one factor, then it suggests that commonality is an  
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23 442 issue meaning the factors in the data set are likely to fall into the same group (Schriesheim,  
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25 443 1979).

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27 444 Standardised Cronbach’s alpha coefficient of 0.907 was obtained for the measured  
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29 445 variables indicating high reliability. Cronbach’s alpha values should be at least 0.70 with  
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31 446 values closer to 1.0, indicating better reliability (Nunnally and Bernstein, 1994; Hair *et al.*,  
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33 447 2008). Having confirmed the acceptance of all the CSFs, absence of commonality and  
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35 448 reliability, the measurement model was then tested.

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38 449 <Table 4>

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41 450 **RESULTS OF MEASUREMENT MODEL OF CSFS FOR STAKEHOLDER**  
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43 451 **MANAGEMENT IN CONSTRUCTION**

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45 452 IBM SPSS AMOS 20 software was used to empirically test the hypothetical model of  
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47 453 critical success factors (CSFs) for stakeholder management in construction. To achieve this,  
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49 454 the measurement model component of structural equation modelling (SEM) was used to  
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51 455 investigate the appropriateness and strength of the relationships between the observed and  
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latent variables as well as to measure if there are any, correlations/co-variances among the four latent variables.

Using confirmatory factor analysis (CFA) also known as “measurement model”, the assessment of fit between the data collected and the theoretically conceptual model (Figure 1) of the relationships between observed and latent variables was done. It is important to note that the latent variables in the hypothetical model include: stakeholder characteristics and project characteristics (SCPC); stakeholder analysis (SA); stakeholder dynamics (SD); and stakeholder engagement/empowerment (SE); and their indicators (measured variables) are the CSFs presented in Table 1.

SEM uses goodness-of-fit (GOF) indices shown in Table 5 from the output obtained in AMOS in order to assess how well the hypothesised model fits the data set. The GOF indices used in this study include the root mean square residual (RMR), comparative fit index (CFI), incremental fit index (IFI), Tucker-Lewis index (TLI), goodness of fit index (GFI), ratio of minimum discrepancy to the degrees of freedom (CMIN/DF) and root mean square error of approximation (Anderson and Gerbing, 1984; Kline, 2004; Iacobucci, 2010). The RMR computes the residual differences between the data set and model prediction and take the square root of the result. It ranges from 0 – 1 with smaller values indicating better fit. The CFI compares the fit of a baseline model to the data with the fit of the hypothesised model to then same data. It also ranges from 0 – 1 but with larger values indicating better fit. IFI is the ratio of the difference between the discrepancy and degrees of freedom of the hypothesised model and that of the baseline model. It also ranges from 0 – 1 with larger values showing better fit. The TLI compares the discrepancy and degrees of freedom for the hypothesised model with those of the baseline model. It also ranges from 0 – 1 with larger values indicating better fit. The GFI is a test if the maximum likelihood estimate of the hypothesised model fit to the data set. It also ranges from 0 – 1 and higher values indicate better fit. The

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7 481 CMIN/DF adjusts the chi-square by computing the ration of the minimum discrepancy to  
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9 482 degrees of freedom. It ranges from 1- 2 with vales closer to 1 indicating closer fit.  
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11 483       After analysing the hypothesised measurement model, the path coefficients and the  
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13 484 GOF indices revealed the need to refine/modify the measurement model. Three main  
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15 485 considerations are used to modify models in SEM (Kline, 2005). These include: looking for  
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17 486 and eliminating paths with very low factor loadings; removing variables indicated by the  
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19 487 modification indices as having multi-co-linearity; and removing observed variables with very  
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21 488 high values in the standardised residual correlation matrix. Additionally, model  
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23 489 refinement/modification should lead to the selection of a fitting model which satisfies not  
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25 490 only the GOF measures but also falls within and satisfies the theoretical expectation  
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27 491 (Molenaar, *et al.*, 2000; Byrne, 2010). After going through the refinement/modification steps,  
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29 492 seven observed variables were dropped from the hypothesised measurement model for  
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31 493 showing signs of multi-co-linearity and having many high standardised residual correlations  
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33 494 above 0.4: three from SCPC (SCPC1, SCPC4, and SCPC5); three from SD (SD1, SD6, and  
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35 495 SD7) and one from SE (SE4). Furthermore, three observed variables (SA1, SA2, and SE1)  
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37 496 have been relocated to another construct and all the correlations among the latent variables  
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39 497 were retained (see Table 6). Since the CSFs excluded from the measurement model have  
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41 498 been strongly accepted by the respondents based on their mean ratings presented in Table 4;  
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43 499 they have been compared with and realigned into other factors that have been retained in the  
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45 500 final measurement model. The reason is to avoid losing too much of the CSFs and care was  
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47 501 taken to ensure that the final CSFs constituting the measured variables in the best fitting  
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49 502 model are still consistent with the extant theoretical postulations. This lead to the merging  
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51 503 (realignment) of CSFs presented in Table 7 based on which the final measurement and  
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53 504 structural models were analysed. The resultant best fitting measurement model is portrayed in  
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55 505 Figure 3 as further refinement/modification failed to improve the model fit. The GOF indices  
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for both the conceptual measurement model and the fitting measurement model are presented in Table 5.

<Table 5>

<Figure 3>

The strength with which the observed variables measure the latent variables in the best fit measurement model, is indicated by their standardised path coefficients (also known as factor loading). Table 6 shows the path coefficients of the influence of the observed variables on the latent variables. Since the standardised path coefficients range from 0.54 to 0.89, it is indicated that the retained observed variables significantly measure the latent variables. Moreover, all the path coefficients are positive and statistically significant at level  $P < 0.05$ , therefore, they are supported. Values of factor loading equal to or greater than 0.40 with significant  $P$  value  $< 0.05$  indicate strong measurement with values closer to 1 indicating stronger measurement (Li *et al.*, 2005; Akson and Hadikusumo, 2008). This suggests that the latent variables are valid groupings of the CSFs for stakeholder management in construction projects.

<Table 6>

<Table 7>

Similarly, the strengths of the correlations and covariant relationships among the latent variables are shown in Table 8 indicating that the latent variables strongly affect one another positively with the smallest value of correlation being 0.579 (between SD and SE) which is still above the minimum threshold of 0.5. Furthermore, all the correlations are statistically significant at level  $P < 0.05$  and the covariance estimates are all below the maximum threshold of 0.3. The standard errors (S.E.) do not present with any outliers (i.e.



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529 any extremely large or small values) same as the critical ratios (C.R.). Therefore, all the  
530 hypothesised correlations among the latent variables are supported and the specific  
531 interrelationships among them can be investigated in a structural component of SEM.  
532 <Table 8>

533 **RESULTS OF STRUCTURAL MODEL AND HYPOTHESES TESTING**

534 Figure 4 presents the final structural equation model of CSFs for stakeholder  
535 management in construction projects with standardised path coefficients on the structural  
536 paths of the supported hypothesised relationships shown in Figure 2. The standardised path  
537 coefficients of the hypothesised relationships were tested using critical ratios, standard errors  
538 and their level of statistical significance to ascertain whether the hypotheses are supported by  
539 the data set or not (see Table 9).  
540 <Figure 4>

541 As presented in Table 9, the standard errors (S.E.) do not present with any extremely  
542 high or low values except for that of H4. The critical ratios (C.R.) for H1, H3, H4 and H6 are  
543 extremely low and a further look at the results presented in Table 9 reveal that only four hy-  
544 pothesised relationships are supported at the statistical significance level of  $P < 0.05$ . The rela-  
545 tionship path between stakeholder characteristics and project characteristics (SCPC) and  
546 stakeholder dynamism (SD) with insignificant P value of 0.322 and low path coefficient of  
547 0.255 does not support Hypothesis 3. Similarly the paths between stakeholder analysis (SA)  
548 and project success (PS) with insignificant P value of 0.721 and a negative low path coeffi-  
549 cient of -0.125; stakeholder dynamism (SD) and project success (PS) with insignificant P  
550 value of 0.902 and a low path coefficient of 0.041; stakeholder characteristics and project  
551 characteristics (SCPC) and project success (PS) with insignificant P value 0.968 and low

path coefficient of 0.012 failed to support Hypotheses 4, 6, 1 respectively. Conversely, the relationship path between stakeholder characteristics and project characteristics (SCPC) and stakeholder analysis (SA) with P value of 0.002 and path coefficient of 0.772 strongly supports Hypothesis 2. Other hypotheses supported by the results presented in Table 9 include Hypotheses 7, 8 and 9. They are supported by the paths between stakeholder analysis (SA) and stakeholder dynamism (SD) with significant P value of 0.025 and acceptable path coefficient of 0.608; stakeholder dynamism (SD) and stakeholder engagement/empowerment (SE) with very significant P value and acceptable path coefficient of 0.634; and stakeholder engagement/empowerment (SE) and project (PS) with significant P value of 0.008 and acceptable path coefficient of 0.695; respectively. Table 10 presents the GOF measures for the conceptual and best fitting structural models of critical success factors for stakeholder management in construction. Figure 4 indicates improvement in the strengths of the supported hypothesis after deleting the hypotheses not supported as shown in Table 9.

<Table 9>

<Table 10>

## DISCUSSION OF FINDINGS

This study investigated the interrelationships among the CSFs for stakeholder management in construction projects based on four latent variables drawn from previous research. The results indicate the existence of statistically significant relationships between the measured (CSFs) and latent variables and among the latent variables (SCPC, SA, SD and SE).

The findings based on the measurement model indicate that SCPC4 “Ensuring the use of flexible project organisation” has the least mean rating 3.85 which is still way above the

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7 575 acceptable rating for a five-point Likert scale being 3.5. This connotes that the survey  
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9 576 respondents considered all the 23 CSFs as vital for the success of stakeholder management in  
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11 577 construction which is partly in line with the findings of Yang *et al.*, (2009) except for the  
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13 578 additional CSFs. Furthermore, Yang *et al.* (2009) found that SE5 (Considering corporate  
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15 579 social responsibilities (paying attention to Economic, legal, environmental, and ethical  
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17 580 issues)) was the most important CSF and could not be grouped under any of the constructs  
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19 581 and identified it as the precondition factor of stakeholder management in construction  
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21 582 projects. However, the findings in the current study grouped SE5 under stakeholder  
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23 583 engagement (SE) with a factor loading of 0.68. Additionally, the most important CSF in the  
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25 584 current study is SE1 (Involving relevant project stakeholders at the inception stage and  
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27 585 whenever necessary to refine project mission) which was initially hypothesised to be under  
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29 586 the construct stakeholder engagement/empowerment (SE) but the result of the measurement  
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31 587 model analysis moved it to the construct stakeholder characteristics and project  
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33 588 characteristics (SCPC). As reported in the preceding section, the results of the “measurement  
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35 589 model” excluded 7 CSFs from the best fitting measurement model including SCPC1, SCPC4,  
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37 590 SCPC5, SD1, SD6, SD7 and SE4 which were deleted during model modification (please see  
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39 591 Table 4 for their full meanings).

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41 592 The strong correlation estimates presented in Table 8 pointed to the existence of some  
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43 593 interrelationships direct or indirect among the constructs of CSFs for stakeholder  
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45 594 management in construction (SCPC, SA, SD and SE). When the hypothesized relationships  
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47 595 were tested, the final structural model suggested that only one of the constructs, stakeholder  
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49 596 engagement/empowerment has a direct positive impact on project success. The results [\(See](#)  
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51 597 [Figure 4 and Table 9\)](#) indicated that the other three constructs (SCPC, SA and SD) can not  
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53 598 directly influence project success (PS) but they influence project success indirectly by their  
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55 599 collective interactions through stakeholder engagement/empowerment (SE) as follows:

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- Stakeholder characteristics and project characteristics (SCPC) influence stakeholder analysis (SA) with a very high path coefficient of 0.81 and a significant P value of 0.026.
- Stakeholder analysis (SA) in turn influences the understanding of stakeholder dynamism (SD) with an equally high path coefficient of 0.83 and a significant P value of 0.002.
- The understanding of stakeholder dynamism (SD) will enable stakeholder engagement/empowerment (SE) with an acceptable path coefficient of 0.62 and a very significant p value.
- Stakeholder engagement/empowerment (SE) influences project success (PS) with an acceptable path coefficient of 0.65 and a very significant P value.

The finding that stakeholder analysis (SA) can not directly impact/influence project success (PS) is a shift from the view within the construction based stakeholder management literature that stakeholder analysis can lead to project success (Jepsen and Eskerod, 2009; Olander and Landin, 2005). However, stakeholder engagement/empowerment (SE) being the only construct found to directly influence project success (PS) depends on the understanding of stakeholder dynamism (SD) which also depends very strongly on the results of stakeholder analysis (SA). The finding that understanding stakeholder dynamism (SD) depends on the results of stakeholder analysis (SA) is in agreement with the position of Aaltonen *et al.* (2008). Moreover, the lack of support for the H3 (Obtaining adequate information on stakeholder characteristics and project characteristics – SCPC enables the understanding of stakeholder dynamism – SD) can be considered counter intuitive. Furthermore, the findings suggest that obtaining information on project characteristics and stakeholder characteristics (SCPC) is a major precondition step in the process of stakeholder management. This finding is in line with the opinion canvassed by a faction of the extant literature (Mitchell *et al.*,

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625 1997; Chinyio and Akintoye, 2008) and disagrees with the position of Yang *et al.* (2009) that

626 the precondition factor for stakeholder management in construction projects is “considering

627 corporate social responsibilities” which by the findings of the current study is an indicator of

628 stakeholder engagement/empowerment (SE).

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629 **CONCLUSIONS**

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630 The aim of this study was to enhance the knowledge on stakeholder management in

631 construction and improve the understanding of the critical success factors of stakeholder

632 management and the interrelations among them. In order to achieve this aim, a conceptual

633 measurement model was developed based on the analysis of literature review findings. The fit

634 between the extant theoretical standing and the survey data was examined and after an

635 iterative statistical process the final structural model for critical success factors of stakeholder

636 management was developed and accepted.

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638 Effects of stakeholder analysis, stakeholder characteristics and project characteristics,

639 stakeholder engagement and stakeholder dynamics on the stakeholder management and on

640 project success were investigated. The reliability of each construct and the overall model is

641 highly satisfactory as all goodness of fit indices were very good.

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642 The findings indicated that that all stakeholder management decisions made in the

643 four distinct constructs (obtaining information on project characteristics and stakeholder

644 characteristics; undertaking stakeholder analysis; understanding stakeholder dynamism; and

645 stakeholder engagement/empowerment) affect each other directly or indirectly as follows:

- The ability of the project management team to clearly obtain adequate information on stakeholder characteristics and project characteristics will influence and aid their ability to carry out stakeholder analysis.
- Understanding stakeholder dynamism depends on the results of stakeholder analysis.
- Decisions on how to effectively engage/empower stakeholders during construction projects relies on the good understanding of stakeholder dynamism.
- Effective stakeholder engagement/empowerment will facilitate project success

These relationships indicated that obtaining information about project characteristics and stakeholder characteristics (SCPC) is the precondition factor (construct) to be able to carry out effective stakeholder management in construction. Failure to adequately and holistically address the critical success factors for stakeholder management in construction projects will prevent stakeholder management efforts from achieving the desired results-project success.

The main contribution of this study to existing knowledge is an empirical evidence of the interrelationships among the CSFs for stakeholder management in construction through their latent variables which is portrayed in the best fitting structural model (Figure 4) showing the relationships between the constructs of CSFs for stakeholder management and project success. This should serve as a guide to construction project management team or responsible professionals for successfully undertaking stakeholder management in construction projects.

From the result presented in Table 4, all the 23 CSFs for stakeholder Management in construction projects should be given adequate considerations. None the less, the five most important CSFs are:

1. SE1 – Involving relevant project stakeholders at the inception stage and whenever necessary to refine project mission:

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- 671            2. SCPC5 – Identifying and understanding stakeholders’ areas of interests in the
- 672            project;
- 673            3. SE4 – Communication with stakeholders properly and frequently;
- 674            4. SD6 – Managing how project decisions affect stakeholders; and
- 675            5. SD1 – Resolving conflicts among stakeholders effectively.

676            Based on the findings portrayed in Figure 4 and highlighted in the conclusion, the  
677 first thing to do in order to be successful in stakeholder management, is to indentify  
678 Stakeholder Characteristics and Project Characteristics (SCPC) following which Stakeholder  
679 Analysis (SA) is performed the results of which will inform the project management team of  
680 the project’s Stakeholder Dynamism (SD) based on which appropriate Stakeholder  
681 Engagement/Empowerment techniques (SE) are Decided. Therefore, the practical steps for  
682 successful stakeholder management in construction project are to follow the following  
683 sequence: Indentify Stakeholder Characteristics and Project Characteristics (SCPC) – Carry  
684 out Stakeholder Analysis (SA) – Understand Stakeholder Dynamism (SD) – Decide  
685 Stakeholder Engagement/Empowerment techniques (SE). Likewise this should serve as a  
686 guide for further research on stakeholder management processes.

687            The main limitation of this study is that only the opinion of the key internal  
688 stakeholders was considered. Further research should therefore take into account the opinions  
689 of a wider range of stakeholders including external stakeholders. Furthermore, a larger  
690 sample size should be targeted in similar future studies. Moreover, ~~T~~the research reported in  
691 this paper was carried out in the UK as discussed earlier under the research methods section;  
692 hence the findings may have portrayed the UK construction professionals’ opinion. However,  
693 the theoretical principles on which the research was based are general and similar research  
694 could be replicated in different countries whose construction procurement processes and  
695 industries are structured like those of the UK or otherwise. Furthermore, the sequential steps

of the process of stakeholder management portrayed in Figure 4 can be tested on real life projects.

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825 **Table 1 List of critical success factors (CSFs) for stakeholder management in**

826 **construction**

| S/N | CSF   | Source  |
|-----|---|---|
| 1   | Clearly formulating the project mission   | Jerges <i>et al.</i> , (2000); Akintoye <i>et al.</i> (2003) Thomson <i>et al.</i> , (2003); Chinyio and Akintoye, (2008) |
| 2   | Ensuring the use of a favourable procurement method   | Atkin and Skitmore, (2008); Olander and Landin, (2008); Rwelamila, (2010)   |
| 3   | Carefully identifying and listing the project stakeholders  | Mathur <i>et al.</i> , (2008); Jepsen and Eskerod, (2009)   |
| 4   | Ensuring flexible project organisation  | Olander and Landin, (2008); Chinyio and Akintoye, (2008);   |
| 5   | Identifying and understanding stakeholders’ areas of interests in the project   | Jepsen and Eskerod, (2009); Olander and Landin, (2008); Yang <i>et al.</i> , (2009)                                       |
| 6   | Determining and assessing the power (capacity to influence the actions of other stakeholders); urgency (degree to which stakeholders’ claims requires immediate attention); | Mitchell <i>et al.</i> , (1997); Yang <i>et al.</i> , (2009)  |

| S/N | CSF   | Source   |
|-----|---|--|
|     | legitimacy (perceived validity of claims); and proximity (level of association or closeness with the project) of stakeholders |  |
| 7   | Appropriately classifying stakeholders according to their attributes/characteristics  | Karlsen, (2002); Mitchell <i>et al.</i> , (1997)   |
| 8   | Predicting and mapping stakeholders' behaviours (supportive, opposition, neutral etc)   | Yang <i>et al.</i> , (2009)  |
| 9   | Predicting stakeholders' potential influence on each other  | Pajunen, (2006); Jepsen and Eskerod, (2009)  |
| 10  | Predicting stakeholders' potential influence on the project   | Pajunen, (2006); Chinyio and Akintoye, (2008); Jepsen and Eskerod, (2009)  |
| 11  | Identifying and analyzing possible conflicts and coalitions among stakeholders  | Jepsen and Eskerod, (2009); Yang <i>et al.</i> , (2009)  |
| 12  | Resolving conflicts among stakeholders effectively  | Yang <i>et al.</i> , (2009)  |
| 13  | Managing the change of stakeholders' interests  | Jergeas <i>et al.</i> , (2000); Jepsen and Eskerod, (2009)   |
| 14  | Managing the change of stakeholders' influence  | Jergeas <i>et al.</i> , (2000); Olander (2006)   |
| 15  | Managing the change of relationship among stakeholders  | Pajunen, (2006); Chinyio and Akintoye, (2008)  |
| 16  | Managing change of stakeholders' attributes   | Olander (2006)   |
| 17  | Managing how project decisions affect stakeholders  | Chinyio and Akintoye, (2008)   |
| 18  | Predicting stakeholders' likely reactions for implementing project decisions  | Chinyio and Akintoye, (2008); Yang <i>et al.</i> , (2009)  |
| 19  | Involving relevant stakeholders to redefine (refine) project mission  | Jerges <i>et al.</i> , (2000); Yang <i>et al.</i> , (2009)   |
| 20  | Formulating appropriate strategies to manage/engage different stakeholders  | Chinyio and Akintoye, (2008); Yang <i>et al.</i> , (2009)  |
| 21  | Keeping and promoting positive relationships among the stakeholders   | Olander and Landin, (2008); Yang <i>et al.</i> , (2009)  |
| 22  | Communicating with stakeholders properly and frequently (instituting feedback mechanisms)                                     | Jerges <i>et al.</i> , (2000); Olander and Landin, (2008); Chinyio and Akintoye, (2008); Yang <i>et al.</i> , (2009) |
| 23  | Considering corporate social responsibilities (paying attention to economic, legal, environmental and ethical issues)         | Mathur <i>et al.</i> , (2008); Yang <i>et al.</i> , (2009)   |

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828    **Table 2 Constructs and indicators of conceptual measurement model of CSFs for**  
829    **stakeholder management in construction**

| Constructs   |               | Indicators   |
|--|---------------|--|
| Stakeholder characteristics and project characteristics (SCPC) |               | <ul style="list-style-type: none"><li>• Clearly formulating the project mission;</li><li>• Ensuring the use of a favourable procurement method;</li><li>• Carefully identifying and listing the project stakeholders;</li><li>• Ensuring flexible project organisation;</li><li>• Identifying and understanding stakeholders’ areas of interests in the project.</li></ul>   |
| Stakeholder analysis (SA)                                      |               | <ul style="list-style-type: none"><li>• Determining and assessing the power (capacity to influence the actions of other stakeholders); urgency (degree to which stakeholders’ claims requires immediate attention); legitimacy (perceived validity of claims); and proximity (level of association or closeness with the project) of stakeholders;</li><li>• Appropriately classifying stakeholders according to their attributes/characteristics;</li><li>• Predicting and mapping stakeholders’ behaviours (supportive, opposition, neutral etc);</li><li>• Predicting stakeholders’ potential influence on each other;</li><li>• Predicting stakeholders’ potential influence on the project;</li><li>• Identifying and analyzing possible conflicts and coalitions among stakeholders;</li></ul> |
| Stakeholder  | dynamics (SD) | <ul style="list-style-type: none"><li>• Resolving conflicts among stakeholders effectively;</li><li>• Managing the change of stakeholders’ interests;</li><li>• Managing the change of stakeholders’ influence;</li><li>• Managing the change of relationship among stakeholders;</li><li>• Managing change of stakeholders’ attributes;</li><li>• Managing how project decisions affect stakeholders;</li><li>• Predicting stakeholders’ likely reactions for implementing project decisions.</li></ul>   |
| Stakeholder engagement/empowerment (SE)                        |               | <ul style="list-style-type: none"><li>• Involving relevant stakeholders to redefine (refine) project mission;</li><li>• Formulating appropriate strategies to manage/engage different stakeholders;</li><li>• Keeping and promoting positive relationships among the stakeholders;</li><li>• Communicating with stakeholders properly and frequently (instituting feedback mechanisms);</li><li>• Considering corporate social responsibilities (paying attention to economic, legal, environmental and ethical issues).</li></ul>   |

830

831 **Table 3 Respondents' profiles**

| Professional Field      | Years of Professional Experience |                     |                     |                         | Total | %Total |
|-------------------------|----------------------------------|---------------------|---------------------|-------------------------|-------|--------|
|                         | From 6 to 10 years               | From 11 to 15 years | From 16 to 20 years | From 21 years and above |       |        |
| Architecture            | 5                                | 4                   | 1                   | 2                       | 12    | 19.67  |
| Construction Management | 1                                | 6                   | 3                   | 8                       | 18    | 29.51  |
| Quantity Surveying      | 3                                | 3                   | 3                   | 5                       | 14    | 22.95  |
| Engineering             | 3                                | 3                   | 1                   | 3                       | 10    | 16.39  |
| Facility Management     | 1                                | 3                   | 1                   | 2                       | 7     | 11.48  |
| Total                   | 13                               | 19                  | 9                   | 20                      | 61    | 100    |
| %Total                  | 21.31                            | 31.15               | 14.75               | 32.79                   | 100   |        |

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833 **Table 4 Mean rating and ranking of Critical Success Factors for Stakeholder**834 **Management**

| Code  | Critical Success factors for Stakeholder Management   | Mean <sup>a</sup> | Rank |
|-------|---|-------------------|------|
| SE1   | Involving relevant project stakeholders at the inception stage and whenever necessary to refine project mission       | 4.43              | 1    |
| SCPC5 | Identifying and understanding stakeholders' areas of interests in the project   | 4.33              | 2    |
| SE4   | Communicating with stakeholders properly and frequently   | 4.33              | 2    |
| SD6   | Managing how project decisions affect stakeholders  | 4.30              | 4    |
| SD1   | Resolving conflicts among stakeholders effectively  | 4.28              | 5    |
| SE3   | Keeping and promoting positive relationships among stakeholders   | 4.21              | 6    |
| SCPC3 | Carefully identifying and listing the project stakeholders from the on set  | 4.18              | 7    |
| SCPC1 | Clearly formulating the project mission   | 4.15              | 8    |
| SCPC2 | Ensuring the use of a favourable procurement route  | 4.13              | 9    |
| SA6   | Identifying and analysing possible conflicts and coalitions among stakeholders  | 4.11              | 10   |
| SD7   | Predicting stakeholders' likely reactions for implementing project decisions  | 4.07              | 11   |
| SE2   | Formulating appropriate strategies to manage/engage different stakeholders  | 4.07              | 11   |
| SA5   | Predicting stakeholders' potential influence on the project   | 4.03              | 13   |
| SD3   | Managing the change of stakeholders' influence  | 4.03              | 13   |
| SA1   | Determining and assessing the attributes (Power, Urgency, Legitimacy and proximity) of stakeholders in/to the project | 4.03              | 15   |



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| Code  | Critical Success factors for Stakeholder Management  | Mean <sup>a</sup> | Rank |
|-------|--|-------------------|------|
| SE5   | Considering corporate social responsibilities (paying attention to Economic, legal, environmental, and ethical issues) | 4.03              | 15   |
| SA2   | Appropriately classifying stakeholders according to their attributes   | 4.03              | 15   |
| SD4   | Managing the change of relationship among stakeholders   | 4.02              | 18   |
| SD2   | Managing the change of stakeholders' interests   | 4.00              | 19   |
| SA3   | Predicting and mapping stakeholders' behaviours (Supportive, Opposition, Neutral, etc)                                 | 3.95              | 20   |
| SA4   | Predicting stakeholders' potential influence on each other   | 3.93              | 21   |
| SD5   | Managing change of stakeholders' attributes  | 3.92              | 22   |
| SCPC4 | Ensuring the use of flexible project organisation  | 3.85              | 23   |

Notes: <sup>a</sup>: 1= Strongly Disagree and 5= Strongly Agree.

**Table 5 Result of GOF measures for both Conceptual and best fitting measurement models of the CSFs for stakeholder management in construction**

| Goodness-of-fit (GOF) measures         | Recommended level of GOF measures   | Conceptual measurement model | Best fitting measurement model |
|--|-------------------------------------|------------------------------|--------------------------------|
| CMIN/DF                                | 1 (very good) – 2 (threshold)       | 1.41                         | 1.18                           |
| Root mean sq. Error of approx. (RMSEA) | >0.05 (Very good) – 0.1 (threshold) | 0.08                         | 0.05                           |
| Root mean sq. Residual (RMR)           | 0 – 1 (Smaller values = better fit) | 0.44                         | 0.35                           |
| Goodness-of-fit index (GFI)            | 0 (no fit) – 1 (perfect fit)        | 0.72                         | 0.82                           |
| Comparative-fit index (CFI)            | 0 (no fit) – 1 (perfect fit)        | 0.83                         | 0.95                           |
| Incremental-fit index (IFI)            | 0 (no fit) – 1 (perfect fit)        | 0.84                         | 0.95                           |
| Tucker-Lewis index (TLI)               | 0 (no fit) – 1 (perfect fit)        | 0.80                         | 0.94                           |

**Table 6 Standardised path coefficients of observed variables' loading on latent variables**

| Latent variables and their indicators <sup>a</sup>                                | Standardised path coefficients |
|---|--------------------------------|
| <b>Stakeholder Characteristics and Project Characteristics (SCPC)<sup>b</sup></b> |                                |
| SCPC2   | +0.54                          |
| SCPC3   | +0.59                          |
| SA1   | +0.55                          |
| SA2   | +0.67                          |
| SE1   | +0.65                          |
| <b>Stakeholder Analysis (SA)<sup>b</sup></b>                                      |                                |
| SA3   | +0.68                          |
| SA4   | +0.75                          |
| SA5   | +0.70                          |
| SA6   | +0.64                          |
| <b>Stakeholder Dynamics (SD)<sup>b</sup></b>                                      |                                |

|  |     |       |
|--|-----|-------|
|  | SD2 | +0.78 |
|  | SD3 | +0.89 |
|  | SD4 | +0.75 |
|  | SD6 | +0.76 |
| <b>Stakeholder Engagement/Empowerment (SE)<sup>b</sup></b> |     |       |
|  | SE2 | +0.69 |
|  | SE3 | +0.72 |
|  | SE5 | +0.68 |

**Note:** The path coefficients are all statistically significant at level  $P < 0.05$ ;

<sup>a</sup>: refer to Table 1 for full meanings of the indicators; <sup>b</sup>: Latent variables

**Table 7 Realigned critical success factors for stakeholder management in construction projects**

| Realignment <sup>a</sup> | Critical Success Factors for Stakeholder Management |   |
|--------------------------|---|---|
|                          | Final CSFs Code                                     | Final SCFs  |
| <b>SE1 + SCPC1</b>       | SE1   | Involving relevant project stakeholders at the inception stage and whenever necessary to formulate and refine project mission           |
| SE3                      | SE3   | None  |
| <b>SCPC3 + SCPC5</b>     | SCPC3   | Carefully identifying and listing the project stakeholders and their areas of interests from the on set                                 |
| <b>SCPC2 + SCPC4</b>     | SCPC2   | Ensuring the use of a favourable procurement route and flexible project organisation  |
| <b>SA6 + SD1</b>         | SA6   | Identifying, analysing and resolving possible conflicts and coalitions among stakeholders   |
| <b>SE2 + SE4</b>         | SE2   | Formulating appropriate communication strategies to manage/engage different stakeholders  |
| SA5                      | SA5   | None  |
| SD3                      | SD3   | None  |
| SA1                      | SA1   | None  |
| SE5                      | SE5   | None  |
| SA2                      | SA2   | None  |
| <b>SD4 + SD6</b>         | SD4   | Managing the change of relationship among stakeholders and how project decisions affect them  |
| SD2                      | SD2   | None  |
| <b>SA3 + SD7</b>         | SA3   | Predicting and mapping stakeholders' behaviours (Supportive, Opposition, Neutral, etc) and reactions for implementing project decisions |
| SA4                      | SA4   | None  |
| SD5                      | SD5   | None  |

**Note:** <sup>a</sup>: affected CSFs are presented in bold in the first column

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840 **Table 8 Standardised correlation and covariance coefficients of the best fitting**  
841 **measurement model of CSFs for stakeholder management in construction**

|      | Covariance links |    | Correlation Estimate | Covariance Estimate | S.E.  | C.R.  | Sig(P) |
|------|------------------|----|----------------------|---------------------|-------|-------|--------|
| SCPC | <-->             | SA | +0.773               | 0.147               | 0.049 | 2.980 | 0.003  |
| SCPC | <-->             | SD | +0.696               | 0.187               | 0.061 | 3.069 | 0.002  |
| SCPC | <-->             | SE | +0.768               | 0.135               | 0.046 | 2.963 | 0.003  |
| SA   | <-->             | SD | +0.782               | 0.212               | 0.064 | 3.319 | ***    |
| SA   | <-->             | SE | +0.730               | 0.130               | 0.044 | 2.963 | 0.003  |
| SD   | <-->             | SE | +0.579               | 0.145               | 0.051 | 2.835 | 0.005  |

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842 \*\*\* Sig(P) value is infinitesimally small (close to zero) hence cannot be reported

843 **Table 9 Standardised path coefficients of the conceptual structural model of the**  
844 **interrelations among CSFs for stakeholder management in construction**

|        | Hypothesised relationships |      | Path coefficient | S.E.  | C.R.  | Sig(P) | Interpretation |
|--------|----------------------------|------|------------------|-------|-------|--------|----------------|
| H1:PS  | <---                       | SCPC | +0.012           | 0.389 | 0.040 | 0.968  | Not supported  |
| H2:SA  | <---                       | SCPC | +0.772           | 0.244 | 3.165 | 0.002  | Supported      |
| H3:SD  | <---                       | SCPC | +0.255           | 0.372 | 0.991 | 0.322  | Not supported  |
| H4:PS  | <---                       | SA   | -0.125           | 0.435 | 0.357 | 0.721  | Not supported  |
| H5:SE  | <---                       | SA   | +0.393           | 0.332 | 1.069 | 0.285  | Not supported  |
| H6:PS  | <---                       | SD   | +0.041           | 0.283 | 0.123 | 0.902  | Not supported  |
| H7:SD  | <---                       | SA   | +0.608           | 0.391 | 2.249 | 0.025  | Supported      |
| H8:SE  | <---                       | SD   | +0.634           | 0.117 | 3.507 | ***    | Supported      |
| H9:PS  | <---                       | SE   | +0.695           | 0.346 | 2.667 | 0.008  | Supported      |
| H10:SE | <---                       | SCPC | +0.528           | 0.324 | 1.503 | 0.133  | Not supported  |

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845 \*\*\* Sig(P) value is infinitesimally small (close to zero) hence cannot be reported

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**Table 10 Result of GOF measures for both Conceptual and best fitting structural models**

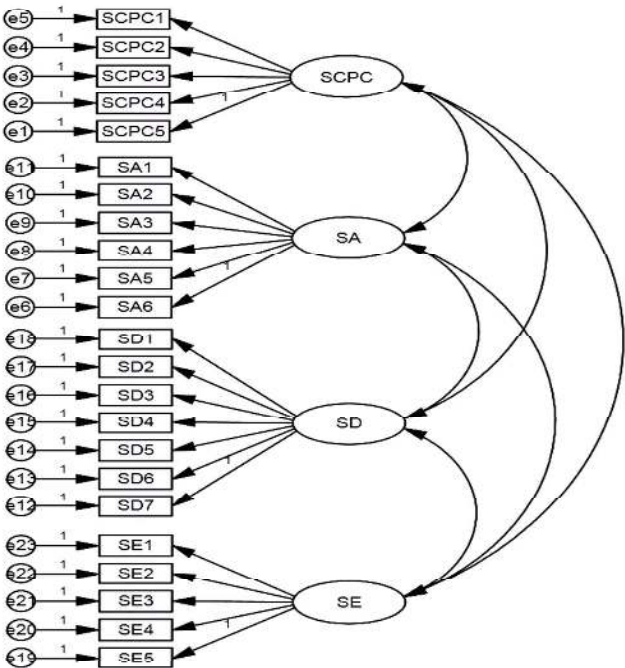
| Goodness-of-fit (GOF) measures         | Recommended level of GOF measures   | Conceptual structural model | Best fitting structural model |
|--|-------------------------------------|-----------------------------|-------------------------------|
| CMIN/DF                                | 1 (very good) – 2 (threshold)       | 1.27                        | 1.24                          |
| Root mean sq. Error of approx. (RMSEA) | >0.05 (Very good) – 0.1 (threshold) | 0.07                        | 0.06                          |
| Root mean sq. Residual (RMR)           | 0 – 1 (Smaller values = better fit) | 0.05                        | 0.04                          |
| Goodness-of-fit index (GFI)            | 0 (no fit) – 1 (perfect fit)        | 0.77                        | 0.82                          |
| Comparative-fit index (CFI)            | 0 (no fit) – 1 (perfect fit)        | 0.90                        | 0.92                          |
| Incremental-fit index (IFI)            | 0 (no fit) – 1 (perfect fit)        | 0.91                        | 0.92                          |
| Tucker-Lewis index (TLI)               | 0 (no fit) – 1 (perfect fit)        | 0.89                        | 0.90                          |

#### List of Figures

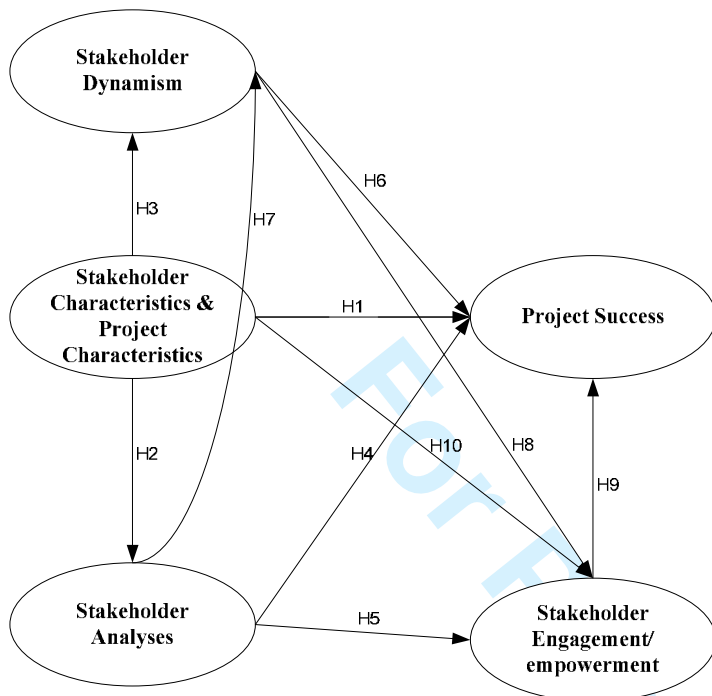
- Figure 1 Conceptual Measurement Model of CSFs for Stakeholder Management in Construction
- Figure 2 Hypothesised structural model of critical success factors for stakeholder management in construction
- Figure 3 the Best Fit Measurement Model of CSFs for SM in Construction

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856 Figure 4 Final structural model of critical success factors for stakeholder management in  
857 construction



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859 Figure 1 Conceptual Measurement Model of CSFs for Stakeholder Management in  
860 Construction



**Figure 2 Hypothesised Structural Model of Critical Success Factors for Stakeholder Management in Construction**

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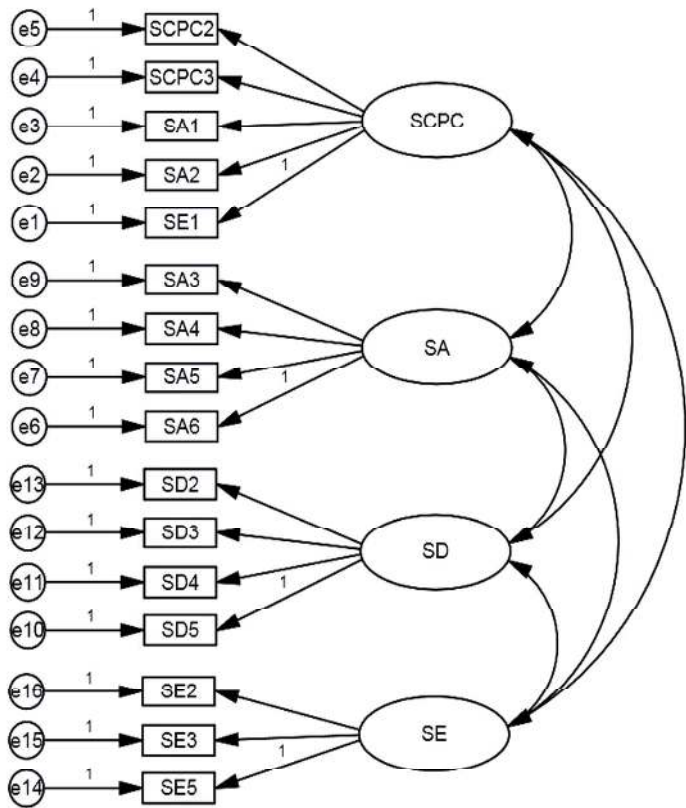
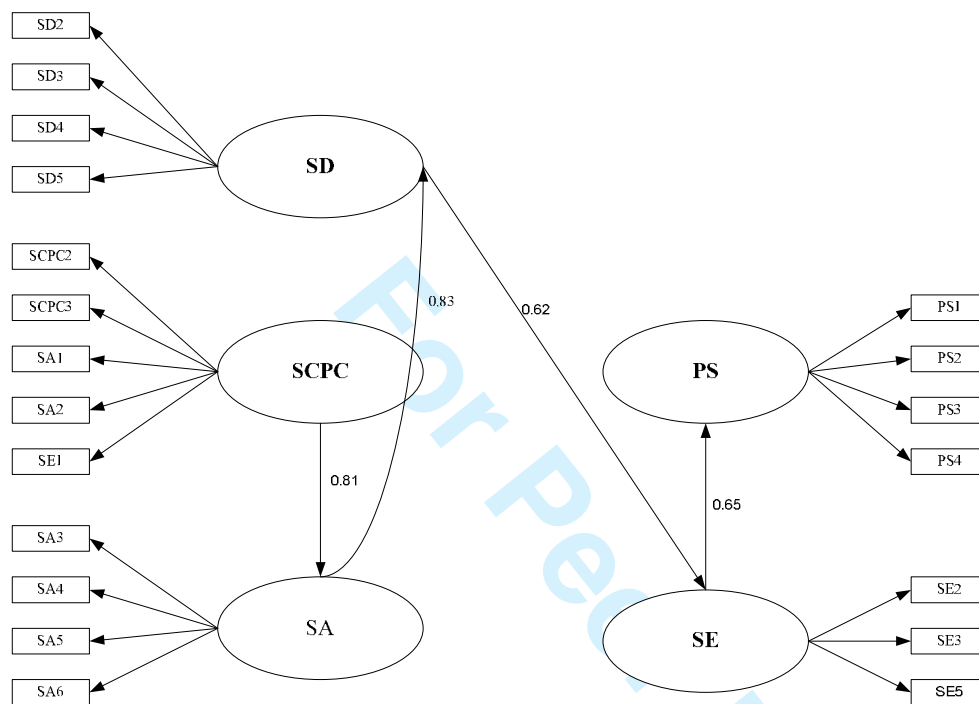


Figure 3 the Best Fit Measurement Model of CSFs for SM in Construction



**Figure 4 Final Structural Model of Critical Success Factors for Stakeholder Management in Construction**

**Appendix A: Un-rotated principal component analysis of critical success factors for stakeholder management in construction projects.**

**Component Matrix<sup>2</sup>**

| Factor | Component |       |       |       |       |       |
|--------|-----------|-------|-------|-------|-------|-------|
|        | 1         | 2     | 3     | 4     | 5     | 6     |
| SCPC1  | .351      | .593  | -.219 | .525  | -.307 | .279  |
| SCPC2  | .385      | -.032 | -.459 | .682  | .457  | .315  |
| SCPC3  | .488      | .145  | .684  | -.082 | .064  | -.211 |
| SCPC4  | .131      | -.454 | .584  | -.347 | .368  | .407  |
| SCPC5  | .536      | .177  | .552  | .258  | -.080 | -.138 |
| SA1    | .427      | -.097 | -.267 | .267  | .417  | -.510 |
| SA2    | .512      | -.227 | .174  | .498  | .233  | -.160 |
| SA3    | .625      | -.357 | .223  | -.060 | .096  | .094  |



|     |      |       |       |       |       |       |
|-----|------|-------|-------|-------|-------|-------|
| SA4 | .677 | -.219 | .158  | .205  | -.011 | .201  |
| SA5 | .645 | -.121 | .356  | .271  | -.217 | -.060 |
| SA6 | .671 | .088  | -.136 | .279  | .017  | .341  |
| SD1 | .479 | .613  | .265  | -.219 | -.086 | .208  |
| SD2 | .742 | -.045 | -.138 | -.027 | -.338 | .092  |
| SD3 | .756 | -.246 | -.316 | -.096 | -.348 | .010  |
| SD4 | .689 | -.460 | -.118 | -.167 | -.053 | -.107 |
| SD5 | .636 | -.549 | -.069 | -.224 | -.166 | -.051 |
| SD6 | .724 | .008  | -.144 | -.322 | .175  | -.221 |
| SD7 | .619 | .136  | -.136 | -.375 | -.028 | -.227 |
| SE1 | .609 | .181  | -.154 | .151  | -.180 | -.174 |
| SE2 | .638 | .288  | .164  | -.580 | .193  | .014  |
| SE3 | .638 | .417  | .006  | -.182 | .295  | .147  |
| SE4 | .510 | .550  | -.172 | -.122 | -.003 | -.065 |
| SE5 | .662 | .217  | -.037 | -.075 | .092  | .131  |

Extraction Method: Principal Component Analysis.

a. 6 components extracted.

Total Variance Explained

| Component | Initial Eigenvalues |               |              | Extraction Sums of Squared Loadings |               |              |
|-----------|---------------------|---------------|--------------|-------------------------------------|---------------|--------------|
|           | Total               | % of Variance | Cumulative % | Total                               | % of Variance | Cumulative % |
| 1         | 7.996               | 34.764        | 34.764       | 7.996                               | 34.764        | 34.764       |
| 2         | 1.960               | 8.520         | 43.284       | 1.960                               | 8.520         | 43.284       |
| 3         | 1.442               | 6.269         | 49.553       | 1.442                               | 6.269         | 49.553       |
| 4         | 1.359               | 5.908         | 55.461       | 1.359                               | 5.908         | 55.461       |
| 5         | 1.204               | 5.234         | 60.694       | 1.204                               | 5.234         | 60.694       |
| 6         | 1.100               | 4.783         | 65.478       | 1.100                               | 4.783         | 65.478       |
| 7         | .998                | 4.339         | 69.817       |                                     |               |              |
| 8         | .926                | 4.027         | 73.844       |                                     |               |              |
| 9         | .782                | 3.398         | 77.242       |                                     |               |              |
| 10        | .773                | 3.362         | 80.604       |                                     |               |              |
| 11        | .670                | 2.912         | 83.516       |                                     |               |              |
| 12        | .607                | 2.641         | 86.157       |                                     |               |              |
| 13        | .507                | 2.204         | 88.361       |                                     |               |              |
| 14        | .497                | 2.161         | 90.521       |                                     |               |              |
| 15        | .402                | 1.748         | 92.270       |                                     |               |              |
| 16        | .376                | 1.634         | 93.904       |                                     |               |              |
| 17        | .352                | 1.529         | 95.433       |                                     |               |              |
| 18        | .294                | 1.279         | 96.712       |                                     |               |              |
| 19        | .225                | .976          | 97.688       |                                     |               |              |
| 20        | .172                | .748          | 98.436       |                                     |               |              |
| 21        | .138                | .602          | 99.037       |                                     |               |              |
| 22        | .112                | .487          | 99.524       |                                     |               |              |
| 23        | .109                | .476          | 100.000      |                                     |               |              |

Extraction Method: Principal Component Analysis.

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For Peer Review