The successful management and implementation of building construction projects is one key area demanding great focus in modern construction. In Malawi, very few building construction projects are successfully managed (i.e. finish within budget, on schedule or according to quality specifications). The current situation necessitates improvement in management of these projects so that a large number of them are successfully managed. This research study joins the many of previous studies in identifying and establishing the strength of influence of the critical contractor-related factors on project management success criteria of cost, time and quality. A hypothesized relationship model was built based on variables found. A survey was then conducted on the successful building construction projects, through a semi-structured questionnaire addressed to Managing Directors or senior technical staff of building construction companies. The results show that contractors’ overall management has got very strong positive influence project management success criteria’s of time and quality of a building project.

Key words: Building Construction Projects, Critical Contractor-Related Factors, Project Management Success, Malawi, Structural Equation Modeling.

1. Introduction
In the past few years, there has been a growing trend in the latest technology in terms of management tools, techniques and computer software on the market. The primary consideration of all these latest developments has been to aid successful implementation and completion of projects. However, despite all this, in the building construction industry, there is still a more accustomed sight of a few successfully managed building construction projects (i.e. projects that finish within budget,
according to schedule, specifications or objectives). This was what motivated the current study. The current situation necessitates improvement in management so that many building construction projects are successfully managed. How to significantly increase the chances of successfully managed building projects is the question this research tried to address.

According to Mobey et. al., (2002) in order to significantly increase the chances of successfully managed building construction projects, it is necessary to have an understanding of what are the critical success factors, to systematically and quantitatively assess these critical factors, anticipating possible effects, and then chooses appropriate ways to either promote or mitigate their effects. Kuen (2004) concluded that projects often possess a specialized set of critical success factors in which if addressed and attention given to them, will improve the likelihood of a successful implementation. Hence this research study tried to identify those critical factors related to contractors influencing project management success and establish the strength of their influence. The study was only based on building construction projects carried out Malawi within the period from 2005 to 2009.

Project management success, which is a subset of project success, is defined here as meeting the three important criteria of cost, time and quality, the ‘Iron Triangle’. Project success remains of great interest to a lot of researchers because of its importance to stakeholders, clients, contractors and consultants alike. The editor paper of International journal of Project Management (26) 2008 addressed 4 key issues that impact project management today; one of them was measuring success. In Malawi, the building construction industry which is fourth largest sector of the economy has seen recent trends in investment in order to meet the social economic development.

A lot of the previous studies only identified those critical factors without establishing any relationships between them. Muhammad, et al (2008) suggested a further study on the need to identify the casual relationships between Critical Success Factor (CSF) and the Key Performance Indicators (KPI). It was therefore one of the objectives of this study to carry on and establish these relationships in a different setting.

2. Research Methodology

In order to achieve the aforementioned objectives of this research, the research design took the format of experimental research design, where the focus was that of ‘cause and effect’
The variables were identified through intensive literature review and included the following: main contractor’s experience, subcontractor’s experience, site management, contractor’s cash flow management, quality control management, health and safety management and contractor’s coordination with fellow contractors (i.e. subcontractors), consultants and (employer or client). The measures of Project Management Success found consist of; Cost, Time, and Quality. The variables identified through literature review were incorporated in a hypothesized Structural Equation Model shown in Figure 2.1.

Figure 2.1 The Hypothesized SEM Model

Based on researcher’s intensive literature review the SEM model was formulated to test the following hypotheses;

**Hypothesis (a)** The large number of years of experience the contractors’ possess, has got strong positive influence on project management success (Cost, Time and Quality)

**Hypothesis (b)** High qualities of contractors’ overall management skills have a strong positive influence on project management success (Cost, Time, and Quality)

**Hypothesis (c)** Close contractors’ coordination with construction team on the project has a positive influence on the project management success (Cost, Time, and Quality)
A semi structured questionnaire was then designed and tested for reliability and validity with a few experienced individuals in the construction industry. The data collection exercise involved, acquiring information from all building contractors who were above the MK30 million category. The respondents were asked to provide information on at least three successfully building construction projects (of their choice) they had actively been involved in management and implementation. The building construction projects were limited to those above the contract sum of MK 30 million (US $200,000 equivalent) which were completed within the period of 2005 to 2009. The questionnaire was distributed to all Managing directors or senior technical staff of the 109 registered building construction companies, which made up the sampling framework, through personal contacts, email and telephone contacts. According to the research objectives, the first section of the data analysis was concerned with identification of critical factors through use of descriptive statistics and Relative Importance Index (RII). The mean scores of the variables obtained were analyzed as follows: 1 - 1.75 = not very significant; > 1.75 – 2.5 = least significant; > 2.5 – 3.5 = mildly significant; > 3.5 – 4.25 = moderately significant; > 4.25 – 5 = most significant. The relative importance index (RII) method used was to determine the relative ranking of the variables. Lastly, the data on influence of variables was analyzed statistically using Structural Equation Modeling (SEM) in order to assess the strength of influence (relationship) of the variables. The effects of exogenous variables on endogenous variables were evaluated as; the range effects greater than 0.30 were considered ‘strong’; the range of effects from 0.10 – 0.29 were considered ‘moderate’; 0.05 - 0.09 were considered ‘weak’; and the range of effect below 0.05 were considered ‘very weak’ (Putri Y 2008).

3. Results & Discussions

Out of 109 registered building construction companies who were invited to provide project information of at least three successful building projects completed only 38 registered building contractors participated in the research. The data collection effort achieved an overall response rate of 34 % and resulting in the sample size of 103 building construction projects which was considered the minimum required. Based on the responses received, 41 % (N = 16) of the respondents identified themselves as Managing directors, 31% (N = 12) identified themselves as Quantity Surveyors working for these contractors, 10% (N = 4) identified themselves as Site Agents, 8 % (N =3) identified themselves as Contracts Managers, another 8 % (N=3) identified themselves
as Site Engineers and lastly 3% (N = 1) identified himself as a Managing Partner. Out of 103 building construction projects responses received, 47% (N = 48) of them were institutional projects like schools, hospitals and health centers, 27% (N = 28) were commercial like shops and office buildings, 17% (N = 17) were industrial like warehouse and factory buildings and 10% (N = 10) were residential.

Of the 9 critical contractor-related factors found through literature review, it was found out that the following are the most critical factors; (1) ‘contractor’s cash flow management’ (µ = 4.77, RII = 2.48) was the most critical contractor-related factor that had an influence on project management success and was ranked first followed by (2) ‘main contractor’s experience’ (µ = 4.74, RII = 2.47) which was ranked second; then (3) ‘contractor’s site management’ (µ = 4.72, RII = 2.45) was ranked third; then,(4) ‘coordination with consultants on the building project’ (µ = 4.64, RII = 2.41) was ranked fourth; then (5) ‘contractor’s quality control management’ (µ = 4.59, RII = 2.39) was ranked fifth; and lastly (6) coordination with fellow contractors on the project (µ = 4.44, RII = 2.31) was ranked sixth as shown in Table 3.1. Contractor’s health and safety management was ranked last due to the fact these matters are rarely taken serious in the Malawi Construction Industry. On contractors’ cash flow management, which is the most critical contractor-related factor, special focus should be on in-coming and outgoing cash and see to it that it is being well planned and controlled to a high degree. While on site management the focus should be on the movement, storage or placement of laborers equipment and materials on site and see to it that all these activities are also well planned and controlled to high degree. Good coordination with consultants and fellow contractors will ensure that all work elements on a project are well coordinated in achieving the project objectives. On quality management the focus should be on meeting the set quality standards through a well controlled control management plan with the assistance of quality inspections done at all times and regularly.

The hypothesized SEM model was later evaluated. The chi square statistics was not used due to its sensitive with sample size. In order to accept the model, cmin/df = relative chi-square ratio < 2.0, GFI = Goodness-of-fit Index ≥ 0.9, CFI= Comparative Fit Index ≥ 0.9, RMSEA = Root Mean Square Error Approximate ≤ 0.08 (Garson 2009). The final modified SEM model showed to fit the data much better than the hypothesized SEM model. The results of the final modified model were as follows; the absolute fit indices, chi square value (X² = 77.327, df = 45, p = 0.002); cmin/df = 1.718 (< 2), GFI = 0.891 (≥ 0.9), the incremental fit index, CFI = 0.867 (≥ 0.9), the parsimonious index, RMSEA = 0.084 (≥ 0.08) as shown in Figure 3.2 and was accepted.
Table 3.1 Ranking of Critical Importance of Contractor-Related Factors

<table>
<thead>
<tr>
<th>Critical Contractor Related Factors (CPRF’s)</th>
<th>Variables</th>
<th>Mean</th>
<th>Std dev</th>
<th>∑ w</th>
<th>RII</th>
<th>Ranking of Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractors’ Cash Flow Management)</td>
<td>4.77</td>
<td>0.536</td>
<td></td>
<td>186</td>
<td>2.48</td>
<td>1</td>
</tr>
<tr>
<td>Main Contractor's Experience</td>
<td>4.74</td>
<td>0.442</td>
<td></td>
<td>185</td>
<td>2.47</td>
<td>2</td>
</tr>
<tr>
<td>Contractors’ Site Management</td>
<td>4.72</td>
<td>0.456</td>
<td></td>
<td>184</td>
<td>2.45</td>
<td>3</td>
</tr>
<tr>
<td>Coordination with Consultants</td>
<td>4.64</td>
<td>0.486</td>
<td></td>
<td>181</td>
<td>2.41</td>
<td>4</td>
</tr>
<tr>
<td>Contractors’ Quality Control Management</td>
<td>4.59</td>
<td>0.595</td>
<td></td>
<td>179</td>
<td>2.39</td>
<td>5</td>
</tr>
<tr>
<td>Coordination with Fellow Contractors</td>
<td>4.44</td>
<td>0.821</td>
<td></td>
<td>173</td>
<td>2.31</td>
<td>6</td>
</tr>
<tr>
<td>Coordination with Client</td>
<td>4.15</td>
<td>0.779</td>
<td></td>
<td>162</td>
<td>2.16</td>
<td>7</td>
</tr>
<tr>
<td>Subcontractor's Experience</td>
<td>4.18</td>
<td>0.730</td>
<td></td>
<td>159</td>
<td>2.12</td>
<td>8</td>
</tr>
<tr>
<td>Contractors’ Health &amp; Safety Management</td>
<td>3.90</td>
<td>1.021</td>
<td></td>
<td>152</td>
<td>2.03</td>
<td>9</td>
</tr>
</tbody>
</table>

Note: Relative Importance Index (RII) = \( \frac{\sum w}{A \times N} \) where: \( \sum w \) is the total weight given to each variable by the respondents, \( A \) is the highest weight i.e in this case 5) and \( N \) is the total number of respondents.

The direct, indirect and total effects of the exogenous variables (contractor related factors) on the endogenous variables (project management success criteria) were then evaluated through the results of the accepted SEM model. The contractor’ overall management skills’ was found to have strong direct effect of \( \gamma =0.697 \) on time and \( \gamma = 0.388 \) on quality). This key finding of the present study indicates the high qualities of building contractors’ overall management skills have a very strong positive influence of increasing the chances of a building construction project finishing within schedule and quality standard set. The contractor’s experience had moderate direct effect of \( \gamma = 0.244 \) on quality). This finding indicates that a more experienced a building contractor has a moderate positive influence on the quality outcome of the building construction project. The resulting structural equation models were as follows;

\[
\text{Time} = 0.697 \text{ Contractor’s Overall Management Skills} - 0.180 \text{ Contractor’s Coordination on the Project} + 0.483 \text{ Prediction Error of the Equation} \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (3.1)
\]

\[
\text{Quality} = 0.388 \text{ Contractor’s Overall Management Skills} + 0.244 \text{ Contractor’s Experience} + 0.260 \text{ Prediction Error of the Equation} \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (3.2)
\]
Figure 3.2. The Structural Equation Model.

The research hypothesis results are summarized in the Table 3.2. Based on the structural coefficients and p-values of the structural paths represented the hypothesis (a) was partially supported, hypothesis (b) was moderately supported while hypothesis (c) was surprisingly not supported.

Table 3.2 Research Hypothesis Results.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Description of the Structural Path in the Model</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>“The large number of years of contractor experience the contractors’ possess has got strong positive influence on the project management success (cost, time and quality)”</td>
<td>Partially supported</td>
</tr>
<tr>
<td>(b)</td>
<td>“High qualities of contractors’ overall management skills have a strong positive influence on project management success (cost, time and quality)”</td>
<td>Moderately supported</td>
</tr>
<tr>
<td>(c)</td>
<td>“Close contractors’ coordination with construction team on the project has a positive influence on project management success (cost, time, quality)”</td>
<td>Not supported</td>
</tr>
</tbody>
</table>

(Source: Primary Data)
4. Conclusion

The first objective of the current research study was to identify the contractor-related factors critical to project management success. Based on the criticality analysis on the RII and mean score range (> 4.25 – 5 considered “most significant”) the following were found to be most critical contractor-related factors; (1st) Contractor’s cash flow management (2nd)main contractor’s experience; (3rd) contractor’s site management; (4th) coordination with consultants; (5th) contractor’s quality control management (6th) coordination with fellow contractors.

The second objective was to establish the strength of influence of those critical factors on three project management success criteria of cost, time and quality. Based on the analysis of structural coefficient (γ) and direct effects, the research findings indicate that contractor’s overall management skills have a very strong direct influence on time and quality outcomes of the building construction project.

The findings are consistent with the views and opinions of a lot of respondents as they indicated proper management as the reason why they think their building construction projects were successfully managed. This indicates how important management skills are on the part of building contractors in relation to the successful implementation of a building construction projects in Malawi.

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