PRE-CONTRACT PLANNING CONTROL:
PART 1: THE SIGNIFICANCE OF ORGANIZATIONAL
CHARACTERISTICS ON MEETING CONSTRUCTION
CLIENT GOALS

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ABSTRACT

This paper investigates the impact which planning, carried out by a construction management (CM) firm during the pre-construction phase of a CM contract, had on the effectiveness with which the firm met client goals. The study was conducted through the use of a questionnaire mailed to 100 construction companies, in UK. The results of the analysis reveals that some aspects of organization planning affect the ability of the CM company to meet client goals.

Keywords: planning, owner, goals, construction, management, organizational, environmental

1. INTRODUCTION

The construction industry predates even the earliest historical records, and has been an important part of civilizations in every part of the world.

In the past, the word planning had a fairly definite meaning, which turned the mind to the work of the architect, the engineer, the surveyor and the planner, but at present the word tends to be used also in relation to many other fields of activity.

The construction industry, has an important impact on the economy of the people in developed and underdeveloped countries. The efficiency with which construction projects are accomplished, and the cost and quality of the resulting constructions, affect not only the economy but also the quality of peoples lives [1]. For the growth of construction management two reasons are cited, (i) the failure of traditional construction methods to attain the owner’s time, cost, and quality objectives, and (ii) the compatibility of the construction management process with increased project complexity [2], indicated that opportunities to shorten the project time and to cut the project costs are often passed by, since the traditional construction process isolates financial planning, design, and scheduling from that of the actual construction.

All the phases of construction, containing the conceptual planning, schematic design, design development, contract documents, bidding, and actual construction had evolved from their beginning in the late 1960’s as continuity of management. This continuity of management,

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coupled with the presence of construction expertise early in the design phase, is the construction industry's response to the challenge of many critics to enter the latter part of the twentieth century and employ modern management techniques. References [3], [4] and [5] reported the extent to which construction plans are used in the process of decision making at head office and on-site. It is an indication of satisfaction with plans prepared by the users. Furthermore, the need to anticipate and overcome resistance to planning and to create a favourable climate for effective planning are reported in references [6], [7] and [8].

Six commonly emphasised objectives of planning identified by [4] are as follows:
(1) predicting future trends, (2) evaluating alternatives (3) enhancing management development, (4) avoiding problem areas, (5) improving short-term performance, and (6) improving long-term performance.

Much has been written about the growth of construction management, however, on what it is, and how to implement it, the available literature is deficient in studies or articles pertaining to a question central to the construction management process. That is, are the companies who provide construction management services any better off than those who do not? Logical extensions to this question, which appear to be lacking in the literature, are investigations into the specific planning techniques used by construction management firms and the impact of their activities on the effectiveness of completed projects.

Although, references [5], [9], and [10], reported that construction planning efforts usually fail to achieve their objectives, however, the identified issue is central to the purpose of this study.

2. AIM AND OBJECTIVES OF THE STUDY

The aim of this paper is to determine, examine and investigate the relationships between construction management company effectiveness and organizational characteristics of the construction firm, and to develop a conceptual model of construction management company effectiveness. Specifically, the objectives of the paper are:
1. to develop a conceptual model of construction management company effectiveness and,
2. to examine and investigate the interaction between construction management company effectiveness and organizational characteristics

3. DEFINITION OF CONSTRUCTION MANAGEMENT PLANNING

In 1982 the Associated General Contractors of America (AGC) defined Construction Management as a method of contracting for project delivery [11]. The primary emphasis of AGC definition is on overseeing and integrating the design and construction, while [12] defines a professional Construction Manager as a firm or organization specialising in the practice of Construction Management. The ASCE definition also states that the Construction Manager does not usually perform significant design or construction work with his/her own forces.

Furthermore, [13] defines Project Planning as the deliberate consideration of all circumstances concerned with a project, in order to evolve the best method of achieving a stated objective. In construction projects the objective is usually the completion of a prescribed amount of work within a fixed time, at a previously estimated cost, and to specified standards of quality.
Reference [5] defines Construction Planning as the determination of what has to be done, the description of how each work task is to be performed, the sequence and time of execution, the enumeration of required resources and their cost within the contractor’s organization and before the beginning of construction.

Finally, the authors define Construction Management Planning as the direction of process of determining appropriate policies for the achievement of meeting client goals, through the completion of a prescribed amount of work within a fixed time, at a previously estimated cost, and to specified standards of quality.

4. CONCEPTUAL FRAMEWORK OF STUDY

The idea that Social Planning Theory consists of propositions that implicitly connect two or more variables in a causal relationship, needs to be stressed throughout this paper. Causal reasoning is increasingly coming to dominate many areas of social planning research, but the foundations of this conceptualisation are often not carefully articulated. Considerable pseudo-philosophical mumbo-jumbo may accompany efforts to explain social phenomena in cause-and-effect terms. Figure 1 states the basic assumptions that must be met before causal explanations can be seriously entertained.

![Conceptual framework of causal interactions](image)

**Fig. 1 Conceptual framework of causal interactions**

The conceptual model in Fig. 1 is also developed to facilitate the research paper objectives (see Fig. 1). The model sets out to depict the relationships between the variables in the planning process of meeting client’s goals. The aim of the model is to facilitate investigation on which factors are important for meeting client’s goals and how these factors relate to Construction Management Company Effectiveness.

The model can also assist in determining how important these factors are when they are used to examine or predict Construction Management Company Effectiveness.

There are four main groups of independent variables as one can see from the above figure, namely the project owner, organizational characteristics, environmental characteristics and planning characteristics. The impact and interaction of the independent variables (organizational characteristics) will determine the dependent variables which are represented as Construction Management Company Effectiveness.
5. RESEARCH METHODOLOGY

5.1. Data required and Collection
The study was conducted through the use of questionnaires mailed to 100 construction companies in the UK, which were selected from contractors’ files at random. The questionnaire was addressed to the Construction Executive Officer.

The questionnaire contained four major sections pertaining the questions about (i) company characteristics; (ii) type of construction management projects the company undertakes; (iii) concerning the planning which the company does in the preconstruction phase, and (iv) the company’s experience in the construction management field over the last five years. Section (iv) also included three questions about the company’s financial performance during the past year. Each question was designed with a choice of five possible answers. The only exceptions were the three questions concerning financial performance. The companies were asked to provide the answers to these questions in the form of ratio. The rate of return for the survey questionnaire was 21 percent.

6. METHOD AND STATISTICAL ANALYSIS

A statistical computer package [14] was used to analyze the questionnaire response data. The response were analyzed by frequency distribution to describe the typical company categorical variables, the use of Pearson’s product moment correlation’s to measure the strength of linear relationship between two interval level variables, and partial correlation to measure of association which described the relationship between two variables while holding constant (controlling) one or more additional variables. This method allows the removal of the effect of the control variable from the relationship between the independent and dependent variables. Furthermore, this method of statistical analysis was used to test for variables which had interrelated effects.

6.1. Research Questions
(i) Does the percentage of completed CM jobs with a final cost equal to or less than that of the owner’s original budget vary as a function of the length of experience which company had with CM contracts?

In order to characterize the company, several different measures were used. Some of these were designed to give an indication of the age of the company, size of its CM contracts, its physical area of operation, and how important CM contracts were to its operations. Another section of the questionnaire asks questions about the company’s experience in construction field over the last five years.

The survey responses regarding the organization of the company provided the response variable for this research question. The respondents were then partitioned into five groups based on the number of years of experience which they possessed in completed CM jobs on time and met the client’s original budget. This research question was answered using descriptive statistics.

(ii) Does the percentage of completed CM jobs with a final cost equal to or less than that of the final pre-bid estimate vary as a function of the length of CM experience which a company had with CM contracts?

Again, the survey response from research question one provided the response variable for this
research question. The respondents were partitioned into five groups based on how often their completed CM projects met the final pre-bid estimates.

(iii) Does the percent of CM jobs completed by the owner’s original completion date vary as a function of the size of a CM company?

Once again, the survey responses obtained from organizational characteristics of the CM companies provided the response variables for this research question. The respondents were partitioned in five groups based on the size of its CM contracts and how often their completed CM projects met the client’s original completion date.

(iv) Does completing the job by the owner’s original date vary as a function of the exposure of CM managers to sources of information about new management techniques?

Each company executive was asked to rank-order the five phases based on the determination of how the CM company increases its knowledge of managing the CM contracts and how often their completed CM projects met the client’s original completion date.

6.2 Study Hypotheses

(i) The length of experience, which a company had with CM contracts, is likely to be related positively to the percent of completed CM jobs with a final cost equal to or less than that of owner’s original budget.

(ii) Length of CM experience is likely also to be positively related to the percent of completed CM jobs with a final cost equal to or less than the final pre-bid estimate.

(iii) The size of a CM company (number of full-time employees) is positively related to the percentage of CM jobs completed by the client’s original completion date.

(iv) The percentage of permanent employees utilized during preconstruction planning is positively related to all effectiveness variables: final cost equal to or less than client’s original budget, final cost equal to or less than final pre-bid estimate, job completed on or before client’s original date, and job completed on or before the date set during reconstruction planning.

(v) Exposure of CM managers to sources of information about new management techniques is positively related to completing the job by the owner’s original date.

7. DESCRIPTIVE ANALYSIS

7.1 Organizational characteristics

Reference [15] has reported that several different measures should be used to characterise the company. Table 1 below shows the typical company responding to the survey.

The table 1 reveals the years in the construction industry for over 20 yrs (>20 yrs, 95.2%), and did not have any in-house design capability (None, 38.1%). This typical company had 5 branch offices that not including site offices (5, 42.9%) and employed, over 350 full-time employees (>350 employees, 38.1%). In addition, this company had completed over 40 CM contracts (>40 CM contracts, 100%) with a total value of over £90 million (£90 million, 85.7%) in the last five years.

The typical survey respondent could be over £30 million of CM work (>£30 million, 66.7%)
with his workforce and of the people employed during the preconstruction phase, 80-100% were permanent employees (80-100%, 85.7%). This company had generated 81-100% (81-100%, 81%) of its in-place volume over the last five years from CM jobs.

Table 1 Organizational characteristics: Mean, Standard Deviations (SD), Range, Minimum and Maximum.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mean*</th>
<th>SD</th>
<th>Range</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years in business</td>
<td>4.905</td>
<td>0.436</td>
<td>6-10 yrs</td>
<td>11-15 yrs</td>
<td>&gt;20 yrs</td>
</tr>
<tr>
<td>Years with in-house design capability</td>
<td>2.714</td>
<td>1.736</td>
<td>11-15 yrs</td>
<td>0</td>
<td>&gt;15 yrs</td>
</tr>
<tr>
<td>Number of branch offices</td>
<td>2.467</td>
<td>1.209</td>
<td>15</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Number of full-time employees</td>
<td>3.762</td>
<td>1.261</td>
<td>251-350</td>
<td>&lt;50</td>
<td>&gt;350</td>
</tr>
<tr>
<td>Number of CM Contracts (last five years)</td>
<td>5.000</td>
<td>0.000</td>
<td>0.000</td>
<td>&gt;40</td>
<td>&gt;40</td>
</tr>
<tr>
<td>Value of CM Contracts (last five years)</td>
<td>4.810</td>
<td>0.512</td>
<td>£2.5-30 mill</td>
<td>&lt;£30-60 mill</td>
<td>&gt;£90 mill</td>
</tr>
<tr>
<td>Percent of individuals, employed during pre-</td>
<td>4.667</td>
<td>0.966</td>
<td>60-80%</td>
<td>&lt;20%</td>
<td>&gt;80-100%</td>
</tr>
<tr>
<td>construction, who are permanent employees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume of CM work with present workforce</td>
<td>4.429*</td>
<td>0.870</td>
<td>£1-10 mill</td>
<td>&lt;£10-20 mill</td>
<td>&gt;230 mill</td>
</tr>
<tr>
<td>Percent of ? – place volume due to CM contracts (last five years)</td>
<td>4.810</td>
<td>0.402</td>
<td>0-20%</td>
<td>61-80%</td>
<td>81-100%</td>
</tr>
<tr>
<td>Useful sources of CM contract management information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- professional journals</td>
<td>2.905</td>
<td>0.944</td>
<td>Some what very useful</td>
<td>Not at all useful</td>
<td>Very useful</td>
</tr>
<tr>
<td>- in house seminars</td>
<td>3.952</td>
<td>1.024</td>
<td>Some what useful</td>
<td>Not at all useful</td>
<td>Very useful</td>
</tr>
<tr>
<td>- seminars by professional</td>
<td>3.667</td>
<td>1.238</td>
<td>Some what useful</td>
<td>Not at all useful</td>
<td>Very useful</td>
</tr>
<tr>
<td>- manager's own experience</td>
<td>4.286</td>
<td>0.902</td>
<td>Some what useful</td>
<td>Not at all useful</td>
<td>Very useful</td>
</tr>
<tr>
<td>Company Organization</td>
<td>3.381</td>
<td>1.284</td>
<td>A combination</td>
<td>A line combination organization</td>
<td>A staff organization</td>
</tr>
</tbody>
</table>

*Note: The mean given is based on the number (1-5) which corresponds to the possible answers in the questionnaire.
Furthermore, as a source of information for managing the company’s CM contracts more efficiently, the manager’s own experience was by far the most important (very useful, 52.4%). Interacting with design firms (somewhat useful, 47.6%) was found to be somewhat useful as an information source while seminars by professionals (very useful, 38.1%), professional journals (some what useful, 57.1%), and in-house seminars (very useful, 38.1%) were described as the most useful. The typical company had an organizational structure which was a combination line and staff structure (combinations, 42.9%).

7.2 Experience of the Company in Meeting Client Goals

The company had met the needs of client, as defined in the questionnaire, less than 60% of the time on CM contracts over the last years (Table 2). However, fewer than 60% of the CM jobs had a final cost equal to or less than the client’s original budget (60-90%, 57.1%) or the final pre-bid estimate (30-60%, 66.6%). In addition, less than 60% of the CM jobs were completed by the client’s original completion date (60-90%, 61.9%) or the date established during the preconstruction phase planning (60-90%, 42.9%).

The company actually contracts for less than 60% of the CM jobs for which they participate in a selection interview by the owner (30-60%, 57.1%). The company’s CM portion is believed to be improving faster than that of their competition (faster, 66.7%)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost equal to or less than the owner’s original budget</td>
<td>3.286</td>
<td>1.146</td>
<td>60-90%</td>
<td>None</td>
<td>All</td>
</tr>
<tr>
<td>Cost equal or less than the final pre-bid estimate</td>
<td>2.905</td>
<td>0.995</td>
<td>60-90%</td>
<td>None</td>
<td>All</td>
</tr>
<tr>
<td>Jobs completed by the owner’s original completion</td>
<td>3.857</td>
<td>0.727</td>
<td>30-60%</td>
<td>1-30%</td>
<td>All</td>
</tr>
<tr>
<td>Jobs completed by date established during preconstruction planning</td>
<td>3.857</td>
<td>0.854</td>
<td>30-60%</td>
<td>1-30%</td>
<td>All</td>
</tr>
<tr>
<td>Participate in a selection interview by an owner</td>
<td>3.048</td>
<td>0.669</td>
<td>1-30%</td>
<td>1-30%</td>
<td>60-90%</td>
</tr>
</tbody>
</table>

8. RESULTS

Partial Correlation

Relationship of Organizational Characteristics to Meeting Client’s Goals

Final cost Equal to or Less than Client’s Original Budget (PCFOB)

As shown in Table 3, the value of CM contracts completed in the last five years (TV) showed not statistically significance (p=0.16) to final cost equal to or less than the effects of environmental characteristics were controlled. This meant that environmental characteristics were not affecting the relationship. The relationship was an inverse one (-0.23). This indicates that as
the total value of completed CM contracts became smaller the likelihood of finishing the project with a final cost equal to or less than the owner's original budget increased. This appeared to indicate that smaller, less complex projects were easier to control, and thus more. Notwithstanding, the result in Table 3 also reveals that the significant $r$ of both percentage of pre-construction phase employees who are permanent (PDPCPE) and the use of the manager's own experience as a source of CM contract management information (MOD) stayed relatively equal regardless of which factors were controlled in their relationship with final cost equal to or less than the client's original budget. These were both positive relationships.

The $r$ for company organization (CCO) held constant regardless of whether environmental characteristics were controlled. This inverse relationship indicated that CM companies organized along a line concept, usually a smaller company, were better than staff organizations at keeping a project within budget and that neither the type of job nor the planning done affected this relationship.

The manager's own experience, useful as a source of CM contract management information (MOE) maintained a significant relationship to meeting the client's budget regardless of control of environmental characteristics. This indicated that environmental characteristics affected this relationship and that the use of manager's experience, it was a positive relationship, was important, in and of itself, in the capability of a CM company to meet the client's budget.

The interrelationship between these three company characteristics (PDPCPE, CCO and MOE) and the ability of the CM company to meet the client's original budget, appeared to support reference [16] who reported that the builder who executes small units, which are comparatively simple cannot necessarily conceive, and by implication does not need the organization and control mechanisms necessary to manage large projects.

Table 3a Organizational characteristics and measure of effectiveness: Zero, Partial Correlation Coefficients and Significance Values

<table>
<thead>
<tr>
<th>Organizational characteristics</th>
<th>Measures of Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PCFOB</td>
</tr>
<tr>
<td></td>
<td>Zero p-value</td>
</tr>
<tr>
<td>YCOS</td>
<td>0.47 0.01</td>
</tr>
<tr>
<td>YCHD</td>
<td>-0.31 0.09</td>
</tr>
<tr>
<td>BSO</td>
<td>0.46 0.02</td>
</tr>
<tr>
<td>FTE</td>
<td>-0.23 0.25</td>
</tr>
<tr>
<td>TV</td>
<td>0.07 0.38</td>
</tr>
<tr>
<td>PDPCPE</td>
<td>0.42 0.02</td>
</tr>
<tr>
<td>VC</td>
<td>0.23 0.15</td>
</tr>
<tr>
<td>PCV</td>
<td>0.2 0.19</td>
</tr>
<tr>
<td>MPJ</td>
<td>0.12 0.3</td>
</tr>
<tr>
<td>MS</td>
<td>-0.29 0.1</td>
</tr>
<tr>
<td>MSP</td>
<td>0 0.5</td>
</tr>
<tr>
<td>MID</td>
<td>-0.41 0.03</td>
</tr>
<tr>
<td>MOE</td>
<td>0.49 0.012</td>
</tr>
<tr>
<td>CCO</td>
<td>-0.35 0.06</td>
</tr>
</tbody>
</table>
Table 3b  Organizational characteristics and measure of effectiveness: Zero, Partial Correlation Coefficients and Significance Values

<table>
<thead>
<tr>
<th>Organizational characteristics</th>
<th>Measures of Effectiveness</th>
<th>POCD</th>
<th>PPCEP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Zero</td>
<td>p-value</td>
</tr>
<tr>
<td>YCOS</td>
<td></td>
<td>0.36</td>
<td>0.05</td>
</tr>
<tr>
<td>YCHD</td>
<td></td>
<td>0.04</td>
<td>0.42</td>
</tr>
<tr>
<td>BSO</td>
<td></td>
<td>0.2</td>
<td>0.17</td>
</tr>
<tr>
<td>FTE</td>
<td></td>
<td>0.33</td>
<td>0.07</td>
</tr>
<tr>
<td>TV</td>
<td></td>
<td>0.21</td>
<td>0.18</td>
</tr>
<tr>
<td>PDPCEP</td>
<td></td>
<td>0.4</td>
<td>0.03</td>
</tr>
<tr>
<td>VC</td>
<td></td>
<td>0.29</td>
<td>0.09</td>
</tr>
<tr>
<td>PCV</td>
<td></td>
<td>0.4</td>
<td>0.03</td>
</tr>
<tr>
<td>JSME</td>
<td></td>
<td>-0.31</td>
<td>0.08</td>
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<td>MDEP</td>
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<td>0.06</td>
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<tr>
<td>MSP</td>
<td></td>
<td>0.17</td>
<td>0.23</td>
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<tr>
<td>MID</td>
<td></td>
<td>0.03</td>
<td>0.45</td>
</tr>
<tr>
<td>MOE</td>
<td></td>
<td>0.56</td>
<td>0.003</td>
</tr>
<tr>
<td>CCO</td>
<td></td>
<td>-0.26</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Final Cost Equal To or Less than Final Pre-Bid Estimate (PCFPDE)
The years a company has been in the construction industry (YCOS) showed a positive relationship (0.50, p = 0.003), to final cost equal to or less than the final pre-bid estimate. This was true when the effects of environmental characteristics were controlled (Table 3a). This indicated that the older, and usually bigger, companies were more likely to complete a project at, or under, the cost given in the final pre-bid estimate than younger companies. This finding was supported by available literature (references [11], [17], and [18]) who felt that past experience was a good indication of potential. With this relationship, it was evident that the effects of environmental characteristics were controlled. This indicated that, at least for old companies, environmental characteristics were important factors in their ability to meet the final pre-bid estimates.

Job Completed on or Before Owner’s Original Date (POCD)
The number of full-time employees (FTE) showed a statistically significance relationship to completing the job on or before the client’s original date when environmental characteristics were controlled (see Table 3). It had an inverse relationship (-0.45, p = 0.02). The use of manager’s own experience as a source of CM contract management information (MOE) also showed a statistically significance (0.48, p = 0.01). This appeared to indicate that not only the manager’s experience was important in a positive manner, but also the effect of the environmental characteristics was important.

The percentage of pre-construction phase employees who are permanent (PDPCEP) a source of CM contract management information (MPJ) maintained relatively constant r values regardless of the environmental characteristics being controlled. The first was a positive relationship while the second was inverse. This meant that for these two company characteristics, the effects of
environment were negligible.

The higher the percentage of pre-construction phase employees who were permanent employees, the better the CM companies surveyed appeared to do in completing the job on or before the client’s original date. This finding supports the argument of reference [16], among others, that being structured as a team was not sufficient. They (the team) needed to be able to work as a team and could only come from having worked as a team previously.

The use of professional journals as a source of CM contract information maintained a relatively constant negative r during both zero and partial correlation procedures. As table 3 reveals, for completing the job on or before the client’s original date (POCD), the relationship of the percentage of pre-construction planning employees who were permanent employees (PDPCE) to complete the job on or before the date set during pre-construction planning were unaffected by environmental characteristics. This provided additional support for the views of reference [16].

Measures of Effectiveness (Interrelationships)
The four measures of effectiveness: final cost equal to or less than the owner’s original budget (PCFOB), final cost equal to or less than the final pre-bid estimate (PCFPDE), job completed on or before owner’s original date (POCD), and job completed on or before the date set during pre-construction planning (PPCP) can be combined into two different groups.

The first of these groups could be visualized as dollars and dates. PCFOB and PCFPDE (see Table 4) were both most directly linked with meeting a cost and had an r of 0.68***. POCD and PPCP were most directly linked with meeting calendar dates and had an r of 0.85***.

Table 4 Relationship between dependent variables as explained by variance

<table>
<thead>
<tr>
<th></th>
<th>PCFOB</th>
<th>PCFPDE</th>
<th>POCD</th>
<th>PPCP</th>
<th>CJPAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCFOB</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCFPDE</td>
<td>0.466** (t = 6869)</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POCD</td>
<td>0.222** (t = 2.330)</td>
<td>156*</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPCP</td>
<td>0.161* (t = 1.911)</td>
<td>0.206* (t = 2.221)</td>
<td>0.725*** (t = 7.086)</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>CJPAC</td>
<td>0.192* (t = 2.122)</td>
<td>0.095* (t = 1.409)</td>
<td>0.104* (t = 1.488)</td>
<td>0.035</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*p = ≥ 0.05 ≤ 0.10  **p = ≥ 0.01 ≤ 0.05  ***p = ≤ 0.001

A second grouping concept would be those measures of effectiveness most directly concerned with goals internal to the CM company, and those most directly concerned with goals more external to the company. PCFPDE and PPCP appeared to be involved with internally set goals and had an r of 0.45*. PCFOB, and POCD appeared to be linked more to goals set by the client and had an r of 0.45*. Furthermore, cutting across the arbitrary groups, cost-dates and internal-external goals, was the relationship between PPCP and PCFOB (0.45*).

From Table 4 one can see that 47% of the variability in completing the project with a final cost equal to less than client’s original budget in UK (PCFOB) was explained by a final cost
equal to or less than the final pre-bid estimate (PCFPDE) which shows relatively high relationship of those measures of effectiveness linked to dollars. Completing the job on or before the date set during pre-construction planning (PPCP) explained 73% of the variability in meeting the client’s original date (POCD), which also demonstrated the close relationship of those measures of effectiveness linked with meeting calendar dates. It also partially confirmed the supposition that those measures of effectiveness concerned with dates were linked, at least for the companies surveyed.

Furthermore, of the variability of completing the project with a final cost equal to or less than the final pre-bid estimates (PCFPDE), completing the project on or before the date set during pre-construction planning (PPCP) explained 21%. This added additional insight into what had been theorised that internally set goals were associated, as were goals set more external to the CM company. This latter supposition was supported by \( r^2 \) between jobs completed on or before the client’s original date (POCD) and completing the project with a final cost equal to or less than the client’s original budget (PCFOB) with \( r^2 = 0.22 \). The relationship that cut across the boundary of date-cost and internal-external goals was that completing the job on or before the date set during pre-construction planning (PPCP) explained 16% of the variability in final cost equal to or less than the client’s original budget (PCFOB).

9. DISCUSSIONS

Hypo I
The hypothesis that the length of experience which a company has with CM contracts was related positively to the percentage of completed CM jobs with a final cost equal to or less than the client’s original budget (YCOS/PCFOB, \( p = 0.47, p = 0.01 \)). This hypothesis was supported by the relationship of the organizational characteristic, year in CM services. The percentage of CM jobs with a final cost equal to or less than the client’s original budget became higher as the years in CM increased.

Hypo II
Length of CM experience was also positively related to the percent of completed CM jobs with a final cost equal to or less than the final pre-bid estimate (YCOS/PCFPDE, \( r = 0.40, p = 0.03 \)). This hypothesis was also supported by the relationship. Increasing along years in CM was the percent of CM jobs with a final cost equal to or less than the final pre-bid estimate. The data indicated that the years a company had been in the CM field was a factor in meeting those measure of effectiveness most directly linked to dollar value (PCFOB and PCFPDE) but not those linked with calendar dates (POCD and PPCP).

Hypo III
The size of a CM company (variable FTE) was positively related to the percent of CM jobs completed by the client’s original completion (\( r = 0.33, p = 0.07 \)) was supported by the data in 6 out of 20(30%) possible correlations. The percentage of permanent employees engaged in preconstruction planning was positively related to all effectiveness: final cost equal to or less than client’s original budget (\( r = 0.43, p = 0.06 \); job completed on or before client’s original data (\( r = 0.40, p = 0.03 \); and job completed on or before the date set during preconstruction planning (\( r =
The above hypothesis was supported by the sample data collected. The percentage of CM jobs completed by the date set during preconstruction planning increased with an increase in the pound sterling value of CM work which the CM firm was able to do with its present workshop.

These relationships appeared to support references [16], [19] and [20], for their argument that increasingly larger construction projects were making necessary companies which could retain the experience gained from previous projects within the company itself.

**Hypo IV**
Exposure of CM manager to the source of information about new management techniques is positively related to effectiveness was not supported by the data gathered as a result of this study (MPI/POCD, r = -0.31, p = 0.08). In fact, the use of professional journals as a source of CM contract management information decreased as the percentage of CM jobs completed. As one can see from Table 3, the five sources of information surveyed, respondents indicated that they found only their own experience useful.

### 10. CONCLUSIONS

The paper concludes that the data collected from this sample indicates that years in the CM field could be used as an indicator of the ability of a CM firm to meet those client's goals related to dollar value. Furthermore, the data also indicates that, by the significant relationships and significant t-values, that smaller, line organization CM companies who rely on the manager's experience for management information, appear to be more capable of meeting the owner's budget than did larger companies. This was indicated as applying to smaller CM projects. A possible explanation may have been that small projects, carried out by large CM companies, tend to fragment the resources available to large companies and that management had a harder job tracking actual cost as related to the budget. However, younger less experienced CM companies completed a smaller percentage of CM projects with a final cost equal to a less than the final pre-bid estimate compared to older and more experienced CM companies. Finally, past experience was a good indication of potential.

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