CRITICAL SUCCESS FACTORS OF PROJECT MANAGEMENT

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ABSTRACT

Although project management has proven its success in construction as a procurement method, there are problems associated with the manner in which the system has been selected and/or implemented that have led to project delays and cost overruns with low client satisfaction. The objective of the study was to identify the factors that contribute to the success and failure in project management system, particularly in the case of large projects. 159 questionnaires from experienced personnel in construction engineering companies were statistically analysed to establish a theoretical framework, which was validated by referencing to 32 detailed case studies obtained from the interviews of the key personnel involved. The results suggested that the overall performance of project management as a procurement system is high, although the analysis revealed that it performed better in cost and quality than in time. The study also identified the factors that have significant impact on the success and failure of large projects, with results indicating that a project can be viewed as a combination of four interdependent sub-systems that relate to the strategic, structural, technical, and managerial aspects driven by the project management team.

Keywords: Construction, engineering, failure, project management, success.

INTRODUCTION

“Project management” is similar to “professional construction management” (PCM) which was first originated in the U.S. PCM was a rather informal method until the late 1960’s, but as construction costs increased during the early 70’s and delayed projects became more frequent, the need for the new approaches and techniques for managing the total construction programme became more evident.

The Chartered Institute of Building (1996) has defined project management as the overall planning, co-ordination and control of a project from inception to completion aimed at meeting a clients requirements in order to produce a functional and financially viable project that will be completed on time within authorised cost and to the required quality standard.
In professional project management, a contractor performs a management function under a professional services contract with the client, treating project planning, design and the construction plan as integrated tasks [Barrie and Paulson, 1976]. As a professional of the construction team, the project manager works with the client, designers, cost consultants and the construction manager, from the brief through the completion of construction, providing leadership in regard to time, cost and quality. The project manager can be a firm or an individual and is paid a fixed fee based on the value of the work. According to Rad and Miller (1978), the PCM practice had greater growth in the design sector of the industry. This process contrasts with U.K. experience, where (formally) prime contractors were first to offer PCM service to clients [Naoum, 1994].

Project management is a form of procurement designed to act as an integrating function, to pull together combinations of resources into temporary organisations to achieve a required purpose. The main advantage of the project management system is that it offers integration by including a professional site management service in addition to architects, cost consultants, structural, mechanical/electrical engineering consultants, site managers, planners, and buyers.

Although project management has proved its success in many construction projects, there are however some problems associated with the manner in which the system has been selected and/or implemented. A number of projects have been completed late or over budget with low client satisfaction, particularly in the publicly funded projects. Some projects overrun on time by 40% - 200% and others have been cancelled before they have even started, resulting in poor expenditure of public spending money.

With this background in mind, the authors pursued the development of project management and aimed to measure its success in large construction engineering projects, with a view to providing some indication of how the PM system performed under different circumstances.

**RESEARCH METHODOLOGY**

In order to achieve the aim of the research, the following methodology was adopted:

Stage one – literature review: Literature on procurement methods was reviewed and analysed, which resulted in the establishment of four categories of variables that may influence the project management outcome, these are: organisational, managerial, system and control.

Stage two – exploratory research: An exploratory research was conducted which took the form of face-to-face interview with three personnel of a large construction client, four project managers, three partners of design consultants and four directors of contractors who were experienced in construction engineering projects. The purpose of the exploratory interviews was to elicit their views regarding the success or failure factors of project management.

Stage three – the pilot study: After the exploratory interview, a pilot survey questionnaire was composed which contained 46 critical success factors grouped under the four
categories which were established in stage one. The questionnaires were sent to over 300 personnel working for the same or different construction engineering companies and which have been involved in project management arrangement for a considerable number of years. The response rate was 51%. The sample returned included 44 client’s organisations, 46 contractors, 54 design consultants and 45 project managers.

In the postal questionnaire, the respondents were asked to rate each of the factors presented using a range from “No influence on project management success” (rating of 1), to “Major influence” (rating of 5). The date gathered from the 159 questionnaires was then analysed statistically using SPSS and the result was published in the Association of Researchers in Construction Management (ARCOM) conference [Walker and Naoum, 1999]. The 46 variables, which were identified to having an effect on project success, were reduced into the 25 influencing variables (V1 to V25) listed in Table 1.

Stage four – the main study. The exploratory interview and analysis of the pilot study questionnaires have led to the developing of a theoretical framework. The proposed framework consists of the 25 influencing factors (established from the pilot study), which were seen as the independent factors affecting time, cost, and the quality of the project.

The validity of the research framework was tested by gathering information and data from completed construction engineering projects. This took the form of face-to-face interviews with key personnel who were involved in each project, supplemented by documentation. The sample contained 16 outstanding projects and another 16 projects that experienced some form of difficulties during design and construction.

The influencing factors (i.e. the cause) and the success factors (i.e. the effect) were examined in each of the 32 case studies. The influencing factors were measured using a rating system of 1-5. For example, if the project demonstrated evidences that project goals and client criteria were clearly established at the outset of the project, then that particular case was given a high score of 5 for this factor. On the other hand, if the project went ahead without a firm understanding to the project goal and client criteria, then the case was given a low score of 1.

Performance on time was measured by the increase or decrease on the estimated programme in months. This was calculated after the +/- authorised time by the client was taken into consideration. Average performance on time was determined by evidence that the project was completed by the original programme date and with the issue of project completion certificate. Outstanding performance was determined if the project completed ahead of schedule. Accordingly, the following rating system was applied:

- 3 months late = 1 (poor)
- 1-3 months late = 2 (below average)
- On original programme = 3 (average)
- Up to 3 months ahead = 4 (above average)
- > 3 months ahead = 5 (outstanding)

Performance on cost was measured by increase or decrease on budget in pounds. This was calculated after the +/- authorised value of variations by the client was taken into account. Average performance on cost was determined by evidence that the project was completed within the original budget. Outstanding performance was determined by
evidence that the project was completed under the budget, and the following rating system was applied:

- > 5% of orig. budget = 1 (poor)
- 1-5% of orig. budget = 2 (below ave.)
- On budget = 3 (average)
- Up to 5% below budget = 4 (above ave.)
- > 5 % below budget = 5 (outstanding)

The quality standard was measured subjectively based on the functionality of building and whether the building team has delivered the project in accordance to the client requirements. An outstanding rating was assigned to the project if there were evidences that the building team adopted an effective quality management system for auditing and controlling the project. Quality of projects were rated from poor – 1, to outstanding - 5.

Stage five – analysis of the results. An overall success factor (ranging from 1-5) of a project was computed by averaging its time, cost, and quality performance ratings. Testing of association between each of the 25 variables and the overall project success factor was conducted statistically in order to determine the significant influencing variables that contribute towards the success or failure of a project.

VALIDITY OF THE RESEARCH FINDINGS

The prime objective of the main study was to examine the causes of success and failure in project management system. Naturally, it is difficult to determine causality with appellate certainty. However, this research was designed to include a number of controlled variables. In particular, all 32 case studies were constructed on “pure” project management concept, and were commissioned by the same client who had similar goals and organisational structure for each project but with various business strategies. Furthermore, the characteristics of the projects were to a large extent the same, i.e. nature of the work, complexity and technology. The cases were also selected with their contractual arrangements more or less standard and tailored for the client. Hence, one of the fundamental differences among the 32 cases was the manner in which the projects were managed by the project management team.

RESULTS

Data from the 32 case studies was inputted into Excel and the relationship between each of the 25 influencing variable and the overall success factor was tested. The objective of the test was to establish the strength of relationship between each influencing variable and the overall project success factor, in order for the significant and dominate variables to be identified. Due to the uncertainty of small sample size for adequate normality testing in the measurement of coefficient strength with parametric methods, nonparametric Chi-square $\chi^2$ was evaluated in addition to Pearson’s correlation coefficient $r$ to reaffirm the measure of relationship. Interval data was demoted into ordinal when Chi-square method was used as the parametric assumptions may be invalid.

The 10 highest significant factors which determined the success or failure of the 32 project management case studies were found and the research findings were then
interpreted by referring to the 32 case studies and examining the causes which led the project to perform outstandingly or poorly. The main findings are presented below.

### Table 1. Summary of variable significance

<table>
<thead>
<tr>
<th>Influence Variable Factor</th>
<th>r</th>
<th>$\chi^2$</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1. Client goals / criteria establishment</td>
<td>0.55</td>
<td>14.18</td>
<td>$p&lt;0.001$</td>
</tr>
<tr>
<td>V2. Contractor involvement and enthusiasm</td>
<td>0.34</td>
<td>0.15</td>
<td>No sig.</td>
</tr>
<tr>
<td>V3. Project team adaptability performance</td>
<td>0.33</td>
<td>5.25</td>
<td>$p&lt;0.02$</td>
</tr>
<tr>
<td>V4. Client authority performance</td>
<td>0.46</td>
<td>5.44</td>
<td>$p&lt;0.01$</td>
</tr>
<tr>
<td>V5. Project manager capabilities and experience</td>
<td>0.31</td>
<td>5.77</td>
<td>$p&lt;0.01$</td>
</tr>
<tr>
<td>V6. Project manager goal commitment</td>
<td>0.22</td>
<td>1.12</td>
<td>No sig.</td>
</tr>
<tr>
<td>V7. Project team atmosphere</td>
<td>0.30</td>
<td>0.43</td>
<td>No sig.</td>
</tr>
<tr>
<td>V8. Project manager authority/influence</td>
<td>0.24</td>
<td>4.41</td>
<td>$p&lt;0.02$</td>
</tr>
<tr>
<td>V9. Project team decision participation</td>
<td>0.29</td>
<td>7.08</td>
<td>$p&lt;0.001$</td>
</tr>
<tr>
<td>V10. Project manager involvement</td>
<td>0.22</td>
<td>2.10</td>
<td>No sig.</td>
</tr>
<tr>
<td>V11. Project team motivation</td>
<td>0.41</td>
<td>3.02</td>
<td>$p&lt;0.05$</td>
</tr>
<tr>
<td>V12. Scope and work definition</td>
<td>0.50</td>
<td>6.46</td>
<td>$p&lt;0.01$</td>
</tr>
<tr>
<td>V13. Planning efforts</td>
<td>0.33</td>
<td>4.58</td>
<td>$p&lt;0.02$</td>
</tr>
<tr>
<td>V14. Project cost estimate</td>
<td>0.38</td>
<td>3.95</td>
<td>$p&lt;0.02$</td>
</tr>
<tr>
<td>V15. Project objectives</td>
<td>0.42</td>
<td>3.14</td>
<td>$p&lt;0.05$</td>
</tr>
<tr>
<td>V16. Contractor oriented design</td>
<td>0.30</td>
<td>1.94</td>
<td>No sig.</td>
</tr>
<tr>
<td>V17. Project team reviews</td>
<td>0.42</td>
<td>1.88</td>
<td>No sig.</td>
</tr>
<tr>
<td>V18. Designer/contractor selection</td>
<td>0.29</td>
<td>4.58</td>
<td>$p&lt;0.02$</td>
</tr>
<tr>
<td>V19. Communications</td>
<td>0.43</td>
<td>3.12</td>
<td>$p&lt;0.05$</td>
</tr>
<tr>
<td>V20. Reporting systems</td>
<td>0.50</td>
<td>3.68</td>
<td>$p&lt;0.05$</td>
</tr>
<tr>
<td>V21. Regular meetings</td>
<td>0.12</td>
<td>1.58</td>
<td>No sig.</td>
</tr>
<tr>
<td>V22. Design interface management</td>
<td>0.34</td>
<td>3.95</td>
<td>$p&lt;0.02$</td>
</tr>
<tr>
<td>V23. Risk identification</td>
<td>-0.13</td>
<td>0.00</td>
<td>No sig.</td>
</tr>
<tr>
<td>V24. Project control system</td>
<td>-0.15</td>
<td>3.02</td>
<td>$p&lt;0.05$</td>
</tr>
<tr>
<td>V25. Safety</td>
<td>0.54</td>
<td>2.94</td>
<td>$p&lt;0.05$</td>
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</table>

### ANALYSIS AND DISCUSSION

**V1. Establishing project goal and client criteria ($\chi^2 = 14.18$)**

Analysis of the 32 case studies strongly suggests that there is a relationship between project success and the degree of clarity of project goals and client criteria, at a significant level of $P<0.001$. This factor appeared to be mostly association with project management success. Client criteria were also linked with two other variables, namely, ‘clarity of scope of work’ and ‘project planning’. Both of these variables are examined below.

This finding confirms the proverb “if you do not know where you are going, you will probably end up somewhere else”. One of the most common reasons that projects fail, is a lack of clarity regarding the expected outcomes. It is crucial that all key players in a project have a clear understanding of what the project is aimed to produce.

In examining the four most poorly performed projects, there were evidences of a complete lack of client definition and understanding of real project goals that resulted in overrun on time and cost. Further analysis of the case studies also suggests that, clear statement of business requirements is not enough on its own to aid towards achieving a
high level of success. These requirements must be reflected in the clients’ brief and in the project plan.

The analysis of this variable into establishing project goals and client criteria raises some concerns. Firstly, it appears that the essential characteristics of project management philosophy are not always adhered to in the projects. Secondly, the professionals in particular, and the construction industry in general, still need to give more attention to previous findings and research work into the area of establishing project goals. It has been repeatedly concluded that the construction industry must introduce long-term relations with clients by understanding their businesses and establishing their project goals very clearly.

It has to be reported however, that the standard of services given by the construction industry can also be related to the amount of effort expended by the client in establishing the brief. Clients and project team leaders should appropriately be integrated into one project organisational structure [Walker, 1994].

V9. Level of participation in decision making process by the project team ($\chi^2 = 7.08$)

Analysis of the results suggests that there is a strong relationship between team decision-making and project performance at a significant level of $P < 0.001$. A large proportion of projects that performed poorly with respect to time and/or cost also had poor project team decision-making process. For example, from the project documentation of four case studies, it was evident that there was a general lack of commitment within the project team in decisions that had an impact on projects outcome. Likewise in other cases, there was no combined effort to formally involve members of the client organisation as well as designers and contractors in the decision making process.

It has to be stressed that, within the project team, the decision making process also depends on the nature of the project and the leadership style of the project manager. Naturally, construction projects vary in their type, size, nature of the task, level of constructional complexity and technology. Large capital projects coupled with high complexity require a wide range of services and expertise. These features can impress a greater managerial pressure upon the design and construction teams and require different styles of leadership and decision making process in order to optimise success in the building of the project. Moreover, large and complex projects are expected to take longer to build than small and simple projects, and a participative decision making style of leadership with bureaucratic organisation is expected to be more appropriate than a directive style [Bresnen et al., 1986].

V12. Clarity of scope and work definition ($\chi^2 = 6.46$)

Analysis of the results showed that the fifteen most successful case studies (on time and within budget and with high level of quality standard) had a well-defined scope of work that were highly integrated with the clients’ brief. Ten other projects broke down and got off track resulting in time overrun because of some key tasks were not included in the work breakdown structure at the planning stage (see V7 below). This relationship was significant at $P < 0.01$. 
Critical success factors of Project management  833

V5. Project manager characteristics ($\chi^2 = 5.77$)

Nine of the fifteen case studies rated outstanding were managed by highly experienced and skilled project managers. Another 14 case studies that either overran on time or on cost were associated with inexperienced or moderately experienced project managers. Unsuccessful projects were also associated with poor interpersonal skills and a lack of leadership qualities. This relationship was significant at $P < 0.01$. Several other studies such as Munns et al. (1996) have identified this variable as being part of the “soft” skills required by the project manager for delivering outstanding projects.

V4. Client’s organisation ($\chi^2 = 5.44$)

In four of the case studies, the clients’ representatives have adopted a complicated and lengthy decision making procedure that resulted in disruptions and delays throughout the construction process. In another four cases, there were evidences that clients’ representative lacked training and staff development for understanding the role of the client in making decisions resulting in overrun on time. The type of client organisational structure proved to be a crucial factor in similar types of investigations. Naoum and Langford (1987) conducted research into management contracting and found that the failure to capitalise on advantages that management contracting can offer (e.g. speed of the overall building process) sometimes lie within the client’s organisational structure. If clients’ own decision making process is not matched to the speed of management contracting or construction management system, the client may lose the advantages of such a fast track methods. Some clients’ organisation had to modify its procedure and structure in order to suit the procurement system adopted for its project. This is particularly applicable in publicly funded projects. Public clients have public accountability and, therefore, are cautious in making decisions concerning public accounts.

V3. Project team work ($\chi^2 = 5.25$)

A large proportion of the case studies that failed to achieve an outstanding level of performance had some degree of fragmentation among their members. This relationship was significant at $P< 0.02$. This is not surprising as the issue of co-ordination and co-operation between client, consultants and contractors have been a subject of debate for many years. The project manager is seen as the key individual within the project to create a good team spirit within the project environment. Teamwork culture is crucial to project success.

This result underpins a previous research by Munns (1995) into project management success who stated that quality for the clients is greater enhanced with a supportive, mutually trusting relationship with the project team with a maintained full and open exchange of information. Munns concluded that any obstacles to this open relationship must be removed to ensure project success. The development of trust is an important tool for the project manager and the ability to create the correct initial atmosphere for the project. The way in which individuals and groups enter a project is important in determining the final outcome. It is therefore imperative for the project manager to be
aware of the intentions and expectations of team members and how they will shape their behaviour in the project.

Findings of this research into establishing clear project objectives and the importance of project teamwork, correspond very closely with the “partnering” philosophy. Building a partnership is seen as means of achieving successful project management. Partnering appears to be a device that encourages greater integration of the project team and create competitive advantages to all that participate in the project, and its concept provides team building, co-operation and equality, rather than the single sided relationship of adversaries to a project.

V13. Planning and programming techniques ($\chi^2 = 4.58$)

Analysis of the 32 case studies into the relationship between planning techniques and project success, proved to be significant at $P < 0.02$.

Needless to say, planning is one of the key tools towards achieving success. It identifies the major work items, tasks and sub-tasks as well as the resources to accomplish the project goals in the best efficient and productive way. Indeed, every professional and construction manager should be competent and experienced enough to plan construction operations.

Previous studies into the relationship between planning and site productivity resulted in similar conclusions. Sanvido and Paulson (1992) tested empirically the possible utilisation of practical tools, from productivity-improvement field, that can support various theoretical decision-making phases. Their study has demonstrated that jobs, where the planning and control functions were performed at the right level in the site hierarchy, were more profitable, finished sooner and were better constructed than those where the functions were performed at the wrong level. Stukhard (1987) on the other hand suggested that the ability to achieve good performance hinges, primarily, on the attainment of forecasting productivity and manpower levels. Equally essential to project success is the minimisation of construction interference and having an effective field co-ordination and proper planning of the activities.

This assertion was subsequently supported by Naoum (1996) who researched the views of 19 head office personnel and 17 site managers on factors that influence site productivity. 29 factors were discussed with the 36 interviewees under three general headings: (1) managerial factors, (2) motivational and (3) technical. Analysis of Naoum’s research showed that both head office personnel and site managers agreed that “ineffective project planning” can be the most crucial factor which is likely to impair site productivity. Borcherding and Garner (1981) also arrived to a similar conclusion.

V18. The selection process of the building team ($\chi^2 = 4.58$)

Analysis of the 32 case studies suggests that there is a relationship between project success and the process of selecting the designer/contractors at a significant level of $P < 0.02$. Most of the case studies that overran on time and/or cost did not follow a formal pre-qualification process for selecting the professionals. In four cases, inappropriate designers were appointed which were largely based on previous knowledge of the project.
team, or as a result of the clients’ influence of their preferences. Moreover, in four other cases, the contractors were selected on the basis of an approved procurement list that was not project specific and was not updated on a project performance feedback basis.

The tendering and contractual issue has been the subject of debate over the past decade or so and a number of suggestions were proposed for selecting the main contractors. Among the prominent work in this area is the report entitled “Constructing the team” by Latham [1994], which recommended that a pre-qualification questionnaire devised by a public authority should be used for publicly funded projects.

V8. Project manager authority and influence/power ($\chi^2 = 4.41$)

Analysis of the 32 case studies strongly suggests that there is a relationship between project success and the level of authority and influence that the project manager had over the project, at a significant level of P<0.02. This finding can be related to the mechanism of the project management structure. Walker (1996) identified four types of project management structure: conventional, package deal, joint responsibility structure, and pure project management. The level of authority and influence of the project management can also be linked with the overall structure of the project management organisation. The goal of the project can be achieved by a “mandate”. The executive managers of the organisation usually give the mandate to the project manager. Hence, the project manager needs to make sure that he/she has an adequate mandate and resources to complete the project and ensure that the project has a reasonable level of priority within the overall mission of the organisation.

V14. Project cost estimate ($\chi^2 = 3.95$)

Analysis of the 32 case studies into the relationship between cost estimate and project success, proved to be significant at P < 0.02. Those projects who implemented the project management system properly by (phasing and costing the construction work packaged accurately), have achieved an outstanding results. The project management team needs to be highly accurate with cost estimate since there is no single tender stage at which the client can make a decision to go ahead or not, since the system would most likely be let in parallel the client would be committed to the early packages. Because of this feature, the system is unsuitable for clients who know their commitment in advance.

It has to be said, however, that the issue of cost estimate can in some cases be rather puzzling. In every project, it can be questioned whether the estimated cost was correct at the outset of the project. Under this argument, Sidwell (1984) contends that “the client is interested in the early predication of the total amount he will have to pay and the variance between this figure and the final sum”, although the predicted cost is not a guarantee of the final actual cost.

CONCLUSION

The aim of this paper has been to identify the factors that determine the success and failure of the construction project management method of procurement. 32 case studies were examined and analysis of the results seems to suggest that a project can be viewed
as a combination of 4 interdependent sub-systems, driven by the project management team. These sub-systems can be labelled as:

1. The strategic sub-system which contains the factors: (i) establishing project goal and client criteria; (ii) clarity of scope and work definition. This subsystem takes place at the initial stages of the project, when the client and project based organisation have a strategic plan to meet the requirements of the project. A development plan must be very clear and well thought of at the outset of the project.

2. The structural sub-system which contains the factors: (i) client’s organisational structure; (ii) project manager authority and influence and (iii) project team work. In this sub-system, the project will be handled by a rather complex mix of organisations with individuals and groups working together to achieve the client and project goals. There is a need of a clear mechanism for linking and co-ordinating these people and groups together within the framework of their roles, authority and power. Structure can be regarded as the backbone of the organisation and its effectiveness depends on how strong or weak the skeleton of the structure is.

3. The technical sub-system which contains the factors: (i) planning and programming techniques and (ii) project cost estimate and control. Project management can be differentiated from general management by its reliance on specific tools and techniques, also in the way in which it views resources such as time, money and human effort. In this sub-system, the scope of the project will be defined and documented, the work will be allocated to participants, budgets, costs, programmes will be established and procedures will be set in place in order to facilitate effective control.

4. The managerial sub-system which contains the factors: (i) project manager characteristics and (ii) level of participation in decision making process by the project team (i.e. leadership style). The managerial sub-system provides the glue that binds the other sub-systems together into a cohesive whole. It is concerned with managing the roles of the contractors, with managing the client, managing the resources, the project scope and the achievement of the project objectives. It embraces the influence of the sub-systems, using tools to monitor the project status but also to objectively monitor development in terms of value, quality, constructability and risk. These issues often need careful diplomacy when they directly impinge on professional perception.

REFERENCES


