

# A SURVEY OF CONSTRUCTION PROJECT COST AND TIME CONTROL PRACTICES IN THE UK

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**Abstract:** Control is important for the successful delivery of projects. The way cost and time of construction projects are controlled differ from one organisation to another because there are numerous project control techniques in existence. However, there is limited current research surrounding the usage of these techniques by firms. To address this, a questionnaire survey was conducted in the UK aimed at identifying common project control practices in the country. Data was collected through administration of questionnaires to the top 150 construction companies (contractors) by company turnover and the top 100 construction consultancies (consultants) in the UK by the number of professional staff employed and total fee earnings. In total, 250 questionnaires were distributed with a response rate of 44%. The data was analysed using descriptive statistics and Z-test of significance. From the analysis of results Gantt bar chart was revealed as the main planning technique, project cost value reconciliation was revealed as the most commonly used cost control technique. It was also found that more than 90% of respondents frequently or always apply time and cost controls to their projects. The study found that there is no significant difference in project control practices between contractors and consultants in the UK.

**Keywords:** cost control, project management, project overrun, questionnaire survey, time control.

## INTRODUCTION

Control is a major tool in project management; project control involves different areas of a project. According to William and Cooke (1997) control areas which are important to the project involves; the control of time, resources and cost. Projects are usually constrained by factors which may include time, cost and quality performance. Cost and time are especially very important objectives of most projects thus necessitating a form of control to prevent project overruns. Irrespective of the objective being controlled the control cycle usually applied in a project environment involves; making a plan, executing the plan, monitoring and recording actual performance, reporting any variance between actual and planned performance and finally taking some form of corrective action. The control cycle has necessitated the development of various tools, techniques and procedures for project control and as such techniques like earned value analysis, performance evaluation and review technique (PERT), cost-value reconciliation, critical path method (CPM) etc are used by construction professionals to control cost and/or time of projects. These techniques are not used in isolation but in conjunction with various software packages, estimating

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methods, programming techniques etc and all these can be said to form the project control practice of a construction project organisation.

Project cost and time management have been the subject of many studies in years gone past, for example Avots (1983) noted that it is not unusual for complex projects to exceed estimates by 50-100% and suggested the use of cost relevance technique as a tool for more effective management of project cost. Carona *et al.*, (1984) suggested the establishment of an analytical process during project control. Arditi (1985) conducted an extensive research on project time and cost overruns in public sector projects where cost overrun of 110.95% over average estimated project cost were discovered for the 126 projects studied. Shash and Al-abdullatif (1993) carried out a survey of planning techniques used by contractors and the CPM and Ghantt bar chart came out as the most used planning, scheduling and controlling techniques for all types and sizes of projects. Naoum (1994) found out that projects based on traditional contracts registered an average of 8% time overrun compared to an average of 5% for management contracting and an average cost overrun of 7% for traditional contracts and 3% for management contracts.

The above studies have all contributed to the area of project cost and time control but all these studies are mainly outdated with the most recent dating back to at least 15 years ago. Most of these studies are also not specifically devoted project control practices but rather on overruns. The survey by Shash and Al-abdullatif (1993) came close to doing this although the study only focused on planning and scheduling and did not cover cost control techniques. The study also focussed on the practice in Saudi Arabia and not the UK. Egbu *et al.* (1998) study of planning and control practices was focused on the UK, the study revealed the schedule and bar charts as the two most frequently used formal planning and control techniques but this study like the preceding study did not cover cost control techniques or the software packages utilised, the study also only focused on refurbishment projects. A similar study was conducted by Akintoye and Fitzgerald (2000), the study was aimed at finding out the current estimating practices in the UK, the study showed that the three main methods used for cost estimating as estimating standard procedure, comparison with similar projects based on documented facts and comparison with similar projects based on experience but this study was just about estimating practices and not project control practices in totality. Although estimating is a broad discipline in its own right but it is stage within the project control cycle. For example in order to control construction projects there has to be a plan (cost estimate and time schedule) that will serve as the benchmark. This was elaborately explained by Al-AJibouri (2003) as measuring the state of the system, comparing these measurements with the desired state of the system and finally taking corrective action to return the system to its desired state or to minimise some loss of functions. A lack of literature on the practice of project cost and time control in totality other than the available studies on individual aspect of the control process and the need to update the information on cost and time overrun of nearly two decades ago to bring to light the current state of things in the twenty-first century has necessitated the need for the study and this paper.

The objective of this paper is to present the result of a survey conducted to determine construction project cost and time control practices of UK construction companies (contractors) and consulting companies (consultants).

## **RESEARCH METHODOLOGY**

### **Research Survey**

The research methodology employed was a quantitative study achieved through a survey. The survey was conducted with the aid of a structured postal questionnaire. In designing the questionnaire a detailed literature review was initially conducted revealing a lot of issues in the area of study. The issues discovered were critically evaluated in relation to the objectives of the study. A questionnaire was then developed which was made up of 22 questions. The questionnaire was divided into three sections; section one was background information targeted at obtaining information on the general particulars of the respondents and their organisation. The second section was about project planning and time control practices of the respondent and their organisation while the third section was on cost control practices.

A total of 250 questionnaires were administered, 150 to the top contractors in the UK by company turnover and the remaining 100 to top consultants in the UK by the number of professional staff employed and the amount of fee earned by the company. The list of these companies was obtained from the annual league table published by the Building magazine. A total of 68 questionnaires were returned by contractors (45% response rate) and 42 were returned by consultants (42% response rate) making a total of 110 returned questionnaires available for analysis giving a total response rate of 44%. This is quite good for a survey of this type as evident from similar surveys such as Akintoye and Fitzegerald (2000), Kumaaswamy and Chan (1998), and Iyer and Jha (2005) with response rates of 42%, 37%, and 25% respectively.

As the survey was about obtaining information on project control practices within the UK construction industry, it was imperative to ensure that the respondents were those who not only had the experience but also had a broad picture of what the practice is within their organisation. Hence project/construction directors, senior managers, project managers were the preferred respondents. The analysis of the questionnaires revealed that nearly three quarter of the respondents were directors/senior managers in both groups of respondents with 71% of responding contractors being directors/senior managers and 73% of responding consultants being directors/senior managers. As would be expected from their roles, these respondents also had significant years of experience in the construction industry. 64% of responding contractors had more than 25 years experience and 69% of responding consultants also had more than 25 years of experience. This showed that there was great depth in the experience possessed by both groups of respondents.

### **Data Analysis**

The data from the questionnaire was analysed by quantitative means. Quantitative analysis performed included descriptive statistics attained with the use of frequency counts and percentages. SPSS 13.0 was used for all of the analyses. Inferential statistics was also carried out using the z-test of two proportions. The z-test is a statistically test used in inference which determines if the difference between a sample mean and the population mean is large enough to be statistically significant, that is it is unlikely to have occurred by chance. As can be seen from the definition above the Z-test is normally used to test differences between means of two samples but the test can also be test frequencies or percentages. This variation is called a two proportional Z-test. (Kirk, 1999)

## RESULTS AND DISCUSSION

### How Time and Cost of Construction Projects are Estimated

Cost and time of construction projects are controlled with the objective of delivery within a predetermined time and a cost budget. Determining these objectives is the starting point of project control because it serves as a baseline to measure against. As part of this survey, it was deemed necessary to know how contractors and consultants determine the time and cost estimate of their construction projects. In an attempt to do this, respondents were asked to indicate the method(s) used in determining the duration and cost of their construction projects. Table 1 shows the results when respondents were asked how the time duration of their projects are determined, from the table it can be seen that more than half of the responding consultants (53.8%) determine the duration of their construction activities by experience based methods only while just 16.7% of contractor base the method of determining their construction projects on experience only. It can also be seen that 35.7% of contractors determine the duration of their construction projects by techniques based on calculations while just 11.5% of responding consultants indicated this technique. From the table 35.7% of responding contractors indicated that they determine the duration of their projects by a combination of experience and calculations while 23.1% of responding consultants use this technique. A test of statistical significance was conducted on the responses of the contractors and consultants. The Z-test of two proportions was utilised for this which showed that there was no statistical difference in both set of responses apart from the first two set of responses where there was a significant difference in the responses of both groups with regards the questions about use of "experience only" and use of "calculations only" in determining the time/duration of their construction projects.

*Table 1: How duration of construction activities/projects are determined*

	Contractors	Consultants
By experience only	16.7%	53.8%
Techniques based on calculations only	35.7%	11.5%
Combination of calculations and experience	35.7%	23.1%
Other techniques apart from the above	4.8%	7.7%
Do not use any techniques	7.1%	3.8%

*Table 2: How cost of construction projects are estimated*

	Contractors	Consultants
By experience only	2.0%	19.2%
Techniques based on calculations	59.0%	46.2%
Techniques based on combination of calculations and experience	29.0%	27.0%
Other techniques apart from the above	5.0%	8.0%

Table 2 shows the result obtained when respondents were asked about how the cost of their construction projects are determined from the table, only 2% of responding contractors indicated that they determine the cost of their construction projects using methods based on experience only as compared to 19% of responding consultants.

59% of responding contractors determine the cost of their construction projects using methods based on calculation only as compared to 46% consultants. 29% of responding contractors indicated that they determine the cost of their construction projects by methods based on a combination of calculations and experience as compared to 27% of consultants. Testing to see if there is any significance difference in the responses of both groups of respondents, the Z-test of two proportion showed that that all but one of the responses by the contractors and consultants to each question were not statistically different. The only statistically different response was on the use of experience only for estimating project cost.

### **Project Cost and Time Control Techniques**

As mentioned earlier control is one of the major tools of project management, cost and time are important objectives in any project endeavour and various techniques exist for controlling these important project objectives. A literature review was initially done to find out the control methods available for use on construction projects. This was presented to the respondents who were asked to choose the technique(s) they commonly used. The result showed that there is a strong similarity between both groups. Table 3 shows the various techniques used by contractors and consultants in controlling the time duration of construction projects. From the table, 35% of responding contractors indicated that they utilise Gantt Bar Chart and 33% of responding consultants utilise the same technique. 28% of contractors indicated that they use CPM and 34% of consultants use the method. An equal proportion of both groups indicated that they use the milestone date programming technique with 17% of contractors and consultants each indicating that they use this method. 10% of contractors use the program evaluation technique as compared with a close 9% of consultants. This trend reflects even in the less commonly use methods as can be seen on the table. The Z-test of two proportions on each set of responses also showed that there is no statistical significant difference between all set of responses.

The analysis of responses in relation to the techniques used for cost control is presented in table 4 and also shows similarity of responses from both groups. For example 22% of responding contractors utilise project cost value reconciliation so does 20% of consultants. 7% of contractors indicated they use earned value analysis as compared to 11% of consultants, 18% of contractors utilise actual vs. forecasted method and 11% of consultants use this technique. PERT/Cost was utilised by 7% of contractors and by 4% of consultants. Unit costing was utilised by 8% of responding contractors and by 13% of responding consultants. 15% of responding contractors indicated that they utilise overall profit and loss as compared to 16% of consultants. Contract profit and loss was utilised by 17% of contractors and by 10% of consultants while 6% of contractors indicated their use of standard costing so did 14% of responding consultants. The Z-test of two-proportions on each set of responses shows that there is no significant difference between the responses of the contractors and consultants. A comparison of the results obtained here to that conducted 16 years ago by Shash and Al-abdullatif (1993) shows that the CPM and the Gantt bar chart which were the most widely used project control techniques then, still maintain that accolade today and that despite the advancement in technology, techniques like PERT, graphical evaluation and review technique (GERT) and computer simulation have not taken over as the preferred project control techniques.

Table 3: Techniques used for project planning and time control

	Contractors	Consultants
Gantt Bar Chart	35.0%	33.0%
Critical Path Networks/Method (CPM)	28.0%	34.0%
Milestone Date Programming Technique	17.0%	17.0%
Program Evaluation and Review Technique (PERT)	10.0%	9.0%
Precedence Network Diagram (PND)	2.0%	2.0%
Elemental Trend Analysis/Line of Balance (LOB)	5.0%	2.0%
Other techniques apart from the above	5.0%	8.0%

Table 4: Techniques used for project cost control

	Contractors	Consultants
Project Cost-Value Reconciliation	22.0%	20.0%
Earned Value Analysis	7.0%	11.0%
Labour/Plant/Material (actual versus forecast reconciliation)	18.0%	11.0%
Program Evaluation and Review Technique (PERT/COST)	7.0%	4.0%
Leading Parameter Method	-	1.0%
Unit Costing	8.0%	13.0%
Overall profit or Loss	15.0%	16.0%
Profit or loss on each contract at valuation dates	17.0%	10.0%
Standard Costing	6.0%	14.0%

### Software Packages For Project Planning and Control

Table 5 shows the software packages utilised for project planning and control by both contractors and consultants. The table shows that 35% of contractors and 57% of consultants utilise Microsoft projects while 44% of contractors utilise Asta Power project as compared to 19% of consultants. 15% of responding contractors indicated their use of primavera so did 19% of responding consultants. Only 2% of responding contractors utilise Deltek Open plan while 4% of responding contractors and 5% of consultants utilise project Commander.

Table 6 shows the software packages utilised by contractors and consultants for cost control table 5 shows that 15% of responding contractors and 11% of responding consultants use Project costing system (PCS). 20% of contractors use MS Projects and 32% of consultants use the same software. Asta power project found enormous usage with contractors as 15% use the software as opposed to only 5% of contractors using the same software. 8% of contractors indicated that they use Primavera Sure Trak as compared to 5% of respondents. 7% of contractors indicated their use of MS Excel as compared with 3% of consultants. Construction industry software (COINS) found usage with 5% of contractors and 3% of consultants and bespoke/in-house software packages was utilised by the highest proportion in both groups as 29% of contractors indicated its usage as compared to 38% of consultants. The Z test of two proportions on each set of results shows that there is no statistical significant difference between the responses of the contractors and consultants.

Table 5: Software packages used for project planning and time control

	Contractors	Consultants
Microsoft Project	35.0%	57.0%
Asta Power Project	44.0%	19.0%
Primavera	15.0%	19.0%
Deltek Open Plan	2.0%	-
Project Commander	4.0%	5.0%

Table 6: Software packages used for project cost control

	Contractors	Consultants
Project Costing System (PCS)	15.0%	11.0%
Microsoft Project	20.0%	32.0%
Asta Power Project	15.0%	5.0%
Primavera Sure Trak	8.0%	5.0%
Microsoft Excel	7.0%	3.0%
Construction Industry Software (COINS)	5.0%	3.0%
Bespoke/in-house Systems	29.0%	38.0%
WinQS	-	3.0%

### Frequency of Application of Project Controls

The survey also sought to discover how frequently project cost and time control is applied to construction projects in the UK. From table 7 it can be seen that both the responding contractors and responding consultants vastly apply control methods on their projects. 76% of contractors always apply their time control method as compared to 30.8% of responding consultants while 17% of contractors indicated that they frequently apply time control methods so did 50% of consultants. When it comes to cost control 93% of contractors always utilise their cost control method as compared to 69.2% of consultants. From the table it can be deduced that 100% of contractors either frequently or always apply cost control to their projects and an equal proportion of consultants (100%) do the same. The application of cost control is more overwhelming than the application of time control and confirms the suggestions of other researchers like Sohail *et al.* (2002) that construction professionals seem to pay more attention to cost performance of projects than time performance.

### Project Time and Cost Overrun

Project time overrun is predominant in the construction industry; in a bid to determine the proportion of projects that encounter time and cost overrun in the UK, the viewpoint of respondents. The analysis of data is shown in tables 8 and 9. From table 8 the proportion of contractors that experience project time overrun on less than 10% of their projects were 42.9% while that the proportion of consultants in the same category was 30.8%. A similar proportion of responding contractors (42.9%) indicated that they experienced time overrun on 10-40% of their projects but a greater number of responding consultants ( 57.7%) experienced time overrun on a similar proportion

of their projects. Statistical test on their responses using the Z-test indicated that there was no statistical difference between all the set of responses.

*Table 7: Frequency of application of cost and time control by contractors and consultants*

Frequency of usage	Contractors		Consultants	
	Time Control	Cost Control	Time Control	Cost Control
Always	76.0%	93.0%	Always	76.0%
Frequently	17.0%	7.0%	Frequently	17.0%
Rarely	7.0%	-	Rarely	7.0%

Table 9 shows the result for project cost overrun; the analysis of the data gathered did not differ significantly from each other and from the responses relating to time overrun. For example the proportion of responding contractors that indicated experiencing cost overrun on less than 10% of their projects is 48% while the proportion of responding consultants indicating cost overrun on a similar proportion of projects is 30.8%. There is a close convergence between the responses of the responding contractors (33%) and the consultants (30.5%) that had experienced cost overrun on 10-40% of their projects. The test of significance on all the set of responses showed no significant difference. It is important to note that studies by Avots (1983), Arditi (1985) and Naoum (1994) all investigated the amount by which project exceeded cost and time estimates and did not investigate the proportion of projects that encountered cost and time overrun nor the proportion of respondents that had experienced overrun on their projects, so it will be tricky and a bit groundless to compare the results of these studies to the current situation. Despite this, it is clear from this current study that the problem of projects overrunning cost and time is still prevalent these days as it was back in the last couple of decades. Although it would be interesting to know if the magnitude of overrun has now increased or decreased.

*Table 8: Proportion of projects that encounter time overrun*

	Contractors	Consultants
> 90% of Projects	2.4%	3.8%
60 - 90% of Projects	2.4%	1.0%
40 - 60% of Projects	9.5%	7.7%
10 - 40% of Projects	42.9%	57.7%
< 10% of Projects	42.9%	30.8%

**Factors that Determine Choice of Control Systems**

Figure 1 shows the factors that determine the choice of project control system utilised by respondents. Analysis of the questionnaire revealed the most important factor that determines their choice as accuracy and effectiveness which was rated as the most important factor by 35.7% of respondents, this was closely followed by project size and complexity with 35% of respondents indicating this as their most important factor, other factors as rated by respondents in order of their importance are project requirement (21.4%), cost of method (14%), simplicity and ease of use (11.9%) and flexibility of method (7.1%). The survey also embarked on determining which factors



the respondents will least consider when deciding their choice of time control method, cost of control system was rated as the least important factor by 33% of respondents, accuracy and effectiveness of system which was ranked as the most important factor by respondents unsurprisingly was ranked by only 2.4% as their least important factor, this further buttress the fact that accuracy and effectiveness is really held in high esteem when making a decision on the choice of time control method/system to be implemented by construction companies in the UK.

Table 9: Proportion of projects that encounter cost overrun

	Contractors	Consultants
> 90% of Projects	2.4%	7.6%
60 - 90% of Projects	7.1%	7.6%
40 - 60% of Projects	9.5%	15.3%
10 - 40% of Projects	33.0%	30.5%
< 10% of Projects	48.0%	30.8%

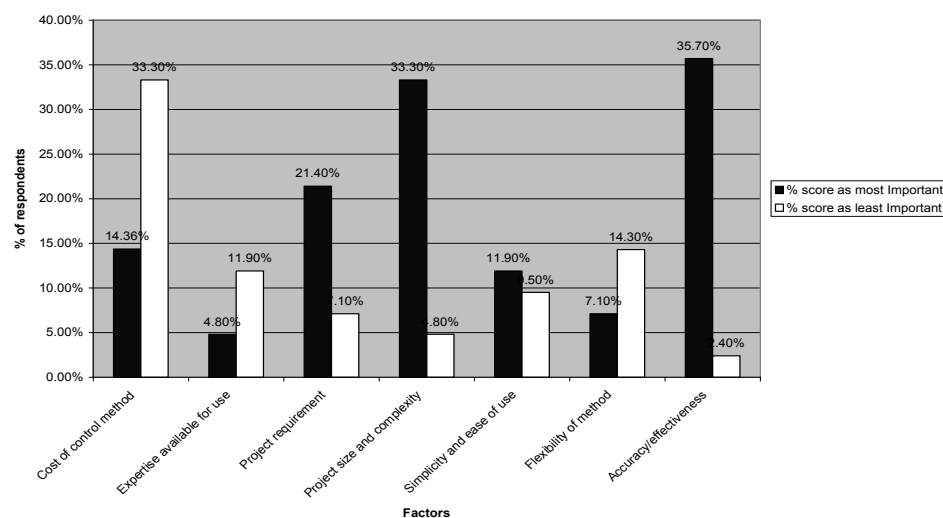


Fig. 1 Most important and least important factors influencing choice of project control system

## CONCLUSION

This study has provided useful information on issues such as magnitude of time and cost overrun, methods of determining construction time and cost, techniques used for construction time and cost control, software packages used for planning and control and the factors that influence choice of control systems.

The paper revealed that the most important technique for planning and time control is Gantt bar chart followed by the critical path method, while the most commonly used techniques for cost control were found to be project cost-value reconciliation and actual versus forecasted reconciliation. It can also be concluded from result of the survey that construction companies in the UK appreciated the importance of project control. This was evident from the survey where 76% of respondents indicated that they always utilise time control methods and 93% of respondents indicated that they always apply their cost control method. Interestingly despite the popularity of the application of control method to construction projects, construction cost and time

overrun were still frequently experienced by the companies surveyed. 57% of contractors and 70% of consultants encounter time overrun on more than 10% of their projects and in relation to cost, 52% contractors and 70% of consultants encounter cost overrun on more than 10% of their construction projects.

Finally, it can be concluded that there is generally a similarity between UK contractors and consultants on various issues relating to their cost and time control practices. They agreed on the magnitude of projects that encountered time and cost overrun as there was no significant difference in their responses. There was also strong similarity in the most commonly used techniques and software packages by both groups both for planning/time control and cost control. This paper has only presented the results and mostly descriptive analysis of a survey and does not detail how these processes are used, how effective they are or the bottlenecks to the project control process in practice and measures that can be implemented to improve cost and time performance of projects; these are currently being researched in a further study.

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