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Cost Escalation And Delays In Construction Industry Using SPSS

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Abstract: ***Cost and schedule overruns can occur due to a widerange of causes on various types of projects. Scheduling is very important in construction industry for reducing and controlling the delay of the project. However, most of the construction projects delays in India were characterized by schedule overrun (Time).Transportation infrastructure development specifically public highway projects remains a major tool for achieving the aspirations of the newly introduced economic principles of the Government of India. However, the importance of this industry and its impact on the national economy, concerns are raised frequently on the poor performances of these projects in terms of time, cost, and quality which directly subjected the construction of these projects to schedule delay, cost overrun, and quality shortfall problems. The objective of this study is to identify the critical factors affecting cost overrun and obtain statistical models using multiple regression and artificial neural networks. Regression models are obtained using SPSS software. Furthermore, the study establishes that contractor's technical staff is insufficient and ineligible to accomplish the project, lack of communication between the construction parties, and unavailability of experienced staff in the owner's and contractor's teams during the project execution are the major factors responsible for causing schedule delay, cost overrun, and quality shortfall respectively. In addition, recommendations for avoiding and overcoming the negative implications of these factors on the performance of the public highway projects.***

Keywords: Cost Escalation, Delays, Construction Industry SPSS

1. INTRODUCTION

Cost and schedule overruns can occur due to a wide range of causes on various types of projects. If project costs or schedules exceed their planned targets, client satisfaction would be compromised. The funding profile would no longer match the budget requirement and further slippage in schedule could result. The resulting effects would be detrimental especially in the case of developing countries whose wealth measure is greatly dependent on their performance in infrastructure provision through the construction industry, especially on road construction projects which constitute a major component of the industry. Cost overruns on government programs frequently attract significant attention from federal agency executive leadership, the Government Accountability Office, Congress, the White House, and even the public at large. One could argue that in the face of shrinking budgets, some federal agencies are incentivized to unrealistically minimize cost and exaggerate maximum technical performance.

The optimistic assumptions associated with the minimum cost/maximum performance precept become integral to program baselines which, lead to cost overruns. As more desirable programs chase decreased Agency funding, the incentive to underestimate program cost increases. Later, when funding shortfalls actually happen, inefficient practices of deferring work, cutting scope and capability, or shifting funding between projects occurs. These shortsighted adjustments, of course, continue to exacerbate cost growth. Cost escalation refers to the increase in the amount of money required to construct a road project over and above the original budgeted amount. In a study to identify factors that cause inaccuracies in cost estimates of highway projects, the Government Accountability Office, found that 77% of highway projects in the USA experienced cost escalation.

Closely aligned with an unrealistic program cost position may be an equally unrealistic, success-oriented schedule. In fact, in the operational reality of project formulation and implementation, a sure-fire path to a cost overrun is an unachievable schedule. However, the relationship between schedule delays and cost overruns is multifaceted. Does a schedule delay always translate into a cost overrun? Are there other aspects of the schedule that contribute to cost overruns, even though a delay is not experienced? Can most cost overruns be traced to root causes in the schedule execution, or are there other explanations? While the authors could not locate a specific source, the view that "80 to 90 percent of cost overruns are due to schedule" is often discussed among project practitioners. While it may be difficult to quantitatively support or refute this view, perhaps an examination of the anecdotal, empirical, and observed data and experiences can shed more light on this claim.

The significance of time and cost in the construction projects is not extensively recognized by the contractors and project managers in some developing countries. Most of the construction projects still have difficulties in preventing delay and cost overrun.

1.1 Objective of the Project

- To investigate the existence of cost and time overrun factors in large construction projects;
- To investigate the reasons for cost and time overrun in construction projects;
- To analyze and tabulate the reasons of delay and cost overrun through factor analysis;
- The main objective of this study is to identify the major causes of delays of building construction projects using a survey.

2. METHODOLOGY

Figure 1. Shows the methodology followed in this study.

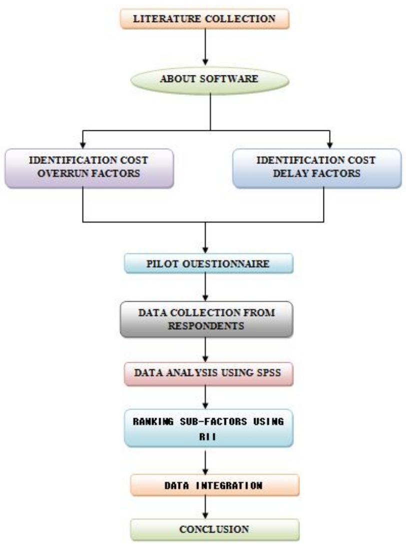

Figure 1 Methodology.

3. COST ESCALATION & SCHEDULING

Delays in construction are caused by several factors. Ahmed et al. (2003) grouped delays into two categories – internal causes and external causes. Internal causes arise from the parties to the contract (e.g. contractor, client, and consultant). External causes, on the other hand, arise from events beyond the control of the parties. These include the act of God, government action, and material suppliers.

- Excusable but non-compensable delay -these are delays caused by occurrences which are not attributable to any of the parties.
- Compensable delay - these delays result from acts or omissions of the owner or someone for whose acts an owner is liable.
- Inexcusable delay - these delays result from a contractor's own fault or his subcontractors or material suppliers.

Scheduling is the laying out of the project activities along a time sequence in which they are to be performed so as to assign the starting and finishes dates to various activities and to allocate resources to them. The schedule is the final product of scope, definition, budgeting, planning and forms the base against which all activities are measured. Project tracking and control cannot be accomplished without a good plan and schedule. By preparing construction project scheduling in advance, you, the owner builder, are able to schedule subcontractors and materials deliveries so that the proper sub and the necessary materials arrive when they are needed, which in turn will allow you to save time, money, and hassle. Construction project scheduling could more aptly be called Construction Schedule Planning as this is where the plan is crafted. It simply shows the sequence of building activities and which ones can be going on at the same time.

3.1 Delay of Project

In construction, delay could be defined as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned schedule and is considered as common problem in construction projects. To the owner, delay means loss of revenue through lack of production facilities and rent-able space or a dependence on present facilities. In some cases, to the contractor, delay means higher overhead costs because of longer work period, higher material costs through inflation, and due to labor cost increases. Completing projects on time is an indicator of efficiency, but the construction process is subject to many variables and unpredictable factors, which result from many sources.

These sources include the performance of parties, resources availability, environmental conditions, involvement of other parties, and contractual relations. However, it is rarely happen that a project is completed within the specified time. One of the most important problem in the construction industry is time and cost overruns. Time and cost overruns occur in every construction project and the magnitude of these delays and cost overruns varies considerably from project to project. So it is essential to define the actual causes of time and cost overruns in order to minimize and avoid the delays and increasing cost in any construction project. This chapter reviews literature concerning the major issues of time and cost overruns in order to recognize the related information regard those issues.

3.2 Time Overrun

Figure 2 shows the Theoretical framework for construction time overrun

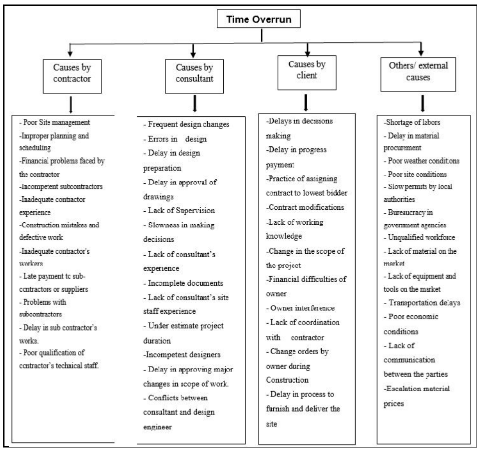

Figure 2 Theoretical framework for construction time overrun

Time overruns is defined as the extension of time beyond planned completion dates traceable to the contractors. Delays are incidents that impact a project's progress and postpone project activities; delay causing incidents may include weather delays, unavailability of resources, design delays, etc.

In general, project delays occur as a result of project activities that have both external and internal cause and effect relationship.

Table 1 Reasons for project time overruns across project lifecycle

STAGES	EXTERNAL ISSUES	INTERNAL ISSUE
Pre-planning	Delay in regulatory approvals	Lack of project managers/commercial managers
	Land/site handover	Lack of cost managers
	Unavailability/delayed availability of funds	Lack of safety officers/enviornmental practitioners
Planning and design	Ineffective procurement planning	Lack of planning engineer/commercial managers
	Delay in regulatory approvals	Lack of MEP engineers
Execution and monitoring	Weak/ineffective project planning & monitoring	Lack of project managers/site managers/planning engineers/quantity supervisors
	Unavailability/delayed availabiilty of funds	Lack of awareness modern equipment &Technology
Closure and handover	Contractual disputes	Lack of commissioning project and site managers audit and total quality management professionals

3.3 Cost Overrun

Cost overrun is defined as excess of actual cost over budget. Cost overrun is also sometimes called "cost escalation," "cost increase," or "budget overrun." Cost overrun is defined as the change in contract amount divided by the original contract award amount .This calculation can be converted to a percentage for ease of comparison.

- This prevents project teams from estimating realistic costs, schedules, and technical risks at the project outset.
- Underestimating technical complexity, whether intentionally or through lack of adequate scope definition. The resulting ill-defined scope increases the cost and schedule.
- Funding instability. Continuous lack of stable funding profiles and solid knowledge of funding for projects force project managers to make decisions that are often inefficient, resulting in cost and schedule growth.
- Limited opportunities for project manager development.

These various studies and observations support the idea that schedule delays and cost overruns are closely related and that while some factors and causes impact both cost and schedule, often problems will first manifest themselves in a time delay which, in turn, leads to cost growth. Figure 3 shows the Theoretical framework for construction cost overrun

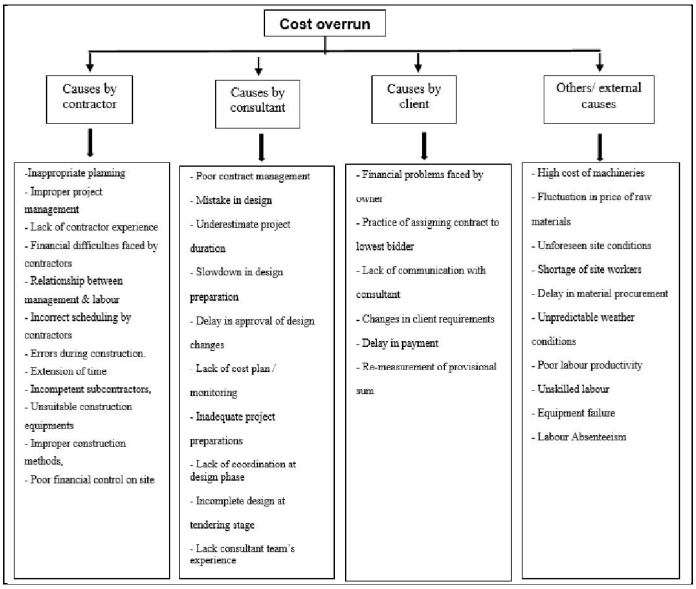

Figure 3 Theoretical framework for construction cost overrun

Critical factors influencing cost overruns are:

- Unpredictable weather,
- Inflationary material costs,
- Inaccurate material estimates,
- Project complexity,
- Lack of information about the site geography,
- Lack of contractors experience on certain type of projects,
- Unfamiliarity with local regulations

Possible causes of cost overruns from the beginning of projects include omission of some items and out-of-date cost estimates. The cost information such as labour rates, equipment rates and material costs used in estimating should be accurate. These can be obtained from historical data, past projects, a proprietary database, or current material costs. It was revealed at the informal discussion had with project participants attached to employer, consultant and contractor organizations that: changes to rules and regulations, delay in issuing instructions and approvals, mistakes in the tender documents, land acquisition issues, delay in relocating utilities, insufficient time for bidders to prepare tenders, delays in making advance payments and other payments, errors in the original measurements and poor document management are some of the important factors that influence the cost overruns in road projects.

3.4 Cost Growth Reasons

- Inadequate Definitions Prior to Agency Budget Decision and to External Commitments.
- Optimistic Cost Estimates/Estimating Errors.
- Inability to Execute Initial Schedule Baseline
- Inadequate Risk Assessments
- Higher Technical Complexity of Projects than Anticipated.
- Changes in Scope (Design/Content).
- Inadequate Assessment of Impacts of Schedule Changes on Cost.
- Annual Funding Instability.
- Poor Tracking of Contractor Requirements against Plans.
- Reserve Position Adequacy.
- Lack of Formal Document for Recording Key Technical, Schedule, and Programmatic Assumptions.

4. PILOT QUESTIONNAIRE

NAME OF INDUSTRY / ORGANIZATION: -----------------
NAME OF SIGNATORY: ---------------------------------------
DESIGNATION: ---
DATE:
PLACE:
SEAL:
SIGNATURE:

4.1 Schedule Delay and Cost Overrun

4.1.1 Consultant Caused Delays

1. Incomplete drawing given by the consultant
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree
2. Late Issuance of instructions by the consultant
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree
3. Mistakes and discrepancies in design documentation?
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree
4. Unclear and inadequate details in drawings?
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree
5. Delay in quality assurance / control?
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree
6. Late in approving and receiving of complete work?
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

4.1.2 Project Related Delays

7. Delay due to the effects of subsurface conditions?
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree
8. Unavailability of utilities in site?
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree
9. Accident during construction?
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree
10. Problem with neighbours in the project location?
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly agree

11. Limited space of construction Area?
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

12. Delay in shifting of long distance to borrow pits?
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

13. Quantity increase over contract during Construction?
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

4.1.3 Cost Influencing Parameters

14. Terrain condition affect the cost overrun?
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

15. Soil & rock suitability / drill ability?
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

16. Material related problem (Transportation, Cost, Handling etc.)
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

17. Payment related problem from owner side
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

18. Poor communication between construction parties
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

19. Climatic condition
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

20. Lack of experience & knowledge of construction parties
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

21. Involvement of more No: of parties (contractor) in single project
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

22. Lack of efficiency of contractor to achieve time goal of project?
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

23. Thickness of various layers in case of flexible pavement (WBM, BBM, BM)
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

24. Conflict among project participants
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

25. Unreliable sources of materials on the local market?
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

5. ABOUT SOFTWARE

SPSS is a widely used program for statistical analysis in social science. It is also used by market researchers, health researchers, survey companies, government, education researchers, marketing organizations, data miners, and others. The original SPSS manual has been described as one of "sociology's most influential books" for allowing ordinary researchers to do their own statistical analysis.[4] In addition to statistical analysis, data management (case selection, file reshaping, creating derived data) and data documentation (a metadata dictionary was stored in the data file) are features of the base software.

5.1 Statistics Included in the Base Software

- Descriptive statistics: Cross tabulation, Frequencies, Descriptive, Explore, Descriptive Ratio Statistics.
- Bivariate statistics: Means, t-test, ANOVA, Correlation (bivariate, partial, distances), Nonparametric tests.
- Prediction for numerical outcomes: Linear regression.
- Prediction for identifying groups: Factor analysis, cluster analysis (two-step, K-means, hierarchical), Discriminate.

The many features of SPSS Statistics are accessible via pull-down menus or can be programmed with a proprietary 4GL command syntax language. Command syntax programming has the benefits of reproducibility, simplifying repetitive tasks, and handling complex data manipulations and analyses. Additionally, some complex applications can only be programmed in syntax and are not accessible through the menu structure. The pull-down menu interface also generates command syntax: this can be displayed in the output, although the default settings have to be changed to make the syntax visible to the user.

They can also be pasted into a syntax file using the "paste" button present in each menu. Programs can be run interactively or unattended, using the supplied Production Job Facility. Additionally a "macro" language can be used to write command language subroutines. A Python programmability extension can access the information in the data dictionary and data and dynamically build command syntax programs. The Python programmability extension, introduced in SPSS 14, replaced the less functional SAX Basic "scripts" for most purposes, although Sax Basic remains available. In addition, the Python extension allows SPSS to run any of the statistics in the free software package R. From version 14 onwards, SPSS can be driven externally by a Python or a VB.NET program using supplied "plug-ins". (From Version 20 onwards, these two scripting facilities, as well as many scripts, are included on the installation media and are normally installed by default.)

SPSS Statistics places constraints on internal file structure, data types, data processing, and matching files, which together considerably simplify programming. SPSS datasets have a two-dimensional table structure, where the rows typically represent cases (such as individuals or households) and the columns represent measurements (such as age, sex, or household income). Only two data types are defined: numeric and text (or "string"). All data processing occurs sequentially case-by-case through the file (dataset). Files can be matched one-to-one and one-to-many, but not many-to-many. In addition to that cases- by-variables structure and processing, there is a separate Matrix session where one can process data as matrices using matrix and linear algebra operations. The graphical user interface has two views which can be toggled by clicking on one of the two tabs in the bottom left of the SPSS Statistics window. The 'Data View' shows a spreadsheet view of the cases (rows) and variables (columns).

Unlike spreadsheets, the data cells can only contain numbers or text, and formulas cannot be stored in these cells. The 'Variable View' displays the metadata dictionary where each row represents a variable and shows the variable name, variable label, value label(s), print width, measurement type, and a variety of other characteristics. Cells in both views can be manually edited, defining the file structure and allowing data entry without using command syntax. This may be sufficient for small datasets. Larger datasets such as statistical surveys are more often created in data entry software, or entered during computer-assisted personal interviewing, by scanning and using optical character recognition and recognition software, or by direct capture from online questionnaires. These datasets are then read into SPSS.

6. SPSS RESULTS

6.1 Factor Analysis

Factor Analysis (FA) is an exploratory technique applied to a set of observed variables that seeks to find underlying factors (subsets of variables) from which the observed variables were generated. For example, an individual’s response to the questions on a college entrance test is influenced by underlying variables such as Intelligence, years in school, age, emotional state on the day of the test, amount of practice taking tests, and so on. Table 1 shows the communalities of the study.

Table1: Communalities

	Initial	Extraction
Delay in quality assurance / control?	1.000	.837
Late in approving and receiving of complete work.?	1.000	.882
Unavailability of utilities in site?	1.000	.844
Quantity increase over contract during Construction.?	1.000	.752
Incomplete drawing given by the consultant	1.000	.764
Late Issuance of instructions by the consultant	1.000	.746
Mistakes and discrepancies in design documentation?	1.000	.731
Unclear and inadequate details in drawings?	1.000	.877
Delay due to the effects of subsurface conditions?	1.000	.929
Accident during construction?	1.000	.791
Problem with neighbours in the project location.?	1.000	.807
Limited space of construction Area?	1.000	.846
Delay in shifting of long distance to borrow pits?	1.000	.887
Terrain condition affect the cost overrun.?	1.000	.853
Soil & rock suitability / drillability.?	1.000	.792
Material related problem	1.000	.909
Payment related problem from owner side	1.000	.822
Poor communication between construction parties	1.000	.892
Climatic condition	1.000	.842
Lack of experience & knowledge of construction parties	1.000	.857
Involvement of more no. Of parties (contractor) in single project	1.000	.883
Lack of efficiency of contractor to achieve time goal of project.?	1.000	.789
Conflict among project participants	1.000	.913

Table 2 shows the total variance explained in the study

Table 2: Total variance explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.247	22.814	22.814	5.247	22.814	22.814
2	3.500	15.219	38.033	3.500	15.219	38.033
3	2.881	12.527	50.560	2.881	12.527	50.560
4	2.007	8.724	59.284	2.007	8.724	59.284
5	1.792	7.792	67.076	1.792	7.792	67.076
6	1.482	6.442	73.518	1.482	6.442	73.518
7	1.223	5.319	78.837	1.223	5.319	78.837
8	1.112	4.837	83.674	1.112	4.837	83.674
9	.760	3.304	86.978			
10	.708	3.080	90.058			
11	.586	2.547	92.605			
12	.521	2.264	94.868			
13	.350	1.520	96.388			
14	.303	1.317	97.705			
15	.189	.823	98.528			
16	.128	.558	99.087			
17	.104	.453	99.540			
18	.088	.381	99.921			
19	.018	.079	100.000			
20	2.503E-16	1.088E-15	100.000			
21	-5.446E-17	-2.368E-16	100.000			
22	-2.756E-16	-1.198E-15	100.000			
23	-1.988E-15	-8.644E-15	100.000			

Table 3 shows the component matrix of the study

Table 3: Component Matrix

	Component							
	1	2	3	4	5	6	7	8
Delay in quality assurance / control?	-.612	.461	-.194	.316	.043	.195	.267	.030
Late in approving and receiving of complete work?	.361	-.150	-.454	-.052	.672	-.058	.193	.166
Unavailability of utilities in site?	.736	.278	.288	.283	-.144	-.073	.189	-.015
Quantity increase over contract during Construction?	.725	-.091	.247	.031	-.083	.190	.245	.231
Incomplete drawing given by the consultant	.400	.154	.061	-.274	.491	-.179	-.456	.141
Late Issuance of instructions by the consultant	-.047	.577	-.466	-.075	.215	-.225	-.279	-.116
Mistakes and discrepancies in design documentation?	-.285	-.257	-.487	.473	.045	.235	.128	.221
Unclear and inadequate details in drawings?	-.491	.421	-.602	.158	-.031	.043	.169	-.202
Delay due to the effects of subsurface conditions?	-.575	-.256	-.220	-.258	.105	.607	-.185	.057
Accident during construction?	.826	-.148	-.004	-.069	-.065	.050	-.058	.269
Problem with neighbours in the project location?	.567	-.126	.064	-.297	-.306	.530	.030	-.053
Limited space of construction Area?	.423	-.056	.146	.671	.230	.349	.050	-.125
Delay in shifting of long distance to borrow pits?	.353	.544	.008	.346	.518	-.007	.064	.273
Terrain condition affect the cost overrun ?	.249	.196	-.327	.089	-.597	-.495	.067	.180
Soil & rock suitability / drillability?	.373	-.317	-.464	-.266	.069	-.133	.492	-.036
Material related problem	-.477	.497	.332	-.481	.116	.121	.085	.241

6.2 One-Way Anova

The answers to the questions are the observed variables. The underlying, influential variables are the factors. Factor analysis is carried out on the correlation matrix of the observed variables. A factor is a weighted average of the original variables. The factor analyst hopes to find a few factors from which the original correlation matrix may be generated. Usually the goal of factor analysis is to aid data interpretation. The factor analyst hopes to identify each factor as representing a specific theoretical factor. Therefore, many of the reports from factor analysis are designed to aiding the interpretation of the factors.

Where μ = group mean and k = number of groups. If, however, the one-way ANOVA returns a statistically significant result, we accept the alternative hypothesis (HA), which is that there are at least two group means that are statistically significantly different from each other. At this point, it is important to realize that the one-way ANOVA is an omnibus test statistic and cannot tell you which specific groups were statistically significantly different from each other only that at least two groups were. To determine which specific groups differed from each other, you need to use a post hoc test. Table 4 shows the ANOVA test results.

Table 4: ANOVA Test results

LSD					
Dependent Variable	(I) Delay due to the effects of subsurface conditions?	(J) Delay due to the effects of subsurface conditions?	Mean Difference (I-J)	Std. Error	Sig.
Late Issuance of instructions by the consultant	Strongly disagree	Netural	-.029	.857	.974
		Agree	-.100	1.224	.936
		Strongly agree	.233	.886	.796
	Netural	Strongly disagree	.029	.857	.974
		Agree	-.071	1.173	.952
		Strongly agree	.262	.814	.752
	Agree	Strongly disagree	.100	1.224	.936
		Netural	.071	1.173	.952
		Strongly agree	.333	1.195	.784
	Strongly agree	Strongly disagree	-.233	.886	.796
		Netural	-.262	.814	.752
		Agree	-.333	1.195	.784
Mistakes and discrepancies in design documentation?	Strongly disagree	Netural	-.114	.654	.863
		Agree	-1.400	.935	.154
		Strongly agree	-.733	.676	.294
	Netural	Strongly disagree	.114	.654	.863
		Agree	-1.286	.896	.170
		Strongly agree	-.619	.621	.334
	Agree	Strongly disagree	1.400	.935	.154
		Netural	1.286	.896	.170
		Strongly	.667	.912	.475

Table 5 shows the multiple comparisons of the study

Table 5: Multiple Comparisons

		agree			
	Strongly agree	Strongly disagree	.733	.676	.294
		Netural	.619	.621	.334
		Agree	-.667	.912	.475
Problem with neighbours in the project location?	Strongly disagree	Netural	-.429	.867	.628
		Agree	-.500	1.238	.692
		Strongly agree	-.167	.896	.855
	Netural	Strongly disagree	.429	.867	.628
		Agree	-.071	1.187	.953
		Strongly agree	.262	.823	.755
	Agree	Strongly disagree	.500	1.238	.692
		Netural	.071	1.187	.953
		Strongly agree	.333	1.208	.786
	Strongly agree	Strongly disagree	.167	.896	.855
		Netural	-.262	.823	.755
		Agree	-.333	1.208	.786

6.3 Reliability Analysis

The ability to meet specific requirements under a specified period. Uncertain parameters modelled by the mean values and the standard deviations and by the correlation coefficients between stochastic variables. The stochastic variables are implicitly assumed to be normally distributed. The reliability index method is an example of a level II method. Table 6 shows the reliability statistics of the study.

Table 6: Reliability statistics

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.542	.488	13

Table 7 shows the item statistics of the study

Table 7: Item statistics

Item Statistics			
	Mean	Std. Deviation	N
Incomplete drawing given by the consultant	2.70	1.380	20
Late Issuance of instructions by the consultant	3.35	1.348	20
Mistakes and discrepancies in design documentation?	3.00	1.124	20
Unclear and inadequate details in drawings?	2.35	.671	20
Delay in quality assurance / control?	2.80	1.281	20
Late in approving and receiving of complete work?	2.65	1.387	20
Unavailability of utilities in site?	3.00	1.487	20
Accident during construction?	2.55	1.276	20
Problem with neighbours in the project location ?	2.25	1.372	20
Limited space of construction Area?	3.50	1.318	20
Delay in shifting of long distance to borrow pits?	2.85	1.694	20
Quantity increase over contract during Construction?	2.30	1.218	20
Terrain conditions affect the cost overrun?	2.65	1.137	20

Table 8 shows the Inter-Item Correlation Matrix with Terrain condition

Table 8: Inter-Item Correlation Matrix with Terrain condition

	Terrain condition affect the cost overrun?
Incomplete drawing given by the consultant	-.070
Late Issuance of instructions by the consultant	.187
Mistakes and discrepancies in design documentation?	.000
Unclear and inadequate details in drawings?	.169
Delay in quality assurance / control?	-.087
Late in approving and receiving of complete work?	-.115
Unavailability of utilities in site?	.218
Accident during construction?	.212
Problem with neighbours in the project location?	.059
Limited space of construction Area?	-.158
Delay in shifting of long distance to borrow pits?	-.001
Quantity increase over contract during Construction?	.080
Terrain condition affect the cost overrun?	1.000

Table 9 shows the Inter-Item Correlation Matrix of the study

Table 9: Inter-Item Correlation Matrix

	Problem with neighbours in the project location?	Limited space of construction Area?	Delay in shifting of long distance to borrow pits?	Quantity increase over contract during Construction?
Incomplete drawing given by the consultant	.097	.116	.340	.150
Late Issuance of instructions by the consultant	-.277	-.252	.278	-.227
Mistakes and discrepancies in design documentation?	-.171	.249	-.055	-.115
Unclear and inadequate details in drawings?	-.272	-.149	.049	-.586
Delay in quality assurance / control?	-.479	-.062	.155	-.297
Late in approving and receiving of complete work?	-.007	.130	.447	.159
Unavailability of utilities in site?	.284	.483	.439	.523
Accident during construction?	.489	.203	.235	.667
Problem with neighbours in the project location?	1.000	.218	-.119	.520
Limited space of construction Area?	.218	1.000	.412	.328
Delay in shifting of long distance to borrow pits?	-.119	.412	1.000	.176
Quantity increase over contract during Construction?	.520	.328	.176	1.000
Terrain condition affect the cost overrun?	.059	-.158	-.001	.080

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6.4 Frequency Analysis

A diagram consisting of rectangles whose area is proportional to the frequency of a variable and whose width is equal to the class interval. A histogram is an accurate representation of the distribution of numerical data. It is an estimate of the probability distribution of a continuous variable (quantitative variable) and was first introduced by Karl Pearson. It is a kind of bar graph. To construct a histogram, the first step is to "bin" the range of values that is, divide the entire range of values into a series of intervals and then count how many values fall into each interval. The bins are usually specified as consecutive, non-overlapping intervals of a variable. The bins (intervals) must be adjacent, and are often (but are not required to be) of equal size. Table 9 shows the statistics of the study.

Table 9: Statistics

		Incomplete drawing given by the consultant	Mistakes and discrepancies in design documentation ?	Delay in quality assurance / control?	Unavailability of utilities in site?	Accident during construction?
N	Valid	20	20	20	20	20
	Missing	2	2	2	2	2
Mean		2.70	3.00	2.80	3.00	2.55
Median		2.50	3.00	3.00	3.00	3.00
Mode		1^a	3	3	1^a	3
Std. Deviation		1.380	1.124	1.281	1.487	1.276

Table 10 shows the Frequency analysis for incomplete drawing given by the consultant

Table 10: Frequency analysis for incomplete drawing given by the consultant

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	22.7	25.0	25.0
	Disagree	5	22.7	25.0	50.0
	Netural	3	13.6	15.0	65.0
	Agree	5	22.7	25.0	90.0
	Strongly agree	2	9.1	10.0	100.0
	Total	20	90.9	100.0	
Missing	System	2	9.1		
Total		22	100.0		

Figure 4 shows graph of the incomplete drawing given by the Consultant

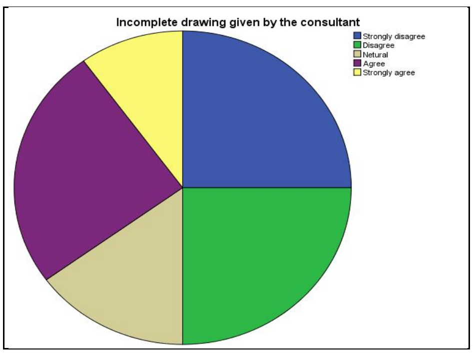

Figure 4 Graph shows the Incomplete drawing given by the Consultant

Table 11 shows the Frequency analysis for Mistakes in design documentation.

Table 11: Frequency analysis for Mistakes in Design documentation.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	9.1	10.0	10.0
	Disagree	4	18.2	20.0	30.0
	Netural	8	36.4	40.0	70.0
	Agree	4	18.2	20.0	90.0
	Strongly agree	2	9.1	10.0	100.0
	Total	20	90.9	100.0	
Missing	System	2	9.1		
Total		22	100.0		

Figure 5 shows the graph of Mistakes in Design documentation.

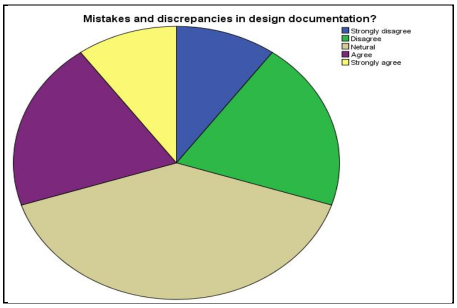

Figure 5 Graph shows the mistakes in design documentation.

Table 12 shows the Frequency analysis for Delay in quality assurance of the study.

Table 12: Frequency analysis for Delay in quality assurance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	22.7	25.0	25.0
	Disagree	1	4.5	5.0	30.0
	Netural	9	40.9	45.0	75.0
	Agree	3	13.6	15.0	90.0
	Strongly agree	2	9.1	10.0	100.0
	Total	20	90.9	100.0	
Missing	System	2	9.1		
Total		22	100.0		

Figure 6 shows the graph of delay in quality assurance.

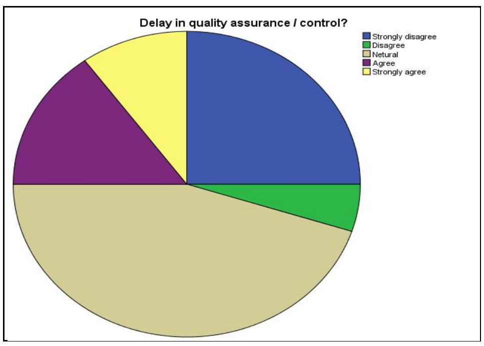

Figure 6 Graph shows the Delay in quality assurance

Table 13 shows the Frequency analysis for Unavailability of Utilities in site

Table 13: Frequency analysis for Unavailability of Utilities in site

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	27.3	30.0	30.0
	Netural	5	22.7	25.0	55.0
	Agree	6	27.3	30.0	85.0
	Strongly agree	3	13.6	15.0	100.0
	Total	20	90.9	100.0	
Missing	System	2	9.1		
Total		22	100.0		

Figure 7 shows the graph of unavailability Utilities in site

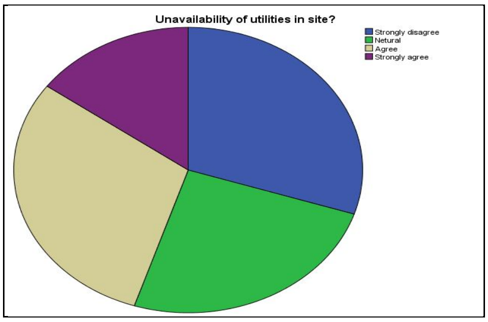

Figure 7 Graph shows the Unavailability of Utilities in site

Table 14 shows the Frequency analysis for Accident During construction

Table 14 Frequency analysis for Accident During construction

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	27.3	30.0	30.0
	Disagree	2	9.1	10.0	40.0
	Netural	9	40.9	45.0	85.0
	Agree	1	4.5	5.0	90.0
	Strongly agree	2	9.1	10.0	100.0
	Total	20	90.9	100.0	
Missing	System	2	9.1		
Total		22	100.0		

Figure 8 shows the graph of accident during construction

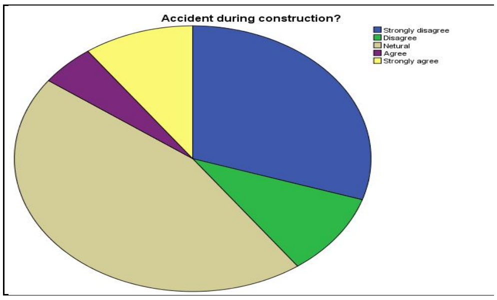

Figure 8 Graph shows the accident during construction

Table 15 shows the Delay in shifting of long distance to borrow pits

Table 15: Delay in shifting of long distance to borrow pits

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	27.3	30.0	30.0
	Disagree	5	22.7	25.0	55.0
	Netural	1	4.5	5.0	60.0
	Agree	2	9.1	10.0	70.0
	Strongly agree	6	27.3	30.0	100.0
	Total	20	90.9	100.0	
Missing	System	2	9.1		
Total		22	100.0		

Figure 9 shows the graph of delay in shifting for this study

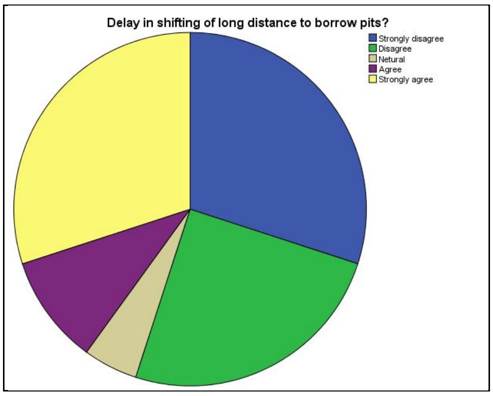

Figure 9 Graph shows the Delay in shifting

7. CONCLUSION

The study sought the views of clients, consultants, and contractors on the relative importance of the factors that cause delays in building construction projects. Organizations and project teams that recognize the factors that may contribute to, or cause, schedule delays and cost growth, and takes steps to reduce or eliminate their impact, are better positioned for project success. Indeed, some of these factors are clearly understood such as discrete risk events, while others are more subtle such as team conflict internally or with a supplier.

- Conduct pause and learn workshops or after action reviews to analyze the reasons and implications for significant schedule delays and cost overruns on projects when significant adverse events occur.
- Implement standardized program planning and control practices that are repeatable and that the entire organization can use.

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