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# Quality-Induced Impacts on Time Overrun, Cost Overrun, Dispute, and Litigation in EPC Contracts

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**Abstract:** This research paper delves into the intricate relationship between quality assurance measures and their consequential effects on time overrun, cost overrun, disputes, and litigation within Engineering, Procurement, and Construction (EPC) contracts of National Highway. Through an extensive qualitative study and in-depth analysis in SPSS, this paper aims to shed light on the critical high risk contract clauses which make project delays, budget overruns, and legal conflicts impacted by quality. The findings presented herein offer valuable insights for stakeholders in the construction industry seeking to enhance project performance and minimize legal liabilities through effective quality control mechanisms. Contractors, consultants, and employees of the authority were handed a questionnaire survey as part of this investigation. Google Forms was used to gather 161 replies. Principal component analysis was used in SPSS to analyse the aforementioned data. The result shows that there are a number of crucial (high risk) contract elements in EPC contracts that could lead to litigation.

**Keywords:** Quality, EPC, litigation, NHAI, SPSS.

## I. INTRODUCTION

The construction industry is fraught with challenges, including time and cost overruns, disputes, and litigation, all of which can significantly impact project outcomes. The construction sector is a pillar of economic growth, making a significant contribution to the development and infrastructure of countries all over the world. Engineering, Procurement, and Construction (EPC) contracts are the foundation of large projects in this dynamic sector because they encompass the complex web of obligations, deliverables, and expectations between project owners and contractors. However, the business is not without its share of difficulties; schedule and expense overruns, disagreements, and litigation frequently surface as persistent problems of concern. The National Highways Authority of India (NHAI) plays a pivotal role in propelling the nation's infrastructure development, overseeing the construction of a vast network of highways and roadways. Within this ambitious endeavor, Engineering, Procurement, and Construction (EPC) contracts form the cornerstone of project execution, delineating the responsibilities and expectations between NHAI and its contractors. However, the landscape of construction projects, even under the aegis of a prestigious organization like NHAI, is not devoid of challenges. Time and cost overruns, disputes, and litigation continue to be recurrent concerns that can significantly impact project outcomes. The significance of this investigation is underscored by the monumental economic investments associated with NHAI projects. Escalating costs, prolonged timelines, and legal entanglements can have significant repercussions on NHAI as well as the broader Indian economy. By unraveling the intricate connection between quality assurance measures and project performance within NHAI's EPC contracts, this research endeavors to equip stakeholders, from contractors to regulatory bodies, with actionable insights to enhance project outcomes and mitigate legal liabilities.

## II. OBJECTIVE OF THE STUDY

To identify high risk contract clauses of EPC contract which have high risk of Time overrun, cost overrun and litigation that were impacted by Quality in National Highway.

## III. LITERATURE SURVEY

A review of many works of literature, was conducted in various journals. A set of guidelines for the use of everyday language in organisational regulations was developed by Kevin Walsh. Appointing and training a reviewer with the responsibility of recognising dubious terminology and alerting the organization's decision-makers to it. establishing red flags and must-have clauses that must be either incorporated into every contract or avoided.

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To learn from and build upon the company's mistakes, locate and collect its lessons learned.(2) The biggest reasons for highway or transportation project delays, according to study by Prasad K.V. et al., were problems with land acquisition and utility-related delays. The results of the study have demonstrated that each project's delays have distinct causes and degrees of importance. To determine the cause of the delay in the settlement of claims during pre-contract negotiations, the creation of sound contract terms, the project timeline, documentation, and records were examined.(3) The allegation's veracity and/or sincerity may be disputed. By focusing management attention to anticipate and address typical problem areas, it is possible to improve claims management and encourage the use of more effective and efficient dispute minimising strategies. (5)Working during the rainy season, flooding, impacts on people's land, awarding the project to the lowest bidder, frequent equipment breakdowns, inadequate contractor technical staff and project teams, poor ground and terrain, delayed progress payments, and low productivity labour are some of these factors. As a general rule, consider the top ten elements of delays as well.(6)It will be vital for drafters/revisers to take into account the criteria described in this study when developing or modifying contract clauses so that project stakeholders can make the most of the available ADR options rather than resort to litigation.(7) There are three primary phases to an issue or conflict before it affects a building project legally. The following are these phases: The first two stages of the claim procedure include claim filing, claim denial, and the failure of a peaceful resolution (Stage 3). Cost overruns or delays in specific building project components are what give rise to a claim that ultimately results in litigation.(4)When legal certainty no longer meets the standards, litigation—which in the past was the initial course of action—will be challenged for judicial review after the district court, high court, and Supreme Court as the final ruling by the aggrieved plaintiff. The benefits of (1) legal certainty, (2) cost, (3) time, and (4) preserving a connection where the decision is final and binding, as well as its confidentiality, make arbitration the preferable course of action. The majority of arbitration panel verdicts can be challenged in court, therefore recently, it has become a last choice. (9)India has a variety of concurrent conflict resolution techniques. Although they are still in their infancy and are not yet commonly employed, Dominant Cause, Apportionment, and other methodologies that are widely used throughout the world have been used in India. (8) Uncertain contract terms, poor contract writing, uneven clause application by various contract parties, a lack of information, and issues with the modification were the top five causes of lawsuits. They continued by stating that inadequate contract documentation and extraneous information are the main reasons why contracting parties disagree. The literature and SCC instances provide examples of these top-ranked classes under the contract and stakeholder categories of the proposed model. The litigation will result in additional expenses (such attorney fees and damage assessments) for the first contract.(10)Every year, a significant amount of time and money is spent trying to settle construction conflicts. To reduce claims and deal with the problems, it is crucial to use the right management plan.(11)Only 8.5% of the projects under review were completed on time and only 7% were completed within budget. Major urban development projects faced the most cost overruns and delays. (12)The interests of the impacted communities have a greater impact on social disputes in the project than internal project interests do. (13)International Journal of Law, Management, and Humanities Traditional dispute resolution processes might be replaced by the idea of alternative dispute resolution (ADR). ADR promises to resolve any issues, including legal, commercial, industrial, and family problems, if negotiations or a compromise are unsuccessful. To promote communication and resolve disputes between the parties, ADR frequently uses unbiased third parties. It is a tactic for upholding interpersonal harmony and reducing hostility between people and groups.(14)Arbitration does not appear to have much of an impact on resolving construction disputes in Kuwait, despite the fact that many disputes that start with arbitration wind up being settled through the court system. (15).By accounting for various claim causes functioning concurrently, the series of models created utilising the frequency of claim causes enabled the prediction of time and cost overruns.(16) The interpretation of the letter and spirit of construction contract conditions is essential in the dispute settlement process. If more than one phrase discusses a particular issue and such phrases overlap, each word must be understood both in the extremely specific context in which it is used and in a holistic manner.(17) The intricacy of using indemnification contract provisions to spread the risk load associated with the architectural, engineering, and construction industries.(18) Arbitration doesn't seem to have much of an impact on resolving building disputes in Kuwait since many matters that begin with arbitration seem to end up in the litigation system..(15)

#### IV. RESEARCH METHODOLOGIES

The approach was used in accordance with Figure No. 1. The diverse respondents' data for the questionnaire survey was gathered using a Google form. Each contractor, consultant, authority, arbitrator, etc. received a separate form. In SPSS, the collected data were analysed. Principle Component Analysis was the approach used. The KMO test and Batletts Test of Sphericity would be examined for sample adequacy. The scree plot reveals a variety of components.

To determine the overall variance, rotated compound matrix, and other information, data were further processed. The rotated compound matrix gives us individual component values. Sort out the component value from higher to lower value with respect to the contract clause.

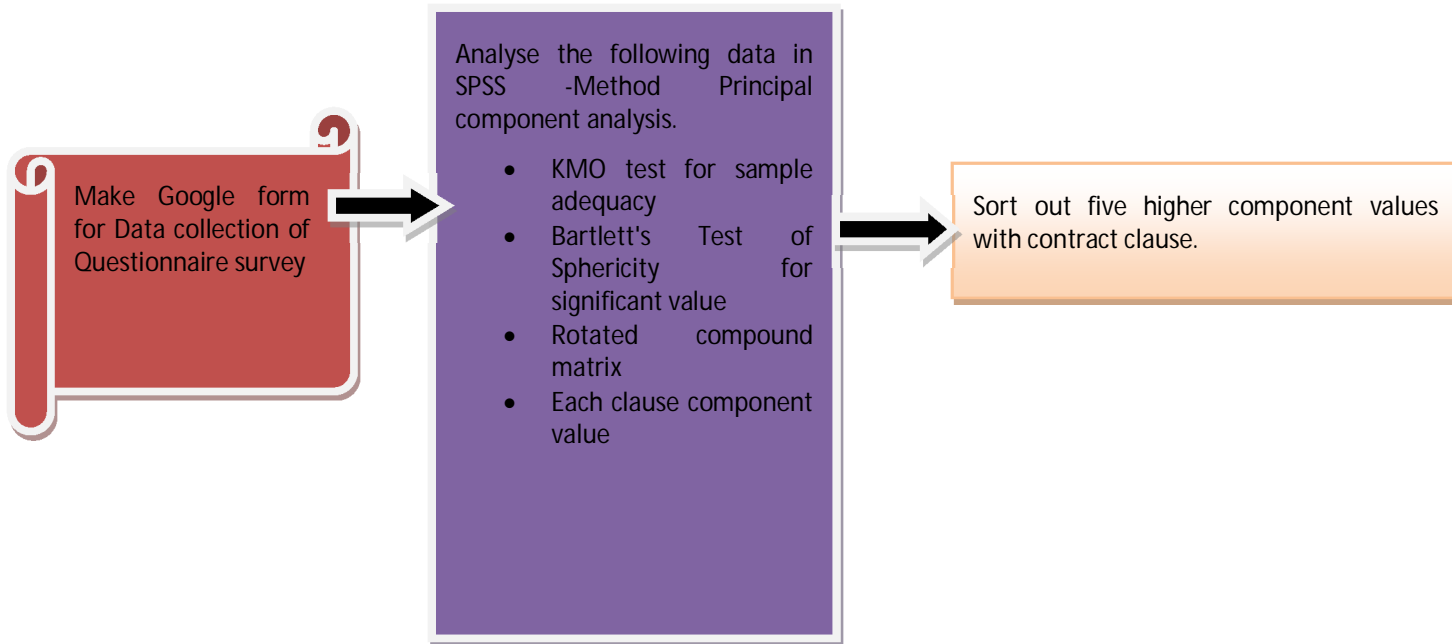


Figure 1 Research methodology

### V. DATA COLLECTION

Through the use of a questionnaire survey, data were gathered. The questionnaire was issued to everyone who is directly or indirectly involved in National Highway EPC projects, including the Arbitrator, Authority personnel, contractors, consultants, etc. There were 27 key questions in the Google form that was created. On a scale of 1 to 5, where 1 is very low, 2 is low, 3 is moderate, 4 is high, and 5 is very high, the responder has provided the impact of time on each contract clause.

There is a summary of the response in Table No. 1. There were 161 total responses. 65 contractors, 47 consultants, 27 personnel of the NH authority, 12 arbitrators, and 10 other people with expertise ranging from two to thirty eight years have contributed their insightful replies.

Table -1 Summary of data response

Sr.No	Type of respondent	No of response	Experience
1	Contractor	65	2 to 38 years
2	Consultant	47	
3	Authority	27	
4	Arbitrator	12	
5	other	10	
		161	

**VI. RESULT AND ANALYSIS**

Principal component analysis was used to analyse the data. By condensing a huge collection of variables into a smaller set that preserves the bulk of the information from the larger set, principal component analysis, or PCA, is a method for lowering the number of dimensions in large data sets.

As the number of variables in a data collection is decreased, accuracy inevitably declines; however, dimensionality reduction can be achieved by trading some accuracy for simplicity. Because there are fewer irrelevant variables to examine, machine learning algorithms can analyse data points far more rapidly and easily with smaller data sets. (19)

SPSS software would be used for analysis. The SPSS software was used to upload all of the data.

The Kaiser- Meyer-Olkin (KMO) test was used to gauge the effectiveness of the sampling. The test result was 0.907, which is greater than 0.7, indicating that the sampling adequacy was adequate. The next test was Bartlett's test, and it was successful because the significance value was 0.00, which is less than 0.5. based on the table no.2

The results of the sphericity tests by Bartlett and Kaiser-Meyer-Olkin (KMO) demonstrate multivariate normality and adequate sampling.(20)

Table -2 Summary of KMO test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.911
Bartlett's Test of Sphericity	Approx. Chi-Square	2487.45
	df	351
	Sig.	0.00

The data was subsequently examined by the researcher as a rotated compound matrix in SPSS. Each component's unique factor and variables are provided in this. Each variable, or contract clause, has a distinct value under each component, according to Table No. 3. The values of all twenty-seven variables are present in the six components.

Table -3 Rotated Component Matrixes

Cl No	Component						Total
	1	2	3	4	5	6	
q25	.760						.760
q24	.737						.737
q22	.732						.732
q23	.730						.730
q26	.717						.717
q27	.697						.697
q20	.695						.695
q21	.652						.652
q19							0.0
q7							0.0
q11		.793					.793
q17		.699					.699
q12		.687					.687
q10							0.0
q18							0.0
q1			.764				.764
q2			.740				.740
q3							0.0
q16							0.0
q15							0.0
q5							0.0
q6							0.0
q14							0.0
q13							0.0
q8						.660	.660
q9						.642	.642
q4							0.0

Extraction Method: Principal Component Analysis.

The variable's value was arranged from highest five value under the condition. The sorted value along with the contract clause are shown in Table 4. Table 4 and analysis show that clauses nos. 11,1,25,2,24 are the five most critical clauses in a contract. A higher component value indicates that the cited clauses are more critical.

Table -4 Summary of more impacted clause

Rank	cl no	Component value	Time impacted Critical contract clause
1	11	0.793	Quality Assurance, Monitoring and supervision
2	1	0.764	Definitions and interpretation
3	25	0.760	Liability and Indemnity
4	2	0.740	Scope of the project
5	24	0.737	Assignment and charges

### VII. CONCLUSIONS

As stated earlier that this research is referred to as EPC clauses in the contract which have high risk of litigation that were impacted by quality.

The 161 responses were collected from the questionnaire survey. Principal component analysis technique used for dimension reduction in SPSS software.

The finding indicates that there are several critical (high risk) contract clauses in EPC contracts for litigation: Quality assurance, monitoring and suspension is the first critical contract clause with a strong impact, according to Table No. 4. Revision& amendment is required of the above time-impacted high risk-critical contract clause to reduce the litigation.

### VIII. FUTURE SCOPES

Effect of a quality parameter in the different contractual models on the national highway.

### IX. CONFLICT OF INTEREST

The corresponding author declares there aren't any competing interests on behalf of the other writers.

### X. LIMITATIONS

This study has two limitations it has considered only the EPC contract of national highways and it focuses only on quality parameter impact.

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