Identification Major Factors Contributing to Delays on Construction Sites using SPSS

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ABSTRACT
Delays in construction projects are a serious difficulty, typically resulting in price overruns, contract conflicts, and worse project quality. This research aims to identify the primary variables leading to construction site delays using the Statistical Package for the Social Sciences (SPSS) for data analysis. The collected data from construction industry specialists using structured questionnaires was then examined for issues like poor project planning, resource limitations, design modifications, and external effects like weather. The investigation aimed to measure the impact of each factor on project schedules, providing a comprehensive understanding of the reasons for delays. Analysed the data using SPSS, applying descriptive and inferential statistical approaches to pinpoint significant delay variables and their significance. The findings revealed that inadequate project management, a lack of competent personnel, and material procurement challenges were among the leading causes of construction delays. The results of this research provide significant information for contractors, project managers, and stakeholders, allowing them to apply proactive delay mitigation techniques. Addressing these essential aspects allows construction projects to have more predictable timeframes and cost-effective results.

Keywords: Delay, Construction, SPSS, Factor Analysis.

1. INTRODUCTION

According to research, the construction industry is critical to the success of any economy. The construction industry is important to the global economy because it creates jobs and contributes significantly to GDP (gross domestic product) [1]. Countries' overall social reputation improves when they effectively complete large construction sector projects that promote health and meet community expectations. If the building industry fails, the global economy will suffer. Over the previous several decades, technological discoveries have triggered a number of evolutionary shifts in the construction industry. Despite extensive scientific research and better management practices, construction projects continue to suffer from delays, conflicts, lost production, poor performance, insufficient coordination, and a variety of other problems. Underperformance in building projects is a worldwide concern. Many writers have used words like "fragmented," "uncertain," "high risk," "low margin," "poor performing," "poor productivity," "over-ambitious," and "hazardous" to describe the building sector [4]. The construction business faces major and difficult challenges, as shown in this diverse graphic. Delays and cost overruns are the two most common concerns in construction projects.Schedule delays cause problems in the vast majority of building projects [5]. The authors refer to an exceeding of the intended project completion date or contractually stipulated date as a "delay" [6, 7]. Deviation from the scheduled schedule is a prevalent issue that affects many projects. We all know that construction projects frequently experience

delays. No economy is immune to project delays, regardless of the size of the building project. Disputes on building sites are an inescapable part of the industry. An ideal method that is unrealistic in practice is to complete a project without disputes [9]. Disputes are an inherent part of building projects, making their occurrence in the construction industry typical. The literature has described conflict in many ways. The necessity to provide the expected results is the root cause of the internal dispute among the project's stakeholders [11]. Disagreement may occur when many people or groups within an organization have opposing aims, opinions, approaches, or interests.Throughout their research, several writers have independently documented D&Cs. The majority of the responsibilities center on determining the root causes, consequences, and control strategies for D&Cs. Elhusseiny et al. [13] conducted research in Egypt to determine the key reasons for delays and how to alleviate them. Elhusseiny et al. [14] looked at the Egyptian construction sector from a different viewpoint and developed a systematic framework to investigate the many reasons for delays. Jonbi et al. [15] examined commercial projects and identified several drivers of delays and related claims. Sunjka and Jacob [16] conducted research on Nigeria's building business. They recognized the key reasons for the delays and their possible impact on the project's outcome. Kraiem and Diekmann [17] identified many types of delays. Aneetha and Kalidindi [18] suggest that a complex web of interconnected elements could potentially delay a building project. Chandu et al. [19] devised an approach to prioritize the causes of schedule overruns in residential construction projects. Similarly, other studies have explored various facets of conflict. Mitkus and Mitkus [20] conducted research to identify the factors that cause disputes in the construction industry. Ng et al. [21] investigated the escalation and development of project conflict. Their investigation also gave insights into the dispute resolution process. Chen et al. [22] conducted a thorough investigation of different conflict types and their effects on project expenses. Elziny et al. [23] conducted a thorough literature study to determine the causes of disagreements and techniques for resolving them. Their research reveals the best ways for balancing opposing interests on building sites. The literature analysis reveals that, among other things, all of this research has examined D&Cs individually. The potential for mutual derivation is the only known relationship between D&Cs. Due to delays, project participants may face barriers in terms of career advancement, interpersonal connections, communication, financial issues, and even legal complications [24], [25]. Although litigation, conflicts, and disagreements may cause delays in construction projects, Aibinu and Jagboro [26] underlined this point.

2. LITERATURE REVIEW

The construction industry is one of the most important sectors for a country's economic growth. More professional options are established. This industry is defined by major structures such as buildings, dams, roads, railroads, and bridges. Any country's economy may profit substantially from an increase in the construction industry's production rate. The project's success is heavily dependent on the manufacturing rate. Nonetheless, the production rate is influenced by a wide range of factors, some predictable and others more enlightening. These concerns have caused a delay in the construction process. While most construction projects follow a similar approach, the causes for delays may vary widely by country due to a variety of factors (e.g., weather, building problems, project location, etc.).

2.1. Types of Delay in Construction Projects

Conflicts, cost overruns, and project failure are all common causes of construction project delays. There are two types of construction delays: excusable and non-excusable. Unexpected circumstances, such as extreme weather, natural catastrophes, or changes in government policy, might explain delays. The contractor may be eligible for a time extension due to these delays, but they cannot incur additional expenses. We do not allow delays caused by factors beyond the contractor's control, such as inadequate project management, insufficient resources, or bad performance. When it comes to time and money, the contractor is often to blame. There are various types of delays, including those that are compensable and those that are not. Compensation delays include material supply, design revisions, and permission delays caused by the owner or customer. Under certain conditions, the contractor may get more time and money. However, delays that are not compensable, especially those caused by neutral factors such as weather, may be acceptable if the only remedy is a delay in the delivery of the promised extension of time with no monetary compensation. Understanding the different forms of delays may help with construction project dispute resolution, risk reduction, and contract preparation.

1. Owner-related causesofdelay
    1. Delay in honoring payment progressively
    2. Delay in the provision or delivery of project site
    3. Slow decision-making process
    4. Errors in design and specifications

5. Lateness in the revision and approval of design documents
6. Poor communication and coordination with contracting parties
7. Difficulties in accessing credit facilities (E.g. Loan)
8. Change orders during construction by owner
9. Conflicts between project joint-owners
10. Indefinite suspension of work by owner
11. Lack of complete documentation before commencement of project
12. Delay in the approval of sample materials

2. Contractor-relatedcausesofdelay
1. Difficulties in project financing
2. Errors during construction
3. Improper planning and preparation during construction project
4. Poor site management and coordination
5. Delays in sub-contractor's work
6. Underestimation or overestimation of the project cost
7. Conflicts between contractor and other parties
8. Delays in the mobilization of workers
9. Regular change of sub-contractor's technical staff
10. Conflicts in sub-contractor's schedule in execution of project
11. Underestimation of the project durations

3. Consultant-relatedcauses of delay
1. Delay in the approval of major changes in the work scope
2. Poor communication and coordination
3. Lack of significant experience ofconsultant
4. Mistakes and discrepancies in contractdocuments
5. Delays in creating design documents
6. Inadequate site survey and datacollection before design
7. Delay in instructions from consultants
8. Back report of the consultant

4. Labor-relatedcausesofdelay
1. Lack/shortage of labors
2. Labor strike
3. Personal conflicts between labors
4. Lack of sufficient skilled labors

5. Materials-related causes of delay
1. Materials procurement difficulties (Lateness)
2. Shortage/lack of materials in the market place
3. Increase/Fluctuation in the prices of materials
4. Delay in the delivery of materials
5. Changes in material types during construction
6. Damage of sorted materials that are needed urgently

6. Equipment-relatedcauses of delay
1. Shortage/lack of equipment
2. Breakdown/Failure of equipment
3. Low level of equipment-operator's skills
4. Challenges with the efficiency and effectiveness of equipment

7. Externalfactors-relatedcauses of delay
1. Unfavorable site conditions
2. Change in weather condition
3. Delay in securing permits
4. Occurrence of accident during construction
5. Introduction of new government policies, regulations, and laws
6. Delay in services provided by utility service providers

3. METHODOLOGY

The conducted an online poll to learn about the causes of delay in construction. A survey that was both comprehensive and easy was developed. There are two sections to the survey. The first section evaluates the survey results, while the second section looks into the variables that contribute to environmental

deterioration. A Likert scale ranging from 1 to 5 is enough for any assessment. Respondents included company owners, designers, site engineers, builders, and quantity surveyors. The survey was sent to businesses, non-profit organisations, and academic institutions. Some were unclear of what to do, while others provided inadequate responses. We reviewed 253 survey forms; 18 were not examined further due to incomplete information. The results were gathered from all replies. There were 253 responses to the survey. We investigated all of the data using structural equation modelling (SEM). The PLS technique uses evaluation and structural equations. Internal models demonstrate the connections between components. Following that, we do SPSS factor analyses. A structured questionnaire was used to identify the variables contributing to project delays. Participants in the poll came from all walks of life and worked in a variety of professions, including construction, transportation, and manufacturing. Respondents provided identifying information (e.g., project job title and years of experience) and used a Likert scale to score the relevance and frequency of different reasons of delays. Furthermore, by asking open-ended questions, participants were able to offer more extensive and informative assessments of their experiences with project delays. The data were examined using both qualitative and quantitative methodologies, such as factor analysis and descriptive statistics. By examining project delays from all perspectives, this comprehensive approach shed light on their complexities and paved the path for more focused methods to management and mitigation.

4. RESULT AND DISCUSSION

4.1 Data Analysis

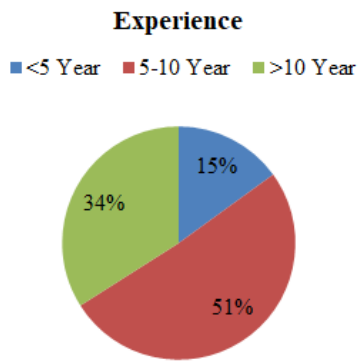

Fig. 1. Experience Information

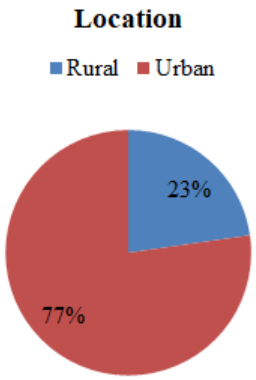

Fig. 2. Location Information

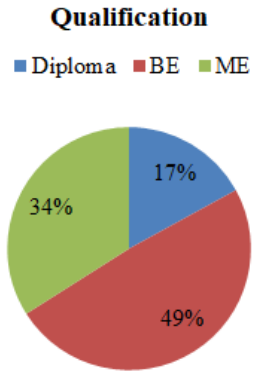

Fig. 3. Qualification Information

Table 1. Analysis of the Causes of delay in construction, including Factor Loadings and the Cronbach's Alpha, RII and Rank

Code	Social Factors	Factor loading	α	RII	Rank
Owner-related causes of delay					
A6	Poor communication and coordination with contracting parties	0.7409	0.9114	0.9197	1
A4	Errors in design and specifications	0.5509	0.9098	0.9177	2
A9	Conflicts between project joint-owners	0.7208	0.9049	0.9157	3
A2	Delay in the provision or delivery of project site	0.7873	0.858	0.9127	4
A8	Change orders during construction by owner	0.6428	0.8989	0.9117	5
A3	Slow decision-making process	0.7431	0.8272	0.9077	6
A1	Delay in honoring payment progressively	0.6458	0.8187	0.8047	7
A12	Delay in the approval of sample materials	0.7873	0.8188	0.7997	8
A10	Indefinite suspension of work by owner	0.8173	0.8052	0.7977	9
A5	Lateness in the revision and approval	0.556	0.9094	0.7947	10

	of design documents				
A7	Difficulties in accessing credit facilities (E.g. Loan)	0.5371	0.7998	0.7887	11
A11	Lack of complete documentation before commencement of project	0.7468	0.9011	0.7737	12
Contractor-related causes of delay					
B5	Delays in sub-contractor's work	0.7286	0.8991	0.9074	1
B3	Improper planning and preparation during construction project	0.5386	0.8975	0.9054	2
B7	Conflicts between contractor and other parties	0.7085	0.8926	0.9034	3
B8	Delays in the mobilization of workers	0.775	0.8457	0.9004	4
B10	Conflicts in sub-contractor's schedule in execution of project	0.6305	0.8866	0.8994	5
B6	Underestimation or overestimation of the project cost	0.7308	0.8149	0.8954	6
B9	Regular change of sub-contractor's technical staff	0.6335	0.8064	0.7924	7
B2	Errors during construction	0.775	0.8065	0.7874	8
B1	Difficulties in project financing	0.805	0.7929	0.7854	9
B4	Poor site management and coordination	0.5437	0.8971	0.7824	10
B11	Underestimation of the project durations	0.5248	0.7875	0.7764	11
Consultant-related causes of delay					
C4	Mistakes and discrepancies in contract documents	0.7163	0.8868	0.8951	1
C6	Inadequate site survey and data collection before design	0.5263	0.8852	0.8931	2
C8	Back report of the consultant	0.6962	0.8803	0.8911	3
C5	Delays in creating design documents	0.7627	0.8334	0.8881	4
C2	Poor communication and coordination	0.6182	0.8743	0.8871	5
C7	Delay in instructions from consultants	0.7185	0.8026	0.8831	6
C3	Lack of significant experience of consultant	0.6212	0.7941	0.7801	7
C1	Delay in the approval of major changes in the work scope	0.7627	0.7942	0.7751	8
Labor-related causes of delay					
D3	Personal conflicts between labors	0.704	0.8745	0.8828	1
D2	Labor strike	0.514	0.8729	0.8808	2
D4	Lack of sufficient skilled labors	0.6839	0.868	0.8788	3
D1	Lack/shortage of labors	0.7504	0.8211	0.8758	4
Materials-related causes of delay					
E4	Delay in the delivery of materials	0.7163	0.8868	0.8951	1
E6	Damage of sorted materials that are needed urgently	0.5263	0.8852	0.8931	2
E2	Shortage/lack of materials in the market place	0.6962	0.8803	0.8911	3
E3	Increase/Fluctuation in the prices of materials	0.7627	0.8334	0.8881	4
E1	Materials procurement difficulties (Lateness)	0.6428	0.8989	0.9117	5

E5	Changes in material types during construction	0.7431	0.8272	0.9077	6
Equipment-related causes of delay					
F2	Breakdown/Failure of equipment	0.7286	0.8991	0.9074	1
F3	Low level of equipment-operator's skills	0.5386	0.8975	0.9054	2
F4	Challenges with the efficiency and effectiveness of equipment	0.7085	0.8926	0.9034	3
F1	Shortage/lack of equipment	0.775	0.8457	0.9004	4
External factors-related causes of delay					
G2	Change in weather condition	0.7532	0.9237	0.932	1
G5	Introduction of new government policies, regulations, and laws	0.5632	0.9221	0.93	2
G4	Occurrence of accident during construction	0.7331	0.9172	0.928	3
G3	Delay in securing permits	0.7996	0.8703	0.925	4
G1	Unfavorable site conditions	0.6551	0.9112	0.924	5
G6	Delay in services provided by utility service providers	0.7554	0.8395	0.92	6

4.2 Quality and Model-Fitness Indices

1. **The path coefficient on average (APC) = 0.931**
   - (A route coefficient value of 0.90 or above is deemed acceptable and a good match.)
2. **R^2 Value = 0.928**
   - R2 always has a value that is somewhere between 0% and 100% of the total.
   - A model that has an R2 value of 0% does not take into account any of the variability in the response variables that comes from outside of the sample. It is possible to make predictions about both the regression model and the dependent variables by looking at their means.
   - It is reasonable to conclude that a model with a fit statistic of one hundred percent adequately accounts for all outliers in the response distribution.
   - If the R2 value is higher, it suggests that the regression model provides a better fit for the data.
3. **Goodness of Fit Index**
   - (GoF) Value =0.134
   - The integrity of fit (GOF) metric is used to guarantee that the model properly reflects experimental data. On a scale of 0 to 1, 0.10 (little), 0.25 (middle), and 0.36 (big) show general agreement with the method model. A good model fit indicates that a model is compact and viable.

4.3 Relative Importance Index

To aid in the review, SPSS was used to analyze the outcomes of eleven surveys. Table 3 displays the analysis's ranking of Navale Bridge accident-related causes and elements by predicted criticality as assessed by the Relative Importance Index (RII) using condition.

Where: W represents the respondents' weighting of each aspect, and its value may range from 1 to 5 (with 1 indicating "strongly disagree" and 5 indicating "strongly agree"). The letter A represents the highest possible weight, which in this case is 5, and the number N represents the total number of respondents.

4.4 Reliability Statistics

SPSS was used to determine sample size dependability. The values might be 0 or 1. This survey result is 0.811, which is more than 0.6 and very close to 1, suggesting that the sample size of the questionnaire is sufficient and reliable.

4.5 Factor Analysis Information Feasibility

The Kaiser-Meyer-Olkin (KMO) and Bartlett tests of sample adequacy supported factor analysis. Factor analysis questionnaire surveys using Bartlett's Test of Sphericity scales KMO 1 is more than 0.5, and the average is 0.715. This demonstrates the significance of factor analysis. This ensures variable homogeneity

and the data validity of factor analysis. Factor analysis is relevant to the variables since Bartlett's Test of Sphericity obtained a p-value (Sig.) of 0.05 at 95% significance.

Table 2. Key Factor Analysis using SPSS

Key Causes Identifies by Factor analysis using SPSS	
Owner-related causes of delay	• Poor communication and coordination with contracting parties • Errors in design and specifications • Conflicts between project joint-owners • Delay in the provision or delivery of project site • Change orders during construction by owner
Contractor-related causes of delay	• Delays in sub-contractor's work • Improper planning and preparation during construction project • Conflicts between contractor and other parties • Delays in the mobilization of workers • Conflicts in sub-contractor's schedule in execution of project
Consultant-related causes of delay	• Mistakes and discrepancies in contract documents • Inadequate site survey and data collection before design • Back report of the consultant • Delays in creating design documents
Labor-related causes of delay	• Personal conflicts between labors • Labor strike
Materials-related causes of delay	• Delay in the delivery of materials • Damage of sorted materials that are needed urgently • Shortage/lack of materials in the market place
Equipment-related causes of delay	• Breakdown/Failure of equipment • Low level of equipment-operator's skills
External factors-related causes of delay	• Change in weather condition • Introduction of new government policies, regulations, and laws • Occurrence of accident during construction

5. CONCLUSION

By analyzing data from surveys, interviews, or project records, SPSS often identifies the most significant reasons for delays on construction sites. SPSS can reveal relationships between various factors, such as project management inefficiencies, insufficient planning, labor shortages, supply chain issues, weather conditions, and financial constraints, by employing statistical techniques such as factor analysis, regression analysis, and correlation analysis. These statistical tools enable researchers to rank and prioritize the elements that have the greatest influence on building delays.The SPSS analysis's findings provide significant insights into the key areas that require improvement to minimize construction delays. The results may help construction managers and stakeholders address the underlying reasons for delays, such as optimizing project scheduling, guaranteeing timely material procurement, and increasing communication among project teams. Overall, SPSS provides a dependable platform for analyzing complicated datasets and detecting crucial elements that cause construction delays, hence optimizing project schedules and cost efficiency.

Finally, this study looked at the leading reasons for building project delays in the Somaliland construction sector. We used Cronbach's alpha to verify and validate the factors affecting project delays, ensuring internal consistency. Construction delays may be attributable to a range of factors, the most important of which are delays induced by contractors, followed by delays caused by owners, consultants, and materials. Delays caused by human mistake, faulty equipment, and other external causes are the least important. Among the sixteen elements identified as contributing to construction project delays in Hargeisa, survey results indicated that progressive payment honoring was the most relevant factor. This

research mainly helps to better understanding of construction industry delays in Somaliland by conducting a detailed assessment and producing written findings. Important stakeholders in the global construction industry may profit from the study's findings. The study has the potential to improve the construction industry's operations and processes by directing the development of evidence-based metrics and strategies for mitigating the consequences of project delays.

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