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Inappropriate construction equipment delay factors a Structural Equation Modelling (SEM) approach

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ABSTRACT

Construction equipment improvement is a trend in the market, and it has several advantages. Inappropriate construction equipment, on the other hand, creates delays in construction projects, harming the firm's reputation. A lot of studies on overall delay have been undertaken around the world. NonethelessHowever, there is a scarcity of studies on construction delays induced by inefficient construction equipment. The purpose of this article is to look into the reasons that cause construction equipment delays and how they affect the firm's reputation. The issues identified in the focus group interviews and the literature survey were used to create a report. To determine the impact of these factors on the progress of Indian building projects, a questionnaire survey was undertaken. The main constraint was that all 300 replies had to be gathered in person from building professionals in order to avoid skewed results. The positive strength of each factor's link was determined using Pearson correlation coefficients. To check if there was a significant difference between the respondents' firm categories, a t-test was utilised. The effective association between the causes of delays due to improper construction equipment and the effects on the company's reputation was validated using structural equation modelling (SEM). The improper construction equipment elements are associated among themselves and combined to influence the company's reputation, according to all of the components investigated by the SEM analysis. To overcome the ineffective equipment delay issues, recommendations are offered.

Keywords: *Construction Delay; Inappropriate Equipment; Management; Inventory; Equipment Selection; Equipment Replacement*

1. INTRODUCTION

In fact, one of the most typical issues in the construction sector is delays [1]. It is only regarded satisfactory if the project is done within the predicted timetable, achieves the minimum quality criteria, and meets the client's expectations [2]. Construction project delays persist despite many resources aiding the business [3, 4]. To improve the efficiency of the construction sector, it is necessary to investigate the causes of delays [5, 6]. Researchers have been investigating the causes and repercussions of building project delays in a range of methods for years, both around the world and in their own country. The crisis observed by numerous experts in various countries differs from country to country and from project to project in time [7].

According to global research, one of the most important factors influencing the success of building projects over the last decade has been delays caused by the use of ineffective on-site equipment [3]. Massive equipment utilisation has resulted in According to global research, delays caused by poor on-site equipment have been one of the most critical variables determining the success of building projects over the last decade [3]. Massive equipment utilisation has resulted in

However, effective equipment planning, budgeting, optimization, and utilisation of developing modelling approaches are woefully inadequate as a result of the requirement to complete building projects as quickly as feasible. Because poor on-site equipment impacts not only the operation or the total project length, but also the project cost [8] in the present trend, construction equipment preparation and scheduling must be carefully examinedThe availability of a broad variety of specialised equipment on the market, each with a unique design feature, makes it difficult to select suitable equipment with advantageous qualities from a diverse range of options available [9]. The SEM [10] is a multivariate statistical approach for analysing the links between latent variables (delay causes) and observable variables (delay effects) in a model. SEM has a strong potential for solving experience-oriented problems in the construction sector [11] because it can quantify the entire correlations between researched components. To make effective decisions to reduce project completion delays and avoid a negative impact on the firm's reputation, it is critical to understand the

relationship between the causes and effects of delays.

Various studies have investigated the elements driving delays in Indian construction projects using various ranking systems. Delay's impacts have also been examined. However, no research has been done utilising Structural Equation Modeling to validate those components versus effects. This is where the research falls short. In India, this research identifies the elements that influence the use of improper construction equipment as well as the factors that influence corporate reputation. The study's originality is satisfied by the use of SEM to validate the association between the elements driving poor construction management and the firm's reputation.

2. PREVIOUS RESEARCH

The first step in managing the delay is to figure out what's causing it [12]. The task of on-site machinery and equipment is vital to achieving efficiency and productivity with the rapid expansion of infrastructure. This choice is determined by comparing the fleet's equipment to the task at hand.

Equipment Selection Errors

Construction equipment selection is a vital stage in execution and planning since it can hinder progress, incur excessive expenditures, and pose substantial safety hazards. To achieve the estimated prices, quality, and duration of the construction project, as well as to assure active participation of both the individual construction union and the entire construction industry, the appropriate construction equipment must be chosen. [14, 15]. Nonetheless, given the project's absolute failure and the challenging financial circumstances, this selection dilemma involves discovering and picking the best version [16]. Unavailability of replacement parts for imported equipment [17], as well as the disposal of equipment for potential economic projects, a lack of service support for imported equipment, unsuitable climatic conditions for certain equipment, and a lack of a prior record of equipment verification, were all issues related to inappropriate on-site equipment [18, 19].

Inventory Management Errors

The operation of the vital equipment necessitates the use of spare components. The nature of the requirement involves spare part acquisition. Both equipment sellers and service providers must keep spare parts in their inventories to limit the financial and commercial consequences of downtime [20]. When the requirement for onsite equipment emerges, the project manager's insufficient inventory planning of replacement parts causes inconvenience owing to a lack of awareness and neglect. One of the most prevalent reasons of project delays is poor procurement management, which results in the non-availability of spare components when they are needed [21]. In that instance, preventive maintenance on the available equipment must be undertaken in order to track the inventory requirement ahead of time [22]. The following are some of the causes of poor procurement management: Inadequate installation: non-stocking of imported spare parts; equipment idleness owing to spare part importation; Study of non-tracking equipment availability and utilisation [4, 23, 24].

Equipment that isn't being replaced

Due to its age, the equipment is susceptible to typical wear and tear. However, due to financial restrictions, they may not be replaced in a timely manner [25]. When equipment is not replaced on schedule, productivity and efficiency suffer [3, 26–28]. Equipment obsolescence is caused by advancements in the building industry [7, 29]. Another problem influencing the construction project's development is a lack of equipment. Due to a lack of funds, equipment cannot be changed [30–32].

Reputational Damage to the Company

Delays have a detrimental influence on project delivery, resulting in late project completion and operation, as well as a tarnished company reputation [33-35]. In the Ethiopian construction sector, the crucial consequences of the delay assessed in connection to the Relative Importance Index (RII) rank contract termination as the third most important factor.

The most significant cause contributing to the firm's reputation loss [7]. The study found five primary repercussions of the delay in the South African construction business; among the five outcomes, inadequate quality of work and disagreements contributed to the loss of the firm's reputation [28]. Another Tanzanian study on the causes and effects of construction project delays revealed negative social impact as the third most important element that damages a company's brand [36]. Another important effect of delay is cost overruns, which contribute to the firm's reputation damage [37, 38]. Construction delays are a source of contention and litigation, and they have a negative impact on the firm's reputation [39].

While equipment is available on-site, the literature analysis indicated that it is useless and inefficient, lowering production. Imported spare parts are not always available when they are needed. Equipment idleness is also exacerbated by the inability to get imported spare parts. Improper selection of the right equipment, improper inventory management, and failure to repair equipment on time are the three main issues that cause delays due to insufficient equipment. Due to a lack of funding, equipment is not replaced when it is needed. Delays induced by the use of improper equipment on the job site can result in cost overruns, poor social impact, disagreements, and lawsuits. All of these effects have an impact on the firm's reputation.

4. RESEARCH METHODOLOGY

The research design of the study is depicted in Figure 1. A focus group interview was done by scheduling personal interviews with twenty-six plant and machinery procurement managers to chronicle the practical challenges that arise on the construction site. Focus group interviews and literature were used to compile the factors, which were then used to build a questionnaire. A questionnaire study was done, and 300 samples from diverse building specialists were collected. Their questionnaire responses were analysed using SPSS software. The level of correlation within the delay factors was determined using Pearson correlation coefficient analysis. The impact of a firm's reputation loss was determined using the t-test. The t-test was employed to look into the association between

the two types of businesses. The positive association between the parameters and their impact on the firm's reputation was validated using SEM analysis. Recommendations are provided based on the findings to address the issues that are causing the delay.

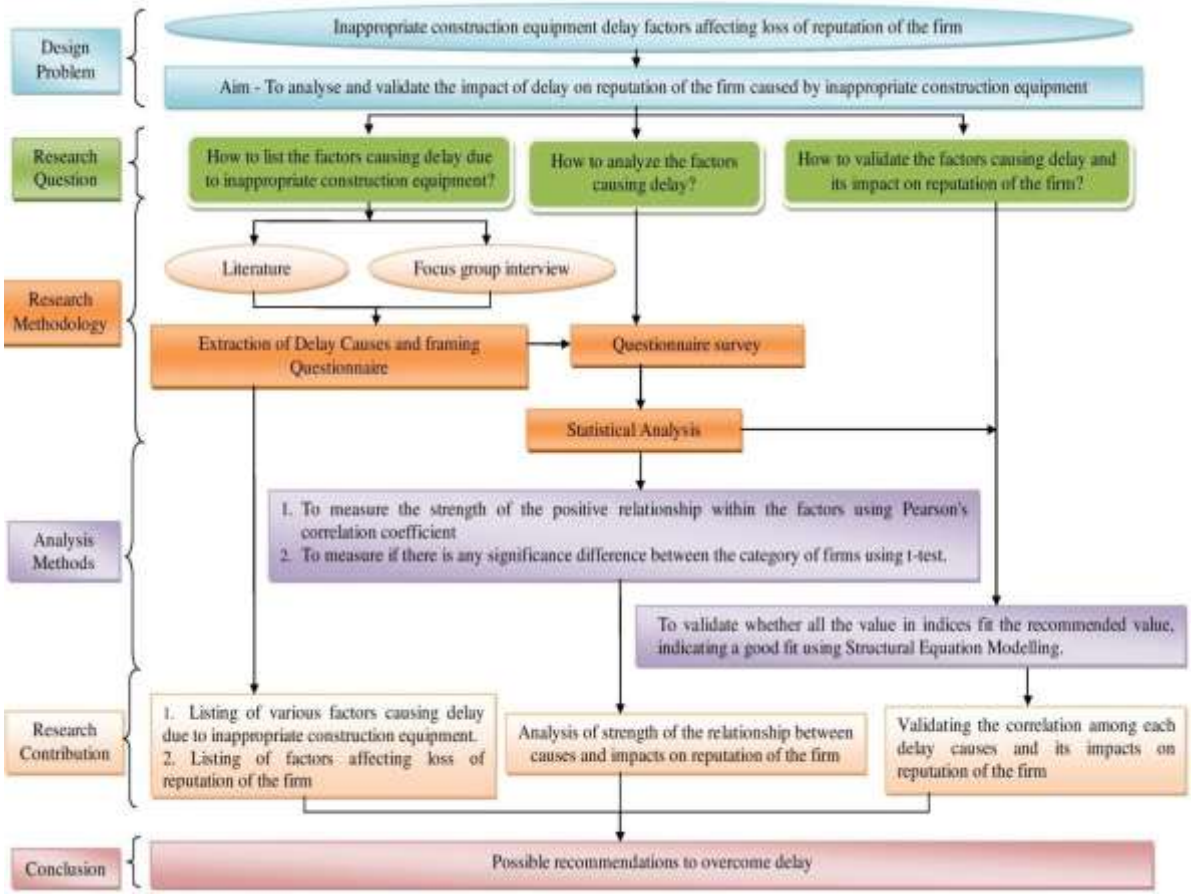

Figure 1. Design of the Study

5. DATA GATHERING

Twenty-six plant and machinery procurement managers were interviewed in a focus group to learn about the current causes of construction equipment delays. The reasons and effects of construction project hindrance owing to improper construction equipment were investigated in one-on-one interviews with each of the specialists. The questions in a questionnaire were grouped into four sections depending on the causes and effects of delay discovered in the focus group interview and literature survey. The questionnaire was examined by two eminent academics and one industry professional. The reviews were double-checked and edited as necessary. Respondents were given the amended questionnaire. A total of 300 answers were received. The survey responses were gathered in person from each respondent using an approved facsimile provided by the company or individual.

Multivariate statistical techniques were used to analyse the responses. The questionnaire responses were graded on a 5-point Likert scale. Improper inventory management, non-replacement of equipment, and improper equipment selection are the three major reasons of delays due to incorrect construction equipment discovered through focus group interviews and a literature research, as shown in Table 1. (1) Non-stocking of imported spare parts (2) Equipment idleness owing to importing spare parts (3) Inadequate installation and (4) Non-tracking of equipment availability and usage research are the causes classified under Improper inventory management. Non-replacement of equipment is caused by the following factors: (5) normal wear with age, (6) low equipment efficiency, (7) obsolescence (outdated equipment), and (8) inadequacy (outdated product design). Improper equipment selection has the following causes: (9) Improper size selection resulting in workspace limits (10) Non-availability of spare parts for imported equipment (11) Demand for qualified operators for specialised equipment (12) Unsuitable for future projects damaging the economy (13) Inadequate service assistance for imported equipment; (14) Unsuitable climatic conditions; and (15) Inadequate study of prior performance. In addition, the impacts of delay on the firm's reputation are classified as follows: (16) Overrun in costs; (17) Negative social impact; (18) Disputes and litigation; (19) Poor job quality; and (20) Contract termination.

Table 1. Causes and Effects of delay

Sl. No	Causes of Delay	Key Factor
1	Imported spare parts are not kept on hand.	
2	Idle equipment due to the importation of spare components.	
	Inventory Management Errors	
3	Insufficient installation	
4	Study of non-tracking of equipment availability and usage	
5	Age-appropriate attire 6 Equipment inefficient	
	Equipment that hasn't been replaced	
7	Obsolescence, or obsolete equipment	

8 Inadequacy, i.e., a product design that is no longer relevant.
9 Inadequate size selection resulting in space constraints
10 Imported equipment spare parts aren't readily available.
11 There is a high demand for experienced operators to operate specialised equipment.
12 For future economic endeavours, it is useless.
Choosing the wrong equipment
13 Inadequate service support for imported equipment 14 Incompatible with the climate
15 There is a lack of historical performance analysis.
Effects of Delay 16 Cost overrun 17
Negative social impact
18 Disputes and litigation
Loss of the firm's reputation 19 Poor quality of work 20
Termination of contract
Since this study was conducted for Indian Context, the sample was collected from various parts of India as given in Table 2.

Table 2. Study Area Locations

Sl. No	Districts	State / Union Territory	No of respondents
1	Chennai	Tamilnadu	54
2	Cochin	Kerala	20
3	Bhopal	Madhya Pradesh	42
4	Ahmedabad	Gujarat	29
5	Portblair	A & N Islands	35
6	Hyderabad	Telangana	20
7	Bangalore	Karnataka	30
8	Mumbai	Maharashtra	44
9	Kolkata	West Bengal	10
10	Amaravathi	Andra Pradesh	16
	Total		**300**

Construction specialists that have worked with construction equipment in the past and on current projects provided the sample. Table 3 shows the frequency of the samples for the following variables: company category, surveyor designation, years of experience, current project type, and current project delay. Because private firms have all designations and personnel with varied degrees of experience, they have a higher response rate than individual enterprises. Individual businesses, on the other hand, have a finite number of employees.

Table 3. Frequency distribution of the collected samples

Category of firm	Frequency	Percent
Private	237	79
Individual	63	21
Designation of Surveyors		
Contractor	36	12
Equipment Dealer	6	2
Equipment Operator	18	6
Engineers	123	41
Project Managers	69	23
Others	48	16
Experience in years		
Up to 5	120	40
6–10	84	28
11–15	39	13
16–20	27	9
Above 20	30	10
Type of the project		
Residential	210	70
Road	9	3
Commercial	81	27
Delay in the current Project (%)		

No delay	144	48
6–10	45	15
11–15	57	19
16–20	48	16
Above 20	6	2
Total	300	100

6. ANALYSIS OF FACTORS

A t-test was utilised to check if there was a significant difference in terms of Inappropriate equipment delay causes between the categories of firms. The results are shown in Table 4. Because the impacts of delay in this study are on the firm's "Reputation," a t-test is employed to see if there is a significant difference between the two groups of firms. As a result, there is no significant difference between the two groups because the P-value is greater than 0.05. the Category of Firms' Mean and SD for the criteria of 'Improper inventory management,' 'Non-replacement of equipment,' and 'Improper equipment selection,' respectively. Whether it's a little business or a large corporation, they all have similar levels of knowledge with the equipment. Both have been seen to have similar equipment-related concerns, causing construction work to be delayed.

Table 4. t-Test Category of firm

Category of firm						
Inappropriate equipment delay causes	**Individual**		**Private**		**T value**	**P value**
	Mean	**SD**	**Mean**	**SD**		
Improper Inventory Management	14.44	2.886	13.75	3.193	0.939	0.350
Non-replacement of Equipment	13.86	3.343	13.40	4.627	0.507	0.613
Improper equipment selection	24.44	5.448	24.80	3.365	0.279	0.781

Table 5. Pearson Correlation Coefficient among Inappropriate equipment delay causes

Inappropriate equipment delay causes	**Improper Inventory Management**	**Non-replacement of Equipment**	**Improper equipment selection**
Improper Inventory Management	1	0.705**	0.589**
Non-replacement of Equipment	-	1	0.642**
Improper equipment selection	-	-	1

The linear relationship between the three elements of delay causes is shown in Table 5. (**) At a 1% level, this is considerable. The rank correlation coefficient of Spearman ranges from +1 to -1. Where +1 represents a perfect positive relationship, -1 represents a perfect negative relationship, and values near zero represent little or no correlation [40]. The correlation coefficient between Inappropriate equipment delay Causes and 'Improper inventory management' and 'Non-replacement of equipment' is (0.705), which indicates a 70.5 percent positive relationship between 'Improper inventory management' and 'Non-replacement of equipment' and is significant at the 1% level. The correlation coefficient (0.642) between components of cause of delay on 'Non Replacement of equipment' and 'Improper equipment selection' reveals a 64.2 percent positive association between 'Non Replacement of equipment' and 'Improper equipment selection,' which is significant at the 1% level. In the previous two situations, the coefficients were larger than 0.6, showing a high correlation coefficient. Because the correlation coefficient (0.589) between'Improper inventory management' and'Improper equipment selection' is less than 0.6, only 58.9% of a positive link is shown, indicating a medium-correlation relationship [11].

Table 6. Mean and SD of Factors affecting delay due to Improper inventory management

Factors affecting delay due to Improper inventory management	**Mean**	**SD**
a. Non - stocking of imported spare parts.	4.044	0.944
b. Equipment idleness due to importing of spare parts.	3.860	0.909
c. Inadequate installation	3.584	0.976
d. Non-tracking of equipment availability and utilization study	3.540	1.039

According to the mean score in Table 6, the main factor affecting project delay due to 'Improper inventory management' is 'Non-stocking of imported spare parts' (4.044), followed by 'Equipment idleness due to importing spare parts' (3.860), 'Non-tracking of equipment availability and utilisation study' (3.540), and 'Inadequate installation' (3.584) are the least important factors.

Table 7. Mean and SD of Factors affecting delay due to non-replacement of equipments

Factors affecting delay due to non-replacement of	**Mean**	**SD**

equipments		
a. Normal wear for age	3.900	0.951
b. Low efficiency of equipment	3.734	0.987
c. Obsolescence i.e. outdated equipments	3.656	1.004
d. Inadequacy i.e. Outdated product design	3.576	1.098

According to the mean score in Table 7, the primary factor causing project delays owing to 'Non-replacement of equipment' is 'Normal wear for age' (3.900), followed by 'Low efficiency of equipment' (3.734). 'Inadequacy i.e. Outdated product design' (3.576) has the least impact on the delay, followed by 'Obsolescence'.
i.e. outdated equipment's' (3.576).

Table 8: Mean and Standard Deviation of Factors Affecting Delay as a Result of Inadequate Equipment Selection

Improper equipment selection causes delays for a variety of reasons.
Mean SD
a. Inadequate size selection, resulting in space limits
3.816 1.043 b. Imported equipment spare parts are unavailable
3.714 0.981 c. Specialized equipment demand for trained operators
3.742 0.951 d. Irrelevant for future economic projects
3.494 1.030 e. Imported equipment lacks service support
3.642 0.963 f. 3.642 0.963 f. 3.642 0.963 f. 3.642 0.963 f. 3.642 0.963 f.
3.510 1.073 g. Inadequate study of previous performance
3.624 1.016

The most important factor influencing project delays due to 'Improper equipment selection' is 'Improper size selection leading to workspace constraints' (3.816), followed by 'Demand of trained operators for specialised equipment' (3.742), 'Non-availability of spare parts for imported equipment' (3.714), and so on. 'Useless for future projects influencing the economy' (3.494) is the least important element causing the project's delay, followed by 'Does not go well with the climatic condition' (3.510), 'Lack of past performance analysis' (3.624), and so on.

Table 9. Mean and SD of Factors affecting Loss of the firm's reputation of the firm

Factors affecting delay due to Loss of the firm's reputation of the firm	**Mean**	**SD**
Cost overrun	3.766	1.011
Negative social impact	3.506	1.090
Disputes and litigation	3.764	0.980
Poor quality of work	3.620	1.109
Termination of contract	3.650	0.972

The most important elements causing Loss of the firm's reputation, according to the mean score in Table 9, are "Cost overrun" (3.766), followed by "Disputes and litigation" (3.764). 'Negative social impact' (3.506) has the least impact, followed by 'Poor quality of work' (3.620).

Results of Structural Equation Modeling
As illustrated in Figure 2, Structural Equation Modelling illustrates how closely the variables of Inappropriate equipment delay, namely "Improper inventory management," "Non-replacement of equipment," and "Improper equipment selection," are interrelated and have an impact on the company's reputation.

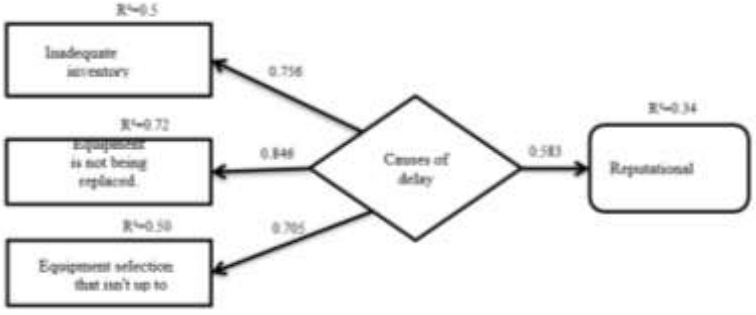

Figure 2. Structural equation model based on standardised coefficient on Inappropriate equipment delay causes

Table 10. Inappropriate equipment delay causes in the Structural Equation Model Analysis

Inappropriate equipment delay causes	Unstandardised coefficient (B)	Standard Error of B	Standardised coefficient	t value	P value
Improper inventory Management	2.241	0.124	0.756	18.142	<0.001**
Non-replacement of equipment	2.651	0.127	0.846	20.922	<0.001**
Improper equipment selection	3.418	0.206	0.705	16.624	<0.001**
Loss of the firm's reputation	3.083	0.234	0.583	13.157	<0.001**

Table 10 illustrates that (**) denotes statistical significance at the 1% level. The leading cause is an unstandardized coefficient of 'Improper equipment selection (3.418),' followed by 'Non-replacement of equipment' (2.651) and 'Improper inventory management' (2.241). The coefficient for 'Loss of the firm's reputation' (3.083) suggests that the causes of improper equipment have a positive impact on it. The goal of a standardised coefficient is to determine the relative contribution of a predictor and an actual variable [41]. Causes of delay are connected with 'Improper inventory management' (B = 0.756, p-value 0.001), 'Non-replacement of equipment' (B = 0.846, p-value 0.001), 'Improper equipment selection' (B = 0.705, p-value 0.001), and 'Loss of the firm's reputation' (B = 0.583, p-value 0.001). No such thing as a negative coefficient exists. All three sources of inappropriate equipment delay are demonstrated to have an influence on a company's reputation in this study.

Table 11. Model fit summary of Structural Equation Model

Indices	Value	Suggested by Hair et al. (2010) [42]
Chi-square value/DF	2.091	<3.00
GFI	0.979	> 0.959
AGFI	0.937	> 0.90
NFI	0.970	> 0.990
CFI	0.972	> 0.955
RMR	0.066	< 0.08
RMSEA	0.039	< 0.08

According to Table 11, the Goodness of Fit Index (GFI) value (0.979) and Adjusted Goodness of Fit Index (AGFI) value (0.937) are greater than 0.959 and 0.9, indicating a good fit. It is found that the calculated Normed Fit Index (NFI) value (0.970) and Comparative Fit Index (CFI) value (0.972) indicate that it is a perfect fit, as do the Root Mean Square Residuals (RMR) value (0.066) and Root Mean Square Error of Approximation (RMSEA) value (0.039).6.

7. DISCUSSION

SEM evaluates the strength of association in both observed and construct variables, according to a Taiwanese study. They discovered how the causes of delay are linked to one another and how they're integrated to affect the effects of delay using SEM. This study was validated by the SEM, which demonstrated the influence of inappropriate equipment delays on the firm's reputation (R2=0.34). In this study [43], the effects of delay, "cost overrun (Rank =1)," "litigation (Rank =3)," "contract termination (Rank =6)," and "increased portfolio of non-performing projects (Rank=7)" on the factor of "loss of firm's reputation." Cost overrun (Rank=2), Disputes (Rank=3), and Litigation (Rank=6) are among the repercussions of delay, according to an Iranian study. Improper inventory management (R2=0.57), non-replacement of equipment (R2=0.72), and improper equipment selection (R2=0.50) all affect the reasons of inappropriate equipment delays. The reasons of delays caused by insufficient equipment are connected, according to this study. According to a study conducted in Hargeisa, "low equipment efficiency" ranks third among the equipment delay factors, contributing to the factor "non-replacement of equipment" [44, 45]. A recent Malaysian study placed 'Improper or insufficient plant and equipment selection' 17th in overall causes of delay [46], supporting the factor 'Improper equipment selection.' 'Equipment unavailability' ranks ninth in Benin and nineteenth in Oman among the total reasons of delay, contributing to the factor 'Improper Inventory Management.' [47-48]. Previous studies have also relied on simple tools like regression, which are inaccurate due to co-linearity and multi-co-linearity effects [27]. The research findings show that absolute fit indices suit the sample data and that the suggested model has an acceptable fit by satisfying the necessary values [36].

8. RECOMMENDATIONS

Although not all causes of equipment delays can be completely eliminated, actions can be taken to reduce the maximum delay by following the following recommendations: a balanced inventory must be maintained to avoid both zero stock and excessive stock, which increases the cost of storing excess spare parts than is required. Changes in project type require time for them to adjust to, resulting in poor planning for obtaining the appropriate equipment. Downtime of equipment must be reduced by detecting and diagnosing the fault during maintenance; quick replacement of equipment with respect to deterioration (normal wear and tear), obsolescence (outdated equipment), and deterioration (normal wear and tear) must be made with respect to deterioration (normal wear and tear), obsolescence (outdated equipment), and deterioration (normal wear and tear) must be made with respect to deterioration (normal wear and tear) and deterioration (

9. CONCLUSION

This study carefully evaluated the reasons for the delays caused by the use of inappropriate construction equipment on the project site through focus group interviews and a literature analysis. Thirteen causes of delay due to inappropriate equipment utilisation were discovered and grouped into three key variables based on focus group interviews and a literature review: 'Improper inventory management,' 'Non-replacement of equipment,' and 'Improper equipment selection.' 'Inadequate equipment selection.' The delay had the following consequences: "Cost overruns; Negative societal impact; Disputes and Litigation; Poor quality of work; and Contract cancellation, resulting in a negative impact on the firm's reputation." These characteristics were presented as questions and distributed to various construction professionals in categories such as firm type, surveyor designation, years of experience, current project type, and current project delay. The indices' values precisely fit the proposed value, suggesting a positive association between Inappropriate equipment delay reasons and the 'Loss of the firm's reputation' factor, according to the SEM. According to SEM, the most sensitive element producing delay is 'Improper equipment selection,' followed by 'Non Replacement of Equipment,' and 'Improper Inventory Management.' As a result, projects must be delivered on time in order to avoid a loss of the firm's reputation. This can be accomplished by enhancing productivity on-site by using proper equipment.

10. LIMITATIONS

This study is limited to inappropriate construction equipment factors alone, despite the fact that there are numerous additional reasons of construction equipment delays, as the 'Inappropriate construction equipment' factor has multiple causes. There are several other impacts of delay, but only the 'Loss of the firm's reputation' has been thoroughly investigated in this study because this issue alone afflicts the country's development on a broad scale. Only a few states have been surveyed because India is such a huge country.

11. FUTURE PERSPECTIVES

By overcoming the study's shortcomings and researching other causes and impacts of equipment delay, future research can be enhanced. The sample size can also be raised by systematically sampling a substantial portion of the population.

12. DECLARATIONS

Contributions of Authors

Research Design, B.I. Conducting questionnaire surveys, analysing and interpreting data; writing—preparation of the first draught; K.Y. : Conducted a focus group interview and analysed and interpreted the results. The published version of the manuscript has been read and approved by all authors.

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Appendix I: Questionnaire Survey

Company Profile
Category of firm:
Type of current project:
Delay in the current project (%):

Respondent's Profile
Name of the Respondent:
Designation:
Experience:
Five Point Likert Scale
5 – Strongly Agree 4 – Agree 3 – Neutral 2 – Disagree 1 – Strongly Disagree

Table A1. Factors affecting delay due to Improper inventory management

Causes	4	3	2	1	0
a. Non-stocking of imported spare parts.					
b. Equipment idleness due to importing of spare parts.					
c. Inadequate installation					
d. Non-tracking of equipment availability and utilisation study					

Table A2. Factors affecting delay due to Non-replacement of equipment

Causes	4	3	2	1	0
a. Normal wear for age					
b. Low efficiency of equipment					
c. Obsolescence i.e. outdated equipment					
d. Inadequacy i.e. outdated product design					

Table A3. Factors affecting delay due to Improper equipment selection

Causes	4	3	2	1	0
h. Improper size selection leading to workspace constraints					
i. Non-availability of spare parts for imported equipment					
j. Demand of trained operators for specialised equipment					
k. Useless for future projects affecting the economy					
l. Lack of service support for imported equipment					
m. Do not go well with the climatic conditions					
n. Lack of past performance analysis					

Table A4. Factors affecting Loss of the firm's reputation of firm

Causes	4	3	2	1	0
Cost overrun					
Negative social impact					
Disputes and litigation					
Poor quality of work					
Termination of contract					

Place and Data: Signature with Company Seal

