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## STUDY ON PAYMENT DELAY OF CONTRACTORS IN CONSTRUCTION PROJECTS

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**Abstract:** The construction industry in India is rapidly expanding and making significant contributions to the country's GDP. Indian construction sector is anticipated to expand at a 6.3% annual pace between 2024 and 2027. When a payment is made late or not in the amounts promised, it poses serious problems for the contractors' cash flow. Several small construction businesses have even gone out of business as a result of late payments. One of the biggest problems, late or delayed payment, can result in disputes between parties, insolvency, project abandonment, and other things. To address the issue, a research paper proposes to find the factors that are affecting to payment delays of contractors. And To determine the correlated relationship for all the barriers taken under the research through SPSS software. The initial stage of the project involves collecting data through a questionnaire form. In this study, offline forms have been sent to various construction stakeholders. In this research, factors are collected through literature papers/ articles and the list of delay factors was evaluated and validated by construction specialists with more than ten years of experience in the region. The collected data is then analyzed using the Relative Importance Index method and statistically using SPSS. This Research study found that Client based factors and Contractor based factors have a correlation coefficient value of 0.758, indicating a strong positive link between the two variables. Based on analyzed data through SPSS & RII we analyzed 10 most significant factors, in which Delay in progress of work and activities was ranked first (mean value 3.39 & RII 0.67869 ) and Design changes during construction were ranked tenth (mean value 3.20 & RII 0.64262 ) which affect payment delay of contractors. This study concludes that Delayed payment would probably result in the contractors having excessive cash flow issues, which will have a terrible ripple effect farther along the contractual payment chain. According to the study's findings, professional organizations and governmental organizations should review and modify the current standard forms of contracts to offer protection, encourage an equitable risk distribution among all parties involved, and give protection. Maybe the issues with late payments might be resolved if the building sector adopted a more professional attitude.

**Index Terms – contractor, delayed payment, late payment, spss software, client, unavailability of funds, subcontractors, poor financial management**

### I. INTRODUCTION

In 2023 and 2024, the gross domestic product of India will grow by 6.0–6.8%, based on the direction of worldwide finance and political developments. Research says that Construction Industry is now expected to increase to 5% in real terms in 2023, down from an earlier forecast of 5.2% growth, according to updated growth projections for the Indian Construction Sector. (Ribeirinho et al. 2020).The Indian construction sector is anticipated to expand at a 6.3% annual pace between 2024 and 2027, encouraged by investments in transportation, energy, and housing projects. Construction of infrastructure is part of the Pradhan Mantri Gati Shakti Master Plan, which was unveiled in the month of October 2021 and is expected to improve economic growth over the next 25 years.

One of the biggest problems, late or delayed payment, can result in disputes between parties, insolvency, project abandonment, and other things. Through excellent communication, careful schedule preparation, and knowledge of the contract agreement, the connection between the parties creates the idea that payment should be secured to avoid any complications in the project. (Chadee et al., 2023) The complexity of large-scale projects demands the flawless multi-tiered coordination of specialized human resources, environmentally friendly materials, technology, and processes within a condensed organizational structure.(Chadee et al., 2023) This strategy is important because it enables the continual development of a building venture in the form of manpower and supplies, leading to the project being completed on time.

Since there is insufficient cash flow to finance construction expenses, specifically for those contractors that aren't economically stable, work progress may be hampered due to delayed payments by clients. Due to a lack of revenue to meet building expenses, late payments from clients may hamper the pace of work, specifically for contractors who aren't in a stable financial position. (Okereke, 2020) (Judi & Abdul Rashid, 2010) The majority of contractors lack the capacity or resources to finish the whole building job before receiving payment. This is particularly true for middle and small-sized contractors. And in certain circumstances, contractors contribute to this scenario by failing to provide enough supporting papers, estimating incorrectly, or failing to follow protocols. Indian

When a payment is made late or not in the amounts promised, it poses serious problems for the contractors' cash flow. Several small construction businesses have even gone out of business as a result of late payments. The practice of well-organized and timely payments in construction projects is one of the most crucial factors that affect a project's success. (Munaaim & Mohd, 2006) Due to the fact that construction projects often take a long time to complete, large quantities of money must be spent, and credit payment terms are frequently used instead of payment upon delivery of materials, the importance of payment is increased. (Wuni et al., 2017)

(Chadee et al., 2023) Based on the majority of consultants and contractors, the projects experienced payment delays from the owner. According to various articles, payment delays from the owner to the contractor generate delays in the contractors' work and cause some problems with productivity. This may also result in disagreements between the owner and the contractor. All of this will have an impact on the overall success of the project.

(Munaaim & Mohd, 2006) By providing social and economic infrastructure, including schools, hospitals, homes, highways, airports, and ports, the construction sector is crucial for generating money and improving people's quality of life. It is interconnected with the entire economy and has a multiplier effect, enabling the growth of other industries. It is crucial to ensure that construction projects are completed effectively and efficiently. Cash flow issues brought on by delays can significantly affect how construction projects are carried out and, as a result, how the nation's infrastructure and built environment are supplied. According to the literature, it is apparent that late payment to contractors can have a significant impact on construction projects and contractors so In this study, which factors are affecting payment delay to the contractor is to be found.

### 1.1. Objective of this research

- To analyze factors from literature papers/articles that affect the payment delay of contractors within the construction sector.
- Determine Improvement methods of factors that are affecting payment delay of contractor

## II. LITERATURE REVIEW

(Munaaim & Mohd, 2006) In order to determine the building industry's failure to pay issues and their effects this article offers data from a survey among Malaysian contractors. The primary causes noted include certification delays, poor financial management by paymasters, regional customs, a lack of effective governance on the part of paymasters, underpayment of certified amounts, and the conventional usage of "pay when paid" provisions in contracts. The results of the study demonstrate how poor payment practices can cause contractors' cash flow issues, stress, and financial difficulty. A right to regular periodic payment, a specified payment deadline, and a quick dispute resolution procedure are remedies for these problems. Another crucial concern with progress payment claims is the promptness of submission, processing, granting interim payments, honouring certifications, and providing interim payments. A stronger perception of professionalism could be able to fix the issue.

(Samuel K Ansah, 2011) In Ghana's construction business, client tardy payments for services rendered on projects are a big source of worry, seriously impacting contractors' cash flow and perhaps putting them in a difficult financial situation. This study found the factors that contribute to payment delays, including inadequate financial management by employers, disputes between the contract's parties, and delays in certification. Enforcing contract provisions for delayed payment, assessing fees for past-due payments, and creating a payment department are all necessary to improve the payment situation.

(Ajayi, 2016) Payment delays can reduce the efficiency of contractors, increase costs, and extend project timelines. According to this study, which used the statistical package for social sciences (SPSS), the reasons for late payments included exaggerated cash flows, claim mistakes, poor financial health, and disagreements about the value of the labor. According to the findings, clients should look for co-investors to back their financial commitment, and stakeholders should collaborate to prevent bottlenecks when deciding how much to pay contractors.

(Wuni et al., 2017) Payment delays have a big impact on how efficiently the government's projects are completed and implemented in Ghana. In this study, a case study sample survey was used to assess and rank the main causes and effects of delays in payments. The findings revealed that eight out of ten reasons for payment delays were deemed significant, with the top five key reasons being certification delays, subpar financial management, client withholding of payment, unclear contractual language, and interpersonal disagreement between the parties. Project abandonment, cost overrun, completion delay, bankruptcy/liquidation, and time overrun were among the 11 consequences that were noted. The report suggested that appropriate payment schedules be established by all stakeholders before the project started, along with regular contact and forewarning of cost overruns.

(Okereke, 2020) Any successful construction project needs financial flow, and contractors' cash flow is more negatively impacted by delayed payments and retention. 100 replies were given in response to 350 surveys, with a response rate of 28.6%. Results indicate that both design and build contracts and conventional procurement contracts with "valuation intervals" and the lag from being committed to making payment designated subcontractually paying" are satisfactory to contractors. It is advised that efforts be directed towards creating new, creative payment methods that will address these problems in light of the unsatisfied payments.

(Haron & Arazmi, 2020) The successful completion of a project is greatly influenced by the practise of timely and effective payment in construction projects. Delays in payment to subcontractors by the contractor and client on construction projects are accepted as a major cause of uncertainty in the Malaysian construction industry due to the potential for severe cash flow issues and financial hardship for construction companies. The study approach used was a questionnaire survey analysis based on the research's results that the major contractor's late payment is when the phrase "pay when paid" is used, while the client's late payment is one of the elements that contribute to the problem. In order to improve the payment situation, contracts must have specific procedures for enforcing payment delays, such as adding a typical contract language that includes assessing late fees.

(Bldr. Basiru Muazu Namaiwa1, Bldr Ashiru Abubakar Sadiq2, 2022) Commercial debt to contractors that is not paid on time is a significant issue in both industrialised and developing nations. This study looked into practical methods for putting a suggested framework into practise in the Nigerian state of Zamfara's construction sector. Using the frequency, percentage, mean, standard deviation, and ranking functions in SPSS software, the data were examined. Because of lack of regulation of the Nigerian procurement statute and standard forms of contract, it has been found that a large number of contractors do not tax rate. To decrease the requirement for contractors to offer unregistered payment and pursue administrators of contracts and customers for payments, it is advised that they turn to charging interest on their outstanding debts.

(Bolton et al., 2022) In the UK, the construction sector frequently has problems with late payments. To study these problems, a research design and survey of 30 chosen projects (355 payments) and 21 subcontractors were conducted. Since there wasn't not a significant relationship between payment delay and contract amount, it was demonstrated that subcontractors were more likely to suffer lengthier payment delays in projects with larger payments. The study also revealed that the release of the second half of the retention faced subcontractors with an even larger difficulty, with a considerable percentage of the money being delayed for over two months after the due date. The results reveal that although legal and contractual processes have endeavoured to tackle the problem, it nonetheless remains and that subcontractors regularly violate them. The Project Bank Accounts, the central retained deposit plan, and smart contracts are current developments that have the potential to eliminate payment delays.

(Chadee et al., 2023) Instable political environments and the slow issuance of variation orders by employers are the major causes of payments being delayed, which is a regular problem in the construction sector. The main reasons for payment delays include a rise in the contractor's debt as well as delays in subcontractor and supplier payments. To help small to medium contracting businesses manage payment holdups, across the globe as well as locally, a risk response framework was created. By educating policymakers and construction professionals about the consequences of delaying approved payments, its subsequent effects and causes, and a risk response technique that reduce the detrimental effects on contractors' funds, this research advances our understanding of construction management. For the confirmatory factor analysis, SPSS was employed and choose the structural equation model with the greatest match.

### III. DATA COLLECTION

Data collection was done to Identify and Analysis various factor affecting payment delay of small and medium contractor in construction projects at Ahmedabad city. Questionnaire was distributed to the respondent through email. Majorly targeted respondent in this study are contractor and other respondent such as client, site engineer, consultant, project manager.

The list of delay factors was evaluated and validated by construction specialists with more than ten years of experience in the region. Validation was done by semi-interview along with a draft questionnaire form. Experts evaluated the content/ questionnaire form and add some factors or remarks about the questionnaire form. An open-ended, Likert scale, and multiple-choice questionnaire survey was then conducted and distributed among different construction professionals. Additionally, some physical questionnaire data was gathered. In this survey form, a total of 30 questions were taken.

#### 3.1 Sample Size Determination

To calculate the sample size of the population, the following equation is used:

$$n = \frac{m}{1 + (m - 1)/N}$$

In this formula n= size of sample

m= 96% confidence level with a margin of error 0.1

therefore m is 87

N= estimated population value

Here 96% confidence level is taken and the sample size for classified stakeholders

According to this formula sample size is 67 and this research study received 61 responses which are 90.16% of the total sample size.

Type of respondent	No of questionnaire filled
Contractor (Class D & E1)	17
Client	10
Consultant	9
Project manger	12
Site engineer	10

Table 1 shows Respondent details

### 3.2 Factors Payment affecting delay of the contractors

Sr No	Factors
Client-based factor	
1	Unavailability of funds
2	Refusal to pay interest on late payment
3	Client's Poor financial management
4	Client's failure to follow the preset procedure
5	Cultural attitudes
6	Client's failure to cultivate a good payment attitude among their employees by wrongfully holding the payment
7	Client failure to understand the contract agreement
Consultant based factor	
1	Lack of coordination of project team activities
2	Consultant failure in treating claims
3	Delay in certification of work done by an architect or contract administration
4	The excess workload on the consultant employees
5	Delays of required documentation needed to full-fill payments
6	Lack of periodical meetings to address payment problems
7	Poor estimation of project cost
Contractor based factor	
1	Contractor failure to do work based on BOQ
2	Contractor's failure to understand the contract agreement
3	Contractor's failure in applying for claims
4	Incomplete documents for variation claims
5	Delay in the progress of works and activities
6	Inaccuracy of estimation
7	Contractor downsizing labor force
8	Contractor's delay in submitting claims
9	Low quality works due to the contractor's uncertain financial condition
Other factor	
1	Rules and regulation changes
2	Economic changes
3	Design changes during construction
4	Miscommunications between client and contractor
5	Sub -Contractors or suppliers refuse to continue providing services
6	Loss of productivity and efficiency
7	Difficulties in procuring materials and equipment

Table 2 shows factors affecting delayed payment of contractors

## IV. DATA ANALYSIS

### 4.1 Primary Data analysis

This analysis begin with frequency analysis method. In this data analysis general information regarding respondent are given. Basic question and answer are mentioned in this questionnaire form.

This chart shows type of respondent. In this questionnaire form respondents is Contractor (Class D & Class E1 Grade), Client, Consultant, Site engineer, Project manager.

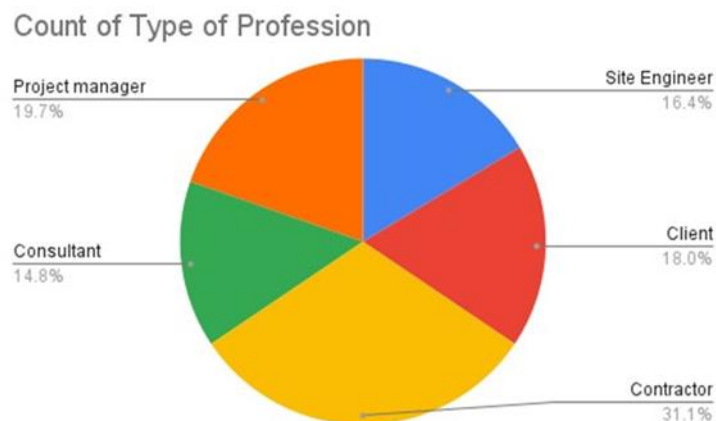


Figure 1 shows Respondent Type of Profession

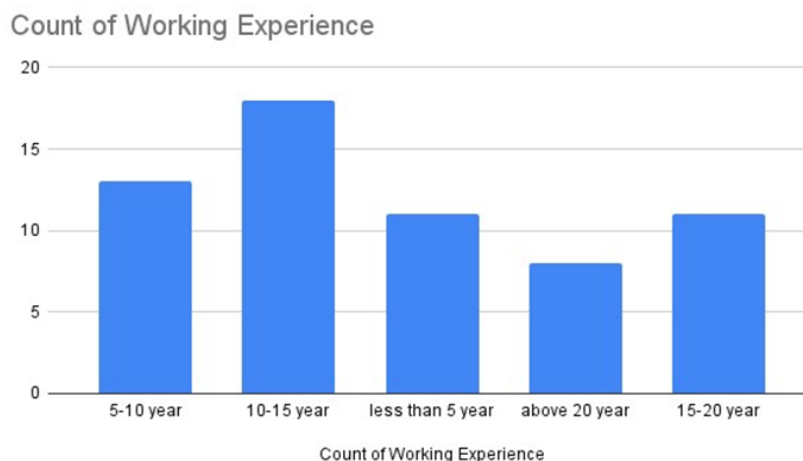


Figure 2 shows Working Experience of Respondent

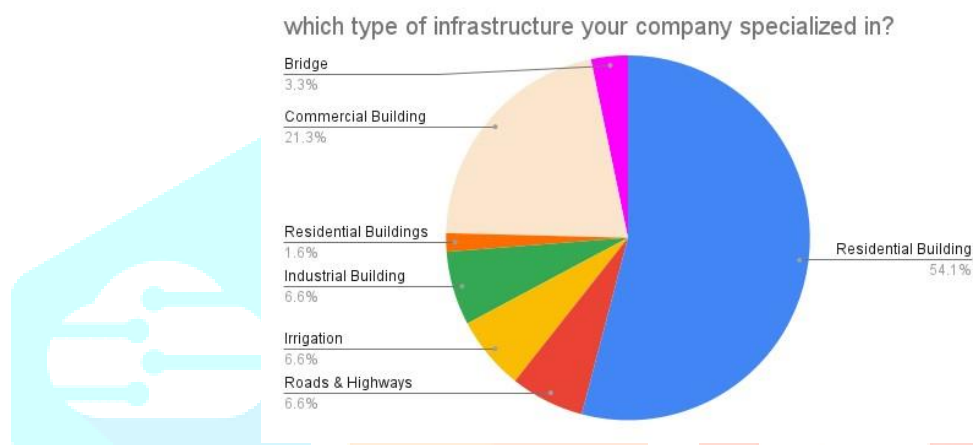


Figure 3 shows which type of Infrastructure Respondent Company Specialized in?

#### 4.2 Secondary Data Analysis

Two separate methodologies are employed to analyse the data from the previously described data gathering

##### 4.2.1 RII (RELATIVE IMPORTANCE INDEX)

The Relative Importance Index analysis was used in this study to arrange the parameters based on Relative Importance. The following formula is used to determine the Relative Importance Index.

$$RII = \frac{\sum w}{A \times N}$$

W= Weighting assigned by respondent

Also, the formula can be explored as:

$$RII = \frac{5n5 + 4n4 + 3n3 + 2n2 + 1n1}{A \times N}$$

In this Research Table 3 shows the Top ten factors found from the Relative importance index method in which the Delay in progress of work and activities was ranked first at 0.6789 and Design changes during construction was ranked tenth at 0.64262. In this study with a result of the RII method Top ten factors were found, such as Delay in the progress of work and activities, Unavailability of funds, Contractor downsizing labor force, Subcontractor or suppliers refuse to continue providing services, Difficulties in procuring materials and equipment, Inaccuracy of estimation, Contractors failure do work based on BOQ, Low-quality works due to the contractors' uncertain financial condition, Miscommunication between client and contractor, Design changes during construction.

4.2.2 Top 10 factors according to RII

Factors	RII	Rank
Delay in progress of work and activities	0.67869	1
Unavailability of funds	0.67213	2
Contractor downsizing labor force	0.66885	3
Sub contractor or suppliers refuse to continue providing services	0.6623	4
Difficulties in procuring materials and equipment	0.65902	5
Inaccuracy of estimation	0.65574	6
Contractors failure do work based on BOQ	0.64918	7
Low quality works due to the contractors uncertain financial condition	0.6459	8
Miscommunication between client and contractor	0.6459	9
Design changes during construction	0.64262	10

Table 3 shows Top Ten factors according to RII Result

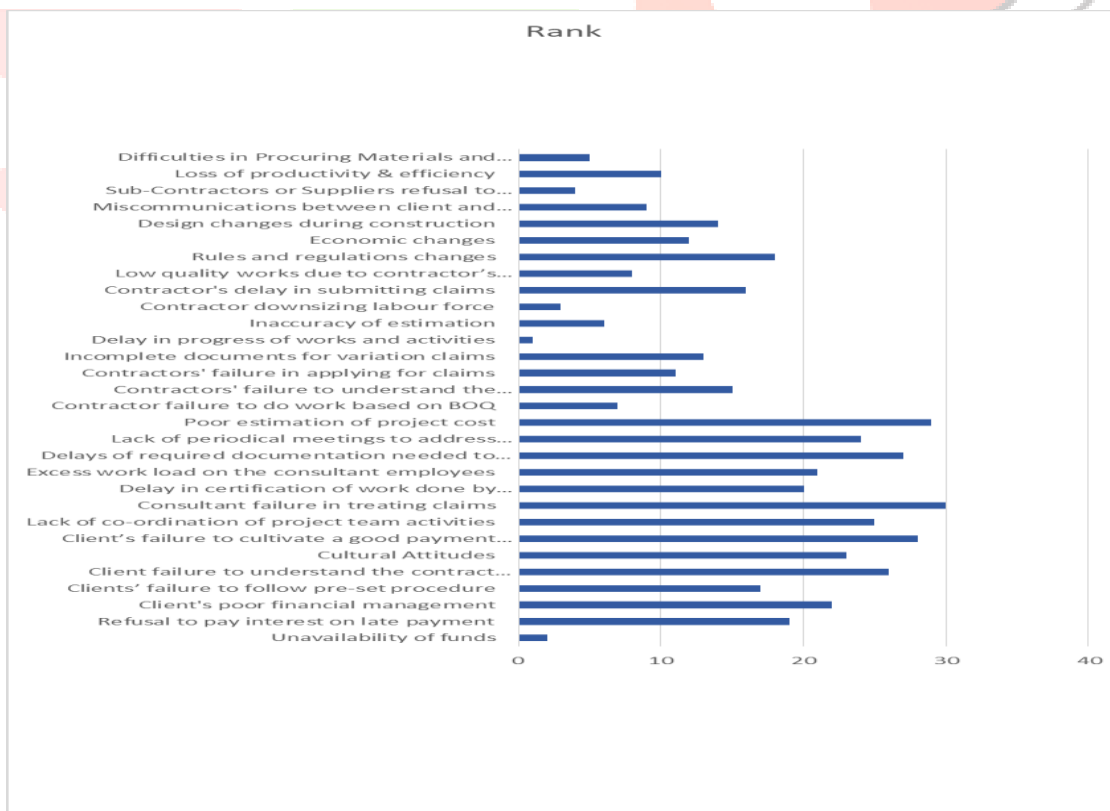


Figure 4 shows RII result of all factors

### 4.2.3 Exploratory Factor Analysis

Using the EFA method of factor analysis, one may determine the underlying link between the variables being examined. It is a multivariate statistical tool for looking at the basic framework, the structure of relationships between variables, or correlations between several variables. Analyze the data from the earlier data collection using EFA. Factor analysis is a technique for determining if several important variables are connected to smaller, invisible components. This is accomplished by categorizing variables according to how closely they correlate with one another.

### 4.2.4 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.666
Bartlett's Test of Sphericity	Approx. Chi-Square	127.153
	df	6
	Sig.	.000

Table 4 shows KMO and Bartlett's test

The Kaiser-Meyer-Olkin test represents a statistic that calculates the percentage of variation in the variables you have caused by fundamental variables. It helps in determining sample effectiveness. Value between 0.8 to 1 shows an acceptable sample, while under 0.6 value shows an inadequate sample and recommends corrective action.

Bartlett's test of Sphericity suggests the variables in question are unconnected as well as unsuitable for structural discovery. Lower significance level scores (less than 0.05) indicate that factor analysis may be beneficial for your data.

### 4.2.5 Correlation Matrix

A correlation matrix, in basic words, is a table that illustrates the correlation, a method of statistical analysis that demonstrates how strong the association between two variables or the amount of linkage between the two. Findings the relationship between two quantitative variables without being able to inter-causal relationship.

	Client factor	Contractor factor	Consultant factor	Other factors
Client factor	1			
Contractor factor	.758**	1		
Consultant factor	.350**	.550**	1	
Other factors	.373**	.577**	.764**	1

Table 5 shows Correlation Matrix

The correlation coefficient (r) value between Client & Contractor is 0.758 which shows a high positive correlation between both the variables.

4.2.6 Top 10 Factors according to mean through SPSS Software

Rank	Factors	N		Mean	Standard deviation	Variance
		Valid	Missing			
1	Delay in progress of work and activities	61	0	3.39	1.357	1.843
2	Unavailability of funds	61	0	3.36	1.379	1.901
3	Contractor downsizing labor force	61	0	3.34	1.263	1.596
4	Sub-contractor or suppliers refuse to continue providing services	61	0	3.31	1.311	1.718
5	Difficulties in procuring materials and equipment	61	0	3.30	1.383	1.911
6	Inaccuracy of estimation	61	0	3.28	1.343	1.804
7	Contractors failure to do work based on BOQ	61	0	3.25	1.468	2.155
8	Low quality works due to contractors uncertain financial condition	61	0	3.23	1.454	2.113
9	Miscommunication between client and contractor	61	0	3.21	1.392	1.937
10	Design changes during construction	61	0	3.20	1.424	2.027

Table 6 shows Top Ten factors according to Mean value

Table 6 shows that which factors are most affecting for delay payment of contractors. In this table Delay in progress of work and activities was ranked first with the mean value of 3.39 and Design changes during construction was ranked tenth with the mean value of 3.20.

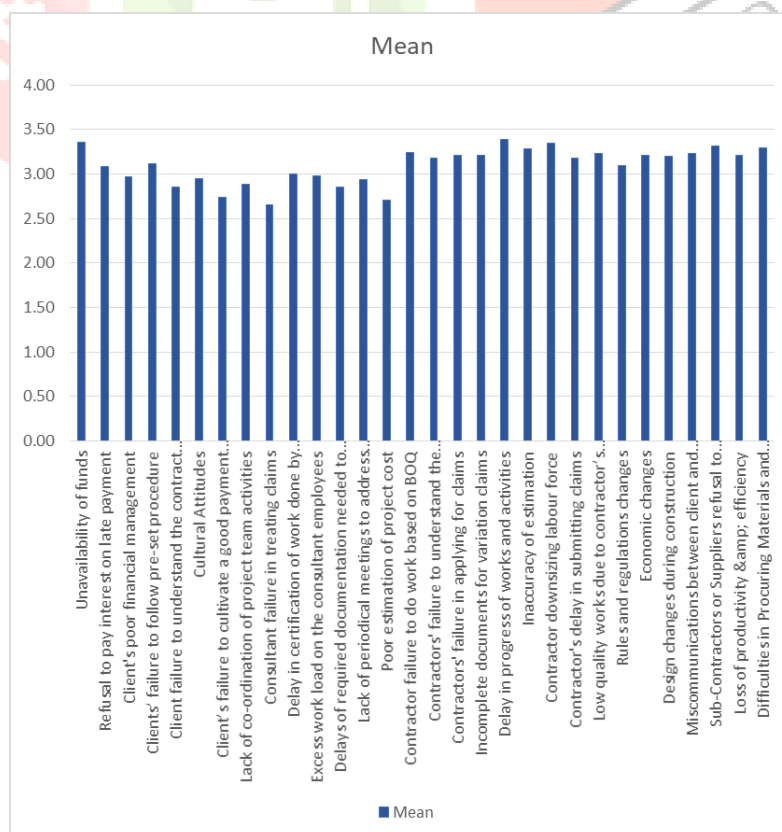


Figure 5 shows Mean value of all factors



## V. RESULTS

As previously stated, this research aims to identify and examine the factors that affect payment delay of contractor in construction industry by exploring the questionnaire in Ahmedabad city. Factors are identified through extensive literature review and questionnaire form is validated from field experts. Data is analysed by relative importance index (RII) and statistically using SPSS. In this research correlation which is a statistical technique that shows how strongly two variables are related to each other is also found. According to the questionnaire survey's findings, a lot of regional contractors have had problems with delay payment in the building sector. The current level of delay payment in the construction industry shows that the available common law and contractual remedies are insufficient. To safeguard the contractor's interest against the potential for a late payment issue, other solutions must be found. To help contractors assess the company's ability to pay and to improve their prospects of receiving payment, it is advised that the company's financial standing and credit rating be made public.

Based on recent observation and analysed data through SPSS & RII we analysed 10 most significant factors, in which Delay in progress of work and activities was ranked first (mean value 3.39 & RII 0.67869) and Design changes during construction was ranked tenth (mean value 3.20 & RII 0.64262) which affect payment delay of contractors. This research study found that client-based factor and the contractor-based component are correlated and Client and Contractor have a correlation coefficient value of 0.758, indicating a strong positive link between the two variables.

The study concluded that Delayed payment would probably result in the contractors having excessive cash flow issues, which will have a terrible ripple effect farther along the contractual payment chain. Contractors may be more likely to miss their deadlines for finishing construction projects if they don't receive money on time. According to the study's findings, professional organisations and governmental organisations should review and modify the current standard forms of contracts to offer protection, encourage an equitable risk distribution among all parties involved, and give protection. Maybe the issues with late payments might be resolved if the building sector adopted a more professional attitude.

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