

# Identification of Factors Affecting Construction Cash Flow: A Statistical Analysis

Karnav N. Ajmera<sup>1</sup>, Ankitkumar S. Patel<sup>2</sup>, Jayraj V. Solanki<sup>3</sup>

<sup>1</sup>PG Student

<sup>2</sup>PG Coordinator & Assistant Professor

<sup>3</sup>Head PG & Assistant Professor

<sup>1,2,3</sup>Department of Civil Engineering; U.V.Patel College of Engineering; Ganpat University; Mehsana; Gujarat, India--

\*\*\*

**Abstract** – The Indian Construction Industry is a huge industry having a 9% share in GDP, also contributing as 2<sup>nd</sup> highest employer among various other industries after the agricultural sector. According to a survey, only 16% of business owners are left with liquidity which would help their business last only for 3-4 months. About 479 infrastructure projects show cost overruns worth Rs. 4.4 trillion, each project worth more than 150 crores. The construction industry being such a vast and important industry for the nation's economy, it can be gauged from the fact that the slow down or failure of this industry will bring a halt to the nation's development.

In order to identify the cause and mitigate them the present study is conducted to identify the factors affecting the construction cash flow. Various kinds of literature were reviewed which highlighted the fact that cash flow forecasting during the execution stage was lacking or might be not forecasted itself. Hence the present study is conducted to identify the factors affecting the construction cash flow. A questionnaire survey was conducted to identify the factors which were later tested for their reliability and also analysed by various Indexing methods like the Probabilistic Approach Method, and Frequency Index Method. Out of sub-factors identified under 7 different factorial heads, results showed that the top most factor affecting cash flow forecasting was cost overrun, time overrun, arbitration, faulty cash flow models, change in the financial position of clients, etc. The research concluded with the fact that the identified factors under different heads must be given most priority while forecasting cash flow and timely revision and identification of new factors plays an important role in having accuracy in projecting construction cash flow.

**Key Words:** Construction Cash-Flow, Cash-flow cycle, cash-flow model, Cash Flow Forecasting, Cash-flow analysis.

## 1. INTRODUCTION

The construction industry in India is one of the largest, with a total contribution of 9% to the country's GDP. Apart from that, the Indian construction sector employs more than 51 million people, placing it second only to the agriculture business among other industries. Between April 2000 and

September 2021, foreign direct investment (FDI) in the construction development industry was \$26.16 billion and, in the infrastructure sector was \$25.95 billion [1]. The Indian Parliament passed a measure to establish a National Bank for Financing Infrastructure and Development (NaBFID) to fund infrastructure projects in India, recognizing its importance. The fact that cement production capacity grew by 8% in April 2022 over April 2021 can likewise be used to gauge the country's construction sector growth[1]. It is obvious from these statistics that the nation's economic growth is heavily reliant on the construction sector's expansion. As a result, the building industry is the core of the country's economy. This wheel is the foundation for job creation, country economic development, and FDI inflows, all of which contribute to higher GDP.

### 1.1 Introduction to Cash Flow Cycle

It is a well-known fact in the business community that "Cash is King," which means that every business or industry, large or small, requires sufficient liquidity to operate successfully. This liquidity can take the form of cash, credit, or capital from institutional or non-banking financial companies (NBFCs), and it is very significant in the construction industry because it is one of the most crucial variables that is often overlooked. Given that the construction sector contributes up to 9% of the nation's GDP, it is apparent that a large sum of money is required to keep it running smoothly. Many other sectors, such as the steel, glass, mining, and cement industries, are built on the foundation of this sector.

"Cash flow can be defined as the movement of money into or outside of the project, company or organization. A net cash flow of the company is the difference between the company's cash flowing into the project and the company's cash going out of the business. It is the difference between expense and revenue" stated [2].

The quantity of cash pumped into the construction sector has an impact on the smooth operation of other dependent businesses. Daily wagers and labourers, who are paid on a daily or monthly basis, are the most common employees in the construction industry. The essential consumable raw materials, such as cement and steel, are delivered after a part

payment of 90% or more have been made. In addition, the general credit limit on some shuttering supplies, such as plywood, pinewoods, props, and shuttering plates, as well as ready-mix concrete, bricks, and other materials, is 20 to 40 days from the date of the purchase order. In the majority of cases, the construction industry's billing cycle is based on milestone completion, which means that work-in-progress bills are submitted at the end of each milestone, while payments to laborer's, subcontractors, and material vendors are made well before the milestone is completed or about to be completed, as per credit limit in the work order. As per the standard sequence of payments to be received, it usually takes about 30-40 days to receive full payment for the invoice generated. Hence the time between cash disbursements and cash receipts is known as cash flow cycle.

Cash Flows are usually of three types namely Neutral, Positive and Negative cash flow.

**Neutral Cashflow:** Situation where income and expense are similar. (It is a rare occurrence, might be visible for shorter durations but is still an acceptable situation.)

**Positive Cashflow:** Situation where outgoings are less than incomings. (It is an ideal strategy for successful business and a win-win situation for all the stakeholders.)

**Negative Cashflow:** Situation where incomings are less than outgoings. (It is not suitable for any business strategy as it clearly shows the outgoings are more than incomings.)

## 2. NEED FOR STUDY

As per a report in Business Standard news, daily 479 infrastructure projects show cost overruns worth Rs. 4.4 trillion, each project worth more than 150 crores. [3]. Inflation and price rise and the great labour migration have played a role on the part of clients and contractors stopping the ongoing work due to project cost overrun and time overrun. According to a survey by LocalCircles, which covered over 8400 businesses, only 16% of business owners are left with liquidity which would help their business last for only 3-4 months. [4]. Hence cash flow management is mandatory in the application of practices in managing project cash flow against a set baseline.

In order to accurately forecast the cashflow, it is necessary to understand all the factors and variables that affects the cash flow calculations. Hence this study is conducted to list out and identify all the variables that affects the construction cash flow.

## 3. OBJECTIVES

The main objective of the research paper is to identify the factors that affect the construction cash flow with the help of literatures and interviews with industrial experts. The secondary objective was to analyze all the factors according

to its weightage and give them ranks accordingly. Various index tests were conducted to check and compare the results accordingly.

## 4. RESEARCH METHODOLOGY

Firstly, the literatures will be reviewed to study the previous cash flow models designed by past researchers and the method of analysis incorporated by them. Later, various identified factors would be collected and organized into a list of categories and at last a proper method of data analysis would be conducted to identify the most and least important factors. A survey/questionnaire will be prepared and floated to the contractors in and around Ahmedabad city along with interview might be conducted and data will be collected. The data later, will be analyzed for various tests, and results will be interpreted.

## 5. LITERATURE REVIEW

From the various literatures studied, the researchers mainly focused on development of various mathematical models for cash flow forecasting along with simulation process to verify the stability of developed models. Various methods used by researchers were identified and results were studied. By referring such research papers, it proved to be very beneficial to have an insight of selection on least used data analysis methods as well as the type of research which would contribute well to the society.

Table 1: Literature Summary

Sr. No	Country of Origin	Author	Research Contribution	Method of Data Analysis
1	CANADA	Yaqiong Liu, Tarek Zayed, Shujing Li [5]	The author identified various factors affecting cash flow and developed a stochastic model for cash flow forecasting.	Analytical Hierarchy Process with Simulation
2	ROMANIA	Augustin Purnus, Constanta Nicoleta Bodea [6]	The results of this study suggest that the construction companies should carefully consider different	Case Study along with Probabilistic Methodology

			factors that can influence decisions both in the bid-tender stage, but especially in the implementation phase of infrastructure projects	
3	EGYPT	Mohamed Razek, Hosam Hosny, Ahmed Beheri [7]	The research developed a cash flow risk model which was compared with on site available data.	Monte Carlo Simulation + Probability distribution with @RISK software
4	VIETNAM	Thi Tu Oanh Le, Thi Thanh Thuy Vu, Van Cong Nguyen [8]	The research identified factors and suggested to use the modified model to the companies in vietnam	Factor Analysis Test SPSS
5	CANADA	Tarek Zayed, Yaqiong Liu [9]	The author identified various factors affecting cash flow and developed a stochastic model for cash flow forecasting.	Analytical Hierarchy Process
6	INDIA	Vaidehi Nirmal, Ashish B. Ugale, Dr. Nitin Ingole [10]	The research through the questionnaire survey identified the need of cash flow forecasting.	Frequency and Percentage Analysis

7	UAE	Hasan Mahmood, Vian Ahmed, Salwa Beheiry [11]	The study's contribution to the body of knowledge is the creation of the CFRI, the validation of the index, the collection of data with analysis.	RII Method
8	UK	Henry Odeyinka, Ammar Kaka, Roy Marledge [12]	The research identified the importance of cash flow forecasting with the help of computer software.	ANOVA
9	INDIA	G Dharmadaran, K.R. Divakar Roy [13]	The research developed a mathematical model for cash flow which reduced a lot of man hours as compared to traditional method.	Mathematical Model
10	INDIA	Mohammad Faisal Khan, Rajiv Banerjee [7]	Various factors identified where checked for variability and uncertainty.	Cronbach's Alpha

## 6. DATA COLLECTION

For the purpose of this research paper, the data collection method to be used was Questionnaire Survey method. In this method, a questionnaire filled with questions is floated to the target audience, who in turn fills out the data and submits it back. The medium for questionnaire floating can be postal method, online data forms via Google Forms, Microsoft Forms or Survey Websites, In-person form fill ups,

etc. This method of data collection is the most economical method but at the same time consumes a lot of time. Also, the data from questionnaire survey cannot be assumed to correct every time. Various reliability tests are to be done on it before the data analysis is started. Questionnaire survey makes it quite simple when the survey sample size is vast and has no geographical boundaries. Questionnaire survey comprised of questions whose responses was based on a 5-point Likert Scale multiple choice answer.

### 6.1 Questionnaire Design

The basis of this research is the questionnaire survey which was designed by reviewing the literatures extensively, as well as interviews with the industry experts, internet articles, etc. The questions so designed were later on validated by the 5 industrial experts whose valuable suggestions and inputs for the same were accommodated for the better survey.

The structure of Questionnaire was divided into few parts as below:

#### 1. Personal Section:

This section deals with the respondent's personal information like Name, Contact Details (Email-Id), Experience, Designation, and at last the name of organization.

#### 2. Financial Section:

This section deals with the financial factors affecting the company's cash flow. Respondents are supposed to select an appropriate option from the 5 points Likert Scale ranging from Very Low to Very High. This section has 18 questions all are based on Likert Scale.

#### 3. Purchase and Market Related Section:

This section deals with questions based on purchases made during a project life cycle along with questions based on the market-related section which directly or indirectly affects the project cash flow. Respondents are supposed to select an appropriate option from the 5 points Likert Scale ranging from Very Low to Very High and comprises of 7 questions.

#### 4. Before and During Construction Section:

This section deals with questions based on factors affecting cash flow forecast before and during the execution stage. Respondents are supposed to select an appropriate option from the 5 points Likert Scale ranging from Very Low to Very High and comprises of 11 questions.

#### 5. HR + Personal Question Section:

This section deals with questions based on factors affecting cash flow forecast due to HR Policies and Personal Reasons. Respondents are supposed to select an appropriate option from the 5 points Likert Scale ranging from Very Low to Very High and comprises of 7 questions.

#### 6. Pandemic Section:

This section deals with questions based on factors affecting cash flow forecast due to pandemics as we witnessed in the last 2 years. Respondents are supposed to select an appropriate option from the 5 points Likert Scale ranging from Very Low to Very High and comprises of 3 questions.

#### 7. Other Section:

#### 8.

This section deals with questions based on factors affecting cash flow forecast due to various other less focused factors. Respondents are supposed to select an appropriate option from the 5 points Likert Scale ranging from Very Low to Very High and comprises of 6 questions.

Table 2: Likert Scale Design

LIKERT SCALE DESIGN	
Very Low	01
Low	02
Medium	03
High	04
Very High	05

### 6.2 Sample Size Calculation

In this paper, the formula used to determine the population is as per Cochran's Formula

$$\eta_0 = \frac{z^2 pq}{e^2}$$

were,

- e is the desired level of precision = 12%
- p is the (estimated) proportion of population = 0.5
- q = 1 - p = 0.5
- z - confidence level = 1.96

$$\eta_0 = 66.69$$

Hence considering sample size = 67

## 7. DATA ANALYSIS

### 7.1 Introduction

The analysis of 6 major factors affecting the construction cash flow are analysed. These factors are 1) Financial Factors 2) Market & Purchase Related Factors 3) Prior to & During Construction Factors 4) HR + Personal Section Factors 5) Pandemic Factors 6) Other Factors. Each of these factors comprises of various questions which were to be answered by respondents. The responses collected were first tested for its reliability with the help of SPSS software by performing the Cronbach's Alpha test. The responses were later tested upon by Probabilistic Analysis method and Frequency Index Method.

### 7.2 Cronbach's Alpha Test

A reliability test is performed to check the reliability of the accumulated data, before beginning the analysis work. The test is known as Cronbach's Alpha Test. This test was performed in the software Statistical Package for Social Sciences popularly known as SPSS.

**Table 3: Cronbach Alpha Reliability Test**

Case Processing Summary			
		N	%
Cases	Valid	67	100.0
	Excluded	0	.0
	Total	67	100
a. Listwise deletion based on all variables in the procedure.			

Reliability Statistics	
Cronbach's Alpha	N of items
0.903	52

The Cronbach's alpha value can be considered as the data's reliability statistics value. The value of alpha is 0.903 as is considered of excellent consistency. Hence it is appropriate to assume that the data accumulated has excellent consistency and can be reliable to use for other data analysis methods.

### 7.3 Probabilistic Analysis Method

Probability is the possibility of the event to occur. As per the responses generated by the questionnaire survey, the factors are ranked as per the responses by allotting the required weightage as per responses. The reasons for selecting the Probability analysis is that, from the literature review summary it was evident that no past researchers have used the probabilistic analysis for data analysis. The responses

are later checked for the ranks with other testing methods and the data are compared with each other.

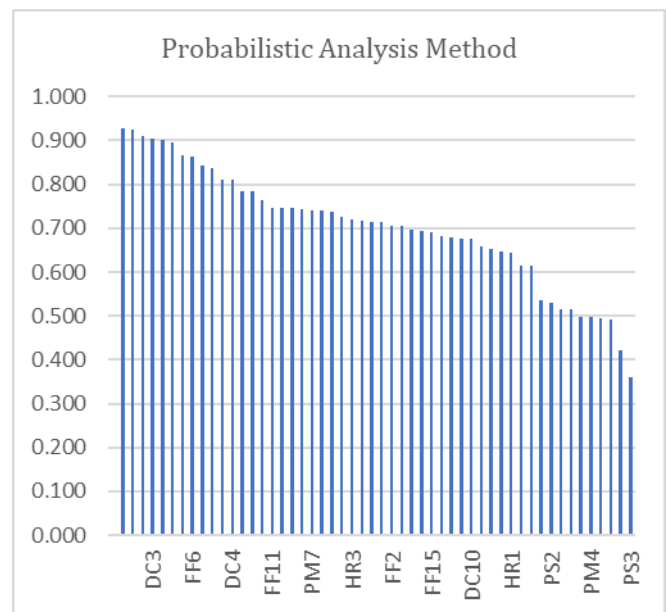
$$PA = \frac{\sum w}{A \times N}$$

were,

$\sum w$  = total weightage of Factors

A = Likert scale length point (i.e., 5)

N = No. of Response (i.e., 67)



*Figure 1 PA Method*

**Table-4: Results as per Probability Analysis Method**

CODE	QUESTIONS	PA	RANK
DC8	Impact of project cost overrun	0.928	1
DC9	Impact of project time overrun	0.925	2
OS5	Impact of issues resulting into Arbitration Occurrence	0.910	3
DC3	Impact of Faulty Cash Flow Model	0.904	4
FF7	Impact of change in financial position of clients on cash flow	0.901	5

OS6	Impact of corruption, and political influence affecting cash flow	0.896	6
DC1	Impact of accuracy in estimation of quantities during the tendering stage on cash flow	0.866	7
FF6	Impact of change in payment conditions between each billing cycle on cash flow	0.863	8
FF18	Impact of price rise of construction materials on cash flow	0.842	9
OS2	Vagueness in scope of work on cash flow	0.836	10
DC2	Impact of variation in quantities executed and BOQ quantities on cash flow	0.812	11
DC4	Impact of lack of cash flow analysis for the project	0.812	11
FF5	Impact of change in progressive payments from clients on cash flow	0.785	13
DC11	Impact of work stoppages due to municipal violations, pandemic and war situations	0.785	13
OS3	Addition/Elimination of scope of work on cash flow	0.764	15
FF11	Impact of higher lending rates for money borrowed from bank on cash flow	0.746	16
PM2	Impact of higher rate of inflation on cash flow	0.746	16
OS4	Frequent QA/QC issues on cash flow	0.746	16
HR7	Impact of low retention of labour teams due to various reasons	0.743	19
PM7	Impact of material vendor strikes on construction cash flow	0.740	20

DC5	Impact of failure of performance strategy due to changes, variation order, etc	0.740	20
HR6	Impact of shortage of technically sound staff	0.737	22
PM5	Impact of decision to hire or purchase machinery and equipment's	0.725	23
HR3	Impact of disputes related to work on cash flow	0.719	24
PM1	Impact of rate escalation on projects cash flow	0.716	25
FF4	Impact of selection of billing cycle/billing frequency on cash flow	0.713	26
DC7	Impact of re-work on cash flow	0.713	26
FF2	Impact of upfront payment from clients for material procurement on cash flow	0.704	28
HR2	Impact of having fair relations with clients, consultants and company on cash flow	0.704	28
FF1	Impact of mobilization advances on company's cash flow cycle	0.696	30
FF13	Impact of advance payment on materials on cash flow	0.693	31
FF15	Impact of High Payroll Expenses on company's cash flow	0.690	32
FF10	Impact of large retention percentage on cash flow	0.681	33
PM3	Impact of selection of inventory management strategy on cash flow	0.678	34
FF12	Impact of delay in releasing of retention amount	0.675	35
DC10	Impact of unavailability of skilled staff and required	0.675	35

	material on cash flow		
FF9	Impact of Interim Bill Certification from Consultant on Cash flow	0.660	37
FF16	Impact of inverted GST structure on construction service and construction materials	0.654	38
FF8	Impact of capital financed from Institutional or NBFC sources?	0.648	39
HR1	Impact of Communication Skills on Cash flow	0.645	40
FF14	Impact of credit availability for material procurement on cash flow	0.615	41
PM6	Impact of taxation on materials to be purchased	0.615	41
OS1	Impact of extreme weather adversities affecting labor productivity on cash flow	0.534	43
PS2	Impact of additional cost like food + accommodation + travel on company cash flow	0.528	44
DC6	Impact of higher competition among contractors affecting contractor's cash flow	0.516	45
HR4	Impact of sub-contracting work on cash flow	0.516	45
FF3	Impact of deduction of mobilization advance from every RA Bill	0.499	47
PM4	Impact of provision of facility to repair and store excess materials on cash flow	0.499	47
HR5	Impact of high employee turnover on cash flow	0.496	49

FF17	Impact of clearing labour wages and material dues on time affecting the negative cash outflow	0.493	50
PS1	Impact of regular sanitization of premises on cash flow	0.421	51
PS3	Impact of health insurance, ppe kits, masks etc on cash flow	0.361	52

### 7.4 Frequency Index Method

Frequency analysis is a method of analysis that is used in many scientific studies. It is quite popular method of analysis as it provides a simple quantitative result. Frequency Analysis is also an important area of statistics that deals with the number of times an event occurs. This method is used to rank the causes of criticality of various factors based on frequency of occurrence as identified by respondents [14].

$$F.I. (\%) = \sum[a \times (n/N)] \times \left(\frac{100}{5}\right) \%$$

were,

a = weight of Likert scale  
n = no. response on a<sup>th</sup> scale  
N = No. of Response (i.e., 67)

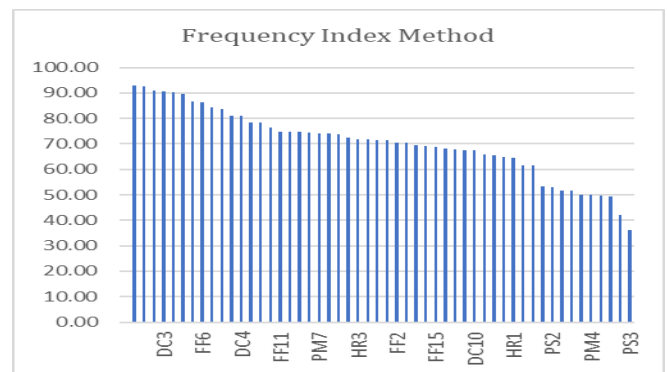


Figure 2 FI Method

Table 5: Results as per FI Method

CODE	QUESTIONS	PA	RANK
DC8	Impact of project cost overrun	92.84	1
DC9	Impact of project time overrun	92.54	2

OS5	Impact of issues resulting into Arbitration Occurrence	91.04	3
DC3	Impact of Faulty Cash Flow Model	90.45	4
FF7	Impact of change in financial position of clients on cash flow	90.15	5
OS6	Impact of corruption, and political influence affecting cash flow	89.55	6
DC1	Impact of accuracy in estimation of quantities during the tendering stage on cash flow	86.57	7
FF6	Impact of change in payment conditions between each billing cycle on cash flow	86.27	8
FF18	Impact of price rise of construction materials on cash flow	84.18	9
OS2	Vagueness in scope of work on cash flow	83.58	10
DC2	Impact of variation in quantities executed and BOQ quantities on cash flow	81.19	11
DC4	Impact of lack of cash flow analysis for the project	81.19	11
FF5	Impact of change in progressive payments from clients on cash flow	78.51	13
DC11	Impact of work stoppages due to municipal violations, pandemic and war situations	78.51	13
OS3	Addition/Elimination of scope of work on cash flow	76.42	15
FF11	Impact of higher lending rates for money borrowed from bank on cash flow	74.63	16
PM2	Impact of higher rate of inflation on cash flow	74.63	16
OS4	Frequent QA/QC issues on cash flow	74.63	18

HR7	Impact of low retention of labor teams due to various reasons	74.33	19
PM7	Impact of material vendor strikes on construction cash flow	74.03	20
DC5	Impact of failure of performance strategy due to changes, variation order, etc	74.03	20
HR6	Impact of shortage of technically sound staff	73.73	22
PM5	Impact of decision to hire or purchase machinery and equipment's	72.54	23
HR3	Impact of disputes related to work on cash flow	71.94	24
PM1	Impact of rate escalation on projects cash flow	71.64	25
FF4	Impact of selection of billing cycle/billing frequency on cash flow	71.34	26
DC7	Impact of re-work on cash flow	71.34	26
FF2	Impact of upfront payment from clients for material procurement on cash flow	70.45	28
HR2	Impact of having fair relations with clients, consultants and company on cash flow	70.45	28
FF1	Impact of mobilization advances on company's cash flow cycle	69.55	30
FF13	Impact of advance payment on materials on cash flow	69.25	31
FF15	Impact of High Payroll Expenses on company's cash flow	68.96	32
FF10	Impact of large retention percentage on cash flow	68.06	33
PM3	Impact of selection of inventory management strategy on cash flow	67.76	34



FF12	Impact of delay in releasing of retention amount	67.46	35
DC10	Impact of unavailability of skilled staff and required material on cash flow	67.46	35
FF9	Impact of Interim Bill Certification from Consultant on Cash flow	65.97	37
FF16	Impact of inverted GST structure on construction service and construction materials	65.37	38
FF8	Impact of capital financed from Institutional or NBFC sources?	64.78	39
HR1	Impact of Communication Skills on Cash flow	64.48	40
FF14	Impact of credit availability for material procurement on cash flow	61.49	41
PM6	Impact of taxation on materials to be purchased	61.49	41
OS1	Impact of extreme weather adversities affecting labor productivity on cash flow	53.43	43
PS2	Impact of additional cost like food + accommodation + travel on company cash flow	52.84	44
DC6	Impact of higher competition among contractors affecting contractor's cash flow	51.64	45
HR4	Impact of sub-contracting work on cash flow	51.64	45
FF3	Impact of deduction of mobilization advance from every RA Bill	49.85	47
PM4	Impact of provision of facility to repair and store excess materials on cash flow	49.85	47
HR5	Impact of high employee turnover on	49.55	49

	cash flow		
FF17	Impact of clearing labor wages and material dues on time affecting the negative cash outflow	49.25	50
PS1	Impact of regular sanitization of premises on cash flow	42.09	51
PS3	Impact of health insurance, ppe kits, masks etc on cash flow	36.12	52

### 7.5 Results Interpretation

The largest contributing factor affecting the construction cash flow was the project's cost overrun and project's time overrun, according to all three methods of study (Probabilistic Analysis, Frequency Index Analysis, and Relative Importance Index). Arbitration Occurrence, Design of Faulty Cash Flow Model, Change in Client Financial Position, Presence of Corruption and Political Influence, Lack of Accuracy in Quantity Estimation During BOQ Preparation, Change in Payment Condition, Price Increase, and Vagueness in Scope of Work were among the top ten contributing factors.

**Financial Factors:** Top Financial Factors as per results derived.

**Table 6:** Financial Factors Ranking Table

RESULTS	RANK
Impact of change in financial position of clients on cash flow	01
Impact of change in payment conditions between each billing cycle on cash flow	02
Impact of price rise of construction materials on cash flow	03
Impact of change in progressive payments from clients on cash flow	04
Impact of higher lending rates for money borrowed from bank on cash flow	05
Impact of selection of billing cycle/billing frequency on cash flow	06
Impact of upfront payment from clients for material procurement on cash flow	07
Impact of mobilization advances on company's cash flow cycle	08

Impact of advance payment on materials on cash flow	09
Impact of High Payroll Expenses on company's cash flow	10
Impact of large retention percentage on cash flow	11
Impact of delay in releasing of retention amount	12
Impact of Interim Bill Certification from Consultant on Cash flow	13
Impact of inverted GST structure on construction service and construction materials	14
Impact of capital financed from Institutional or NBFC sources	15
Impact of credit availability for material procurement on cash flow	16
Impact of deduction of mobilization advance from every RA Bill	17
Impact of clearing labor wages and material dues on time affecting the negative cash outflow	18

**Purchase & Market Related Section:** Top factors in this category as per results derived

**Table 7:** Purchase & Market Related Factors Ranking Table

RESULTS	RANK
Impact of higher rate of inflation on cash flow	01
Impact of material vendor strikes on construction cash flow	02
Impact of decision to hire or purchase machinery and equipment	03
Impact of rate escalation on projects cash flow	04
Impact of selection of inventory management strategy on cash flow	05
Impact of taxation on materials to be purchased	06
Impact of provision of facility to repair and store excess materials on cash flow	07

**Before & During Construction Factors:** Top factors in this category as per results derived.

**Table 8:** Before & During Construction Factors Ranking Table

RESULTS	RANK
Impact of project time overrun	01
Impact of Faulty Cash Flow Model	02
Impact of accuracy in estimation of quantities during the tendering stage on cash flow	03
Impact of variation in quantities executed and BOQ quantities on cash flow	04
Impact of lack of cash flow analysis for the project	05
Impact of work stoppages due to municipal violations, pandemic and war situations	06
Impact of failure of performance strategy due to changes, variation order, etc	07
Impact of re-work on cash flow	08
Impact of unavailability of skilled staff and required material on cash flow	09
Impact of higher competition among contractors affecting contractor's cash flow	10

**HR + Personal Factors:** Top factors in this category as per results derived

**Table 9:** HR + Personal Factors Ranking Table

RESULTS	RANK
Impact of low retention of labor teams due to various reasons	01
Impact of shortage of technically sound staff	02
Impact of disputes related to work on cash flow	03
Impact of having fair relations with clients, consultants and company on cash flow	04
Impact of Communication Skills on Cash flow	05
Impact of sub-contracting work on cash flow	06
Impact of high employee turnover on cash flow	07

**Pandemic Factors:** Top factors in this category as per results derived

**Table 10:** Pandemic Factors Ranking Table

RESULTS	RANK
Impact of additional cost like food + accommodation + travel on company cash flow	01
Impact of regular sanitization of premises on cash flow	02
Impact of health insurance, ppe kits, masks etc on cash flow	03

**Other Factors:** Top factors in this category as per results derived

**Table 11:** Other Factors Ranking Table

RESULTS	RANK
Impact of issues resulting into Arbitration Occurrence	01
Impact of corruption, and political influence affecting cash flow	02
Vagueness in scope of work on cash flow	03
Addition/Elimination of scope of work on cash flow	04
Frequent QA/QC issues on cash flow	05
Impact of extreme weather adversities affecting labor productivity on cash flow	06

## 9. CONCLUSIONS

The study focused on the creation of a questionnaire survey based on literature reviews, expert validations, stakeholder interviews, and, finally, information from print and digital media. Financial Factors, Purchase & Market Related Factors, Before & During Construction Factors, HR + Personal Factors, Pandemic Factors, and Other Miscellaneous Factors were all correctly recognized by the questionnaire.

A brief review of topmost ranked factors is given below:

### Financial Factors:

Financial factors have a significant impact on cash flow. If a client's financial situation changes, it hurts cash flow. It may also be disrupted if the payment terms are changed in the middle of a billing cycle. The increase in material prices has a short-term impact on cash flow since it results in a bigger out-of-pocket commitment because payments are made on time. All financial aspects must be thoroughly forecasted based on their rank, historical experience based on similar projects, and other considerations to compensate to some extent rather than face enormous losses.

### Purchase & Market Factors:

This element has a significant impact on negative cash flow since it deals with the buy section, which necessitates timely payment to vendors or subcontractors. When the contractor raises a bill for the same, the contractors receive payment. As a result, the contractor's cash flow may be harmed because a big sum of money is disbursed and may not be reimbursed for a long period. For a given period of time, the contractor will also have a loss of interest charge.

### Before & During Construction Factors:

The key factors that affect cash flow are cost overrun and time overrun. As a result, some provisions for it must be determined during cash flow analysis and honored only if and when the condition of cost and time overruns is realized. Certain conditions must be kept in mind when finishing the contract, as they may aid the contractors in the event of a dispute over overruns. Another issue that influences cash flow is a flawed cash flow analysis caused by a lack of experience. When constructing the cash flow, extreme caution must be exercised.

### HR + Personal Sections:

Low labor retention, as well as a shortage of technically competent personnel, were the key factors affecting cash flow. The cash flow is impacted because every time a new labor gang comes, certain accommodations for food and lodging are made, resulting in unforeseen expenses that may be recovered from the labor bills. Communication skills play a minor influence in cash flow because, in some cases, a portion of the money can be recovered just by persuading clients.

### Pandemic Sections:

During the analysis of the findings, it was discovered that the questions in this part were frequently rated low to medium. Although this part has a minor impact on cash flow, it must be taken into account when estimating cash flow.

### Other Miscellaneous Factors:

The key discovered reasons in this part were the prevalence of arbitration disputes and the system's corruption. All of this has a detrimental impact on cash flow, and necessary precautions must be taken throughout construction to avoid such occurrences. It is also vital to pre-determine the scope of work, which will aid contractors in determining the appropriate execution strategy as well as cash flow forecasts. If the scope of work expands or contracts, the cash flow analysis changes, resulting in strategy failure. If numerous sites are up and running at the same time, it may have a significant impact on cash flow.

## 10. FUTURE SCOPE

In this study, it was concluded that numerous elements affect cash flow. These criteria, as well as the probabilistic

and frequency index approaches, were put to the test along with the reliability test. In the future, various simulations and models may be created to establish a common cash flow forecasting method that can be used by all construction stakeholders.

## REFERENCES

- [1] NIPFA, "Construction Industry in India | Construction Sector Investments," *Invest India*. 2022, [Online]. Available: <https://www.investindia.gov.in/sector/construction>
- [2] K. N. Jha and Pearson., *Construction project management : theory and practice*. Pearson, 2015.
- [3] PTI, "479 infrastructure projects show cost overruns worth Rs 4," 2022. [https://www.business-standard.com/article/economy-policy/479-infrastructure-projects-show-cost-overruns-worth-rs-4-4-trillion-121080100174\\_1.html](https://www.business-standard.com/article/economy-policy/479-infrastructure-projects-show-cost-overruns-worth-rs-4-4-trillion-121080100174_1.html).
- [4] D. Sanchita, "Many Indian startups and small businesses are running out of cash fast, a new survey shows Business Insider India." <https://www.businessinsider.in/business/startups/news/a-new-survey-shows-startups-msme-firms-are-running-out-of-cash/articleshow/76398244.cms>.
- [5] Y. Liu, T. Zayed, and S. Li, "Cash flow analysis of construction projects," *Proceedings, Annu. Conf. - Can. Soc. Civ. Eng.*, vol. 3, no. January 2009, pp. 1306–1313, 2009.
- [6] A. Purnus and C. N. Bodea, "Multi-criteria Cash Flow Analysis in Construction Projects," *Procedia Eng.*, vol. 164, no. June, pp. 98–105, 2016, doi: 10.1016/j.proeng.2016.11.597.
- [7] M. A. El Razek, H. E. D. Hosny, and A. El Beheri, "Risk factors in construction projects cash flow analysis," *Int. J. Comput. Sci. Issues*, vol. 11, no. 1, pp. 199–215, 2014.
- [8] T. T. O. Le, T. T. T. Vu, and C. Van Nguyen, "Identifying factors influencing on the cash flow of construction companies: Evidence from Vietnam stock exchange," *Manag. Sci. Lett.*, vol. 10, no. 1, pp. 255–264, 2020, doi: 10.5267/j.msl.2019.7.036.
- [9] Y. Liu, T. Zayed, and S. Li, "Cash flow analysis of construction projects," *Proceedings, Annu. Conf. - Can. Soc. Civ. Eng.*, vol. 3, pp. 1306–1313, 2009.
- [10] M. V. P. Nirmal, "Cash-Flow Management in Building Construction Projects," *Int. J. Res. Appl. Sci. Eng. Technol.*, vol. 7, no. 12, pp. 564–573, 2019, doi: 10.22214/ijraset.2019.12092.
- [11] H. Mahmoud, V. Ahmed, and S. Beheiry, "Construction Cash Flow Risk Index," *J. Risk Financ. Manag.*, vol. 14, no. 6, p. 269, 2021, doi: 10.3390/jrfm14060269.
- [12] H. A. Odeyinka, A. Kaka, and R. Marledge, "An Evaluation of Construction Cash Flow Management Approaches in Contracting Organizations," *Assoc. Res. Constr. Manag.*, vol. 1, no. September, pp. 3–5, 2003, [Online]. Available: [http://www.arcom.ac.uk/docs/proceedings/ar2003-033-041\\_Odeyinka\\_Kaka\\_and\\_Marledge.pdf](http://www.arcom.ac.uk/docs/proceedings/ar2003-033-041_Odeyinka_Kaka_and_Marledge.pdf).
- [13] G. Dhamodaran and K. R. D. Roy, "Estimation of cash flow from value of work done for construction projects in India," *Int. J. Eng. Adv. Technol.*, vol. 8, no. 2, pp. 433–437, 2019.
- [14] R. Mamata, P. Chauhan, D. Patel, C. Panchal, and D. Bhavsar, "RII & IMPI : effective techniques for finding delay in construction project," *Int. Res. J. Eng. Technol.*, vol. 03, no. 01, pp. 1173–1177, 2016.