



CONSTRUCTION SUPPLY CHAIN MANAGEMENT AND ORGANIZATIONAL PERFORMANCE IN CONSTRUCTION PROJECTS

1Handge Gauri, 2Prof.M.C. Aher

1student, 2Assistant Professor

1Pune university NDMVP College,

2NDMVP samajs,Karmaveer Adv.Baburao Ganpatrao Thakare College of engineering

ABSTRACT

In the present global market, the competition is not between the companies but between the supply chains. Whereas delays are common in construction projects. The occurrence of delays in construction projects is common and significantly affects in various ways. Delays in supply of materials and material shortage are some of the most important factors that cause a delay in construction project delivery globally. The critical effects of delay investigated are cost overruns, time overrun, and termination of the contract, arbitration, and litigation. Delay management in the construction industry is the main factor responsible for delays in the construction of the project and the growing rate of project delay is directly affecting the timely delivery of construction projects. This study evaluates the effect of delay on the construction of the project and remedial measures to prevent the delay in construction. This study aims to identify the effect of delays on completion of project & time of execution. And find the actual causes of project delay delivery factors that affect the supply chain management (SCM), then carry out the quantitative analysis using a questionnaire survey among contractors, engineers, and suppliers by using the Relative Importance Index (RII) Method. All factors affecting SCM have been ranked using RII Method using the response acquired respondent.

Keywords: Supply Chain Management, Delay, Relative Important Index, SPSS Software.

1. INTRODUCTION

The construction industry in India can be separated into primary three market fragments: Real Estate, Industrial, and Infrastructure. And there is a huge venture stream into the infrastructural improvement in India. Construction companies experienced a decrease in productivity and an increase in costs. Owners of these firms thought that these cost increases were due to economic and inflation problems and research explained that was also attributable to poor management. With the expanding worldwide rivalry, Indian firms need to take all the stakeholders of the building supply chain who impact the efficiency of the work of labor.

Recently supply chain has become a major subject of management research and manufacturing theory. It has been defined as the network of organizations that are involved through upstream and downstream linkages, in the different processes and activities that produce value in the form of services and products in the hands of the ultimate customer. Currently, supply chain management is in its developing stage. In this current scenario to avoid conflicts and competition among the suppliers, a proper supply chain management system is needed. Supply chain management (SCM) has been widely regarded as an effective and efficient management measure and strategy to improve the performance of the construction industry, which has suffered from high fragmentation, large waste, poor productivity, cost and time overruns, and conflicts and disputes for many years. Currently, supply chain management is in its developing stage. In this current scenario to avoid conflicts and competition among the suppliers, a proper supply chain management system is needed. It mainly consists of several participants and is complex.

The construction sector players include engineers, contractors, suppliers, and clients. They have major roles in establishing and developing SCM and collaboration. Many challenges are faced by the construction industry in India, and the important challenge among them is the improper material supply chain in construction. Every product that reaches an end-user is the cumulative effort of multiple organizations. These organizations refer collectively as a supply chain. Supply chain Network of organizations and business processes for procuring materials, transforming raw materials into finished products, and distributing the finished products to the customers. Supply chain management is an integration of suppliers, distributors, and customer logistics into one cohesive process.

Delays in a construction project are considered to be one of the usual problems in the construction industry. These are negative effects on the project concerning performance, time, and cost. Therefore, it is essential to identify the type of delays that usually occur during construction. This problem not only affects the construction sector but also the economy's growth and the feasible development of the nation. Construction delays can be defined as the late completion of work compared to the contract schedule or planned schedule. Those delays can be minimized only when their causes are known and identified. The reduction of delays can be achieved by applying the process of knowledge management and project learning which gives perception into the various problems and their solutions. Feedbacks from projects are the real eye-opener and they are helpful for others to avoid the same problems. The identification of various types of delays leads to various reasons for the delay. The reasons for the delays are recognized and the effect on construction projects can be reduced. The reasons for delays are contractor and client-related. Uncooperative project scope and improper early planning are the prime delays by the client. The objectives of this study are to evaluate and identify the effect of delays on project completion & time of execution and find the actual causes of project delay delivery.

1.1 Supply Chain Management

'Supply chain' is the term used to describe the linkage of companies that turns a series of basic materials, products, and services into a finished product for the client. All construction companies, be they client, main contractor, surveyor, supplier, or designer are therefore part of a supply chain. Because of the project-based nature of construction and the way that procurement normally operates, they are usually members of different supply chains on different projects. Each company in the chain has a client – the organization to which the services are provided – but an integrated supply chain will have the objective of understanding and working wholly in the interests of the 'project client'. The movement of a product or service from supplier to customer takes place with the help of the organization, people, technology, and resources. According to Terry & Harrison "a supply chain is a network of facilities and distribution options that perform the functions of procurement of materials, the transformation of materials into intermediate and finished products and the distribution of the finished products to customers".

- The benefits for individual companies in the supply chain include:
- Reduced real costs, with margins maintenance
- The incentive to remove waste from the process
- Greater certainty of out-turn costs

- Delivery of better underlying value to the client
- More repeat business with key clients

2. RESEARCH METHODOLOGY

A descriptive research method was adopted in this research by using a well-structured questionnaire for data collection. The data collected to determine the major factors which affect project delays was done through a survey by explorative questionnaire to the respondents involved in daily activities of construction firms.

The questionnaire was planned and designed so that respondents can give the rank to their answers based on their opinions. The analysis of these data was done by a ranking method named the relative importance index (RII) method.

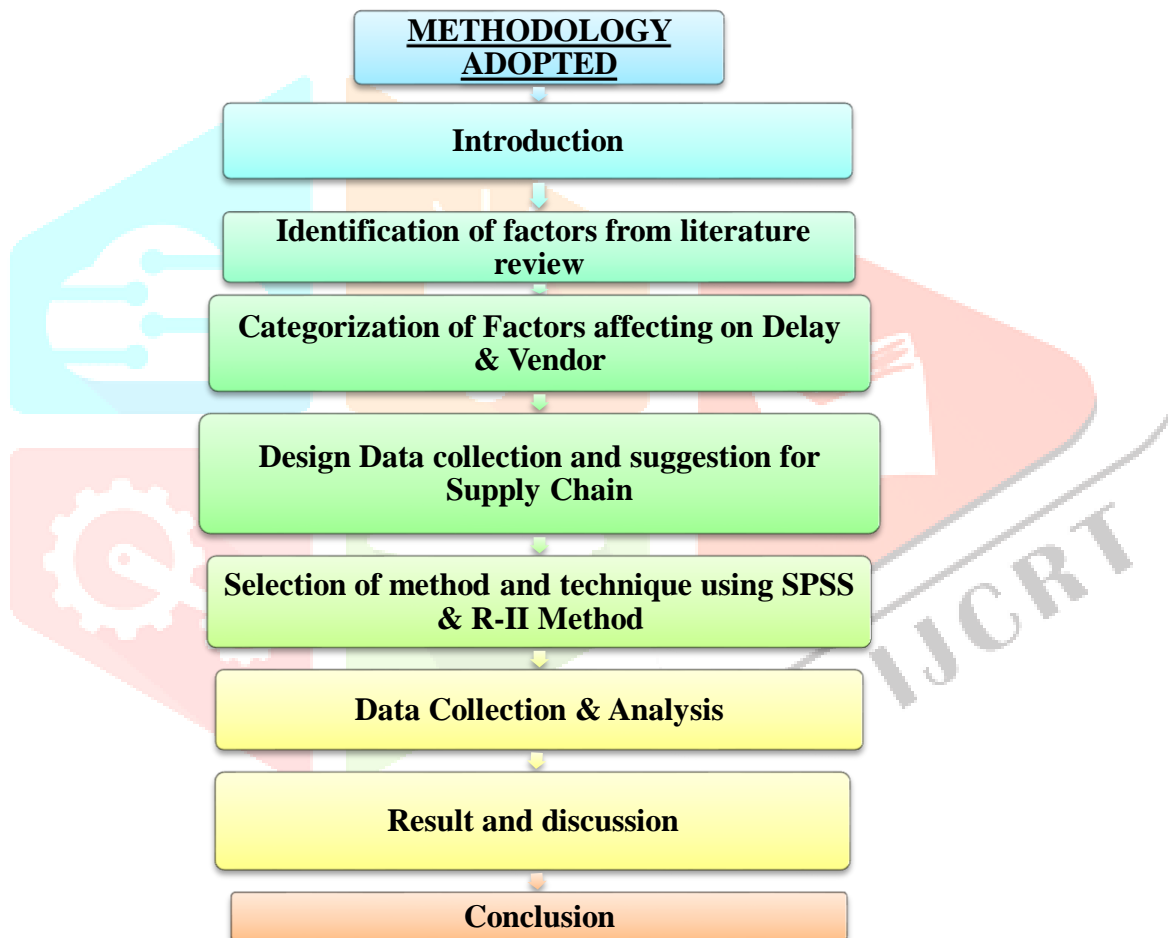


Figure 2.1: Flow of Methodology

3. DATA COLLECTION

Data collection was made from various sources. Initially, factors affecting delays in supply chain management were collected through a literature review from various research papers. The final survey was done to collect information; the survey form of the questionnaires was distributed to the engineers requested through a web survey i.e. Google form. The response to the questionnaire was to be answered in the form of a rating of 1-5, where 1 being not important and 5 being very important. The questionnaires were distributed through various electronic media platforms to a variety of respondents working around the construction projects. About 100 people have responded to the questionnaire survey.

3.1 Data Collection:

Table 3.1 Ranking of factors of working tools and objects

Factors	RII	Impact	Ranking
Quality of building materials	4.25	Very High	5
Quality of working tools	4.01	High	4
Complexity of works	3.72	Low	2
Material transport methods	3.02	Extreme Low	1

T
a
b
l
e

e 3.2 Ranking of factors that motivate employees

Factors	RII	Impact	Ranking
Types of salary payment	4.27	Very high	5
Staff Support	4.05	High	4
Reward Mechanism	3.69	High	4
Spiritual Life	3.58	Mid	3
Training and improving skills	3.32	Low	2
Initiative at work	3.18	Extreme low	1

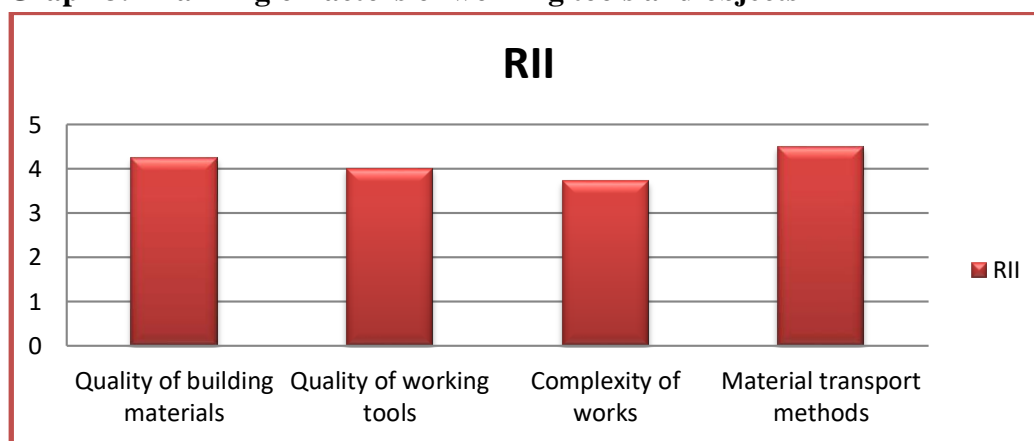
Table 3.3 Ranking of factors on workers themselves

Factors	RII	Impact	Ranking
Experience of workers	4.29	Very high	5
Labor Discipline	4.12	Very high	5
Physical ability	4.01	High	4
Psychophysiology ability	3.78	High	4
Labor Intensity	3.52	Mid	3
Age	3.41	Low	2
Gender	3.19	Extreme Low	1
Level of training	3.09	Extreme Low	1

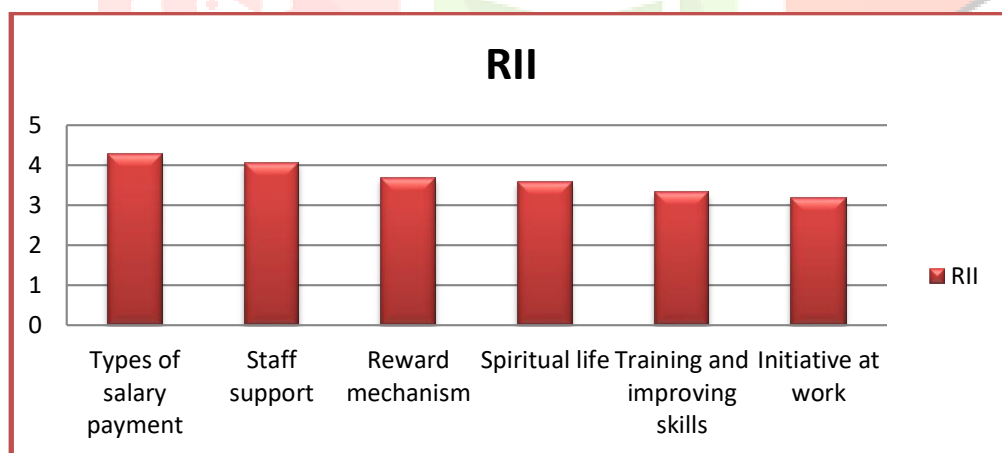
Table 3.4 Ranking of operational and managerial factors

Factors	RII	Impact	Ranking
Ability to organize production	4.23	Very high	5
Construction supervision	4.20	High	4
Application of technology	3.92	Mid	3
Workers' arrangement	3.73	Low	2
Labor's Communication	2.89	Extreme low	1

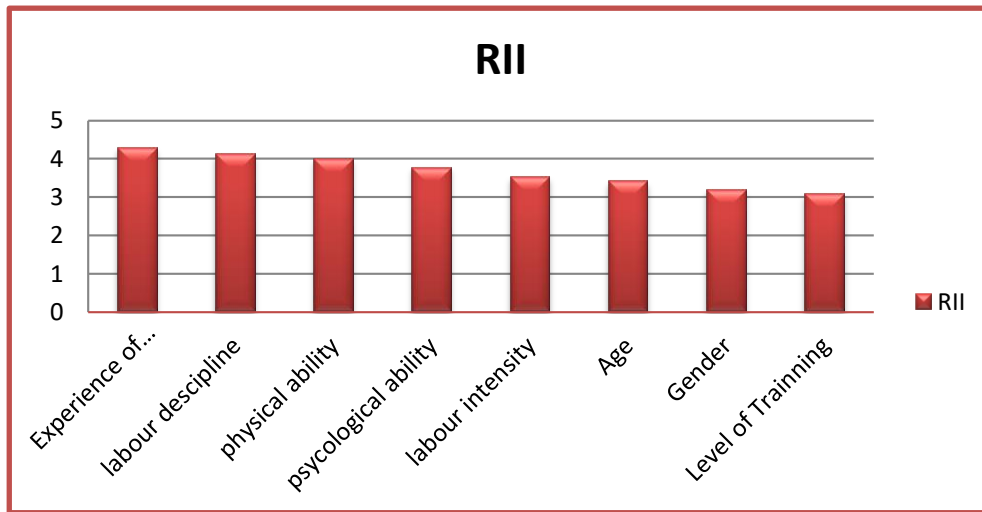
Graph 3.1 Ranking of factors of working tools and objects



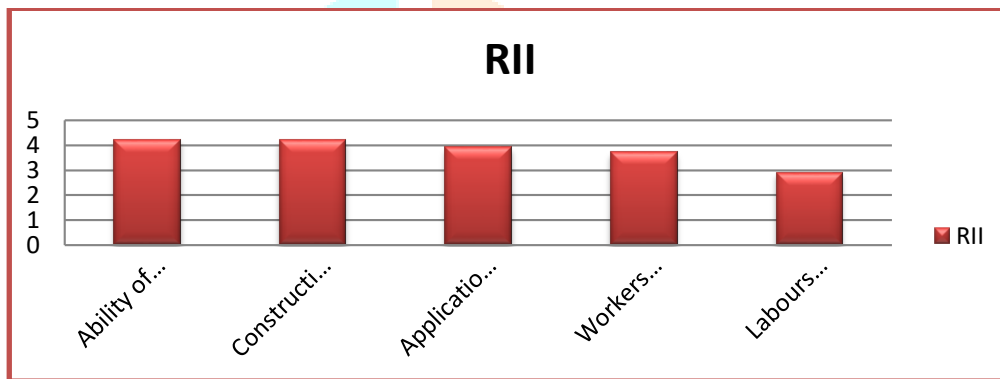
Graph 3.2 Ranking of factors that motivate employees



Graph 3.3 Ranking of factors on workers themselves



Graph 3.4 Ranking of operational and managerial factors



4. RESULTS & DISCUSSION

4.1 Questionnaire Survey

The questionnaire design practice advanced on a communicating basis. Questions in the respondent profile were created to collect information such as job position, the experience of the work, locations of the current and/or previous works, and contact information. The responses were to be based on the understanding, knowledge, and experience of the respondents and related to a particular project.

This simple and straight method was selected to establish a means of developing a list of factors affecting cost. A Five-point scale of 1(Strongly agree) to 5 (Strongly Disagree) was considered for evaluating the impact of each factor.

4.2 Pilot Survey and Questionnaire Revision:

To improve the questionnaire section, a pilot study was accompanied. This section contained identification of different causes, collection, and conclusions of data. The application of this section benefited in the better formation of the survey development. Total 25 questionnaires, were sent to laborers, contractors, architectures, owners, project managers, evaluators, and project engineers of various building construction organizations.

4.3 SPSS SOFTWARE-

Analysis of the questionnaires survey was done using IBM SPSS Software. SPSS Statistics is a software package used for statistical analysis. The software name originally stood for Statistical Package for the Social Sciences (SPSS), reflecting the original market. It is a Windows-based program that can be used to perform

data entry and analysis and to create tables and graphs. It is capable of handling large amounts of data and can perform all of the analyses covered in the text and much more. It is a widely used program for statistical analysis in social science. It is also used by market researchers, health researchers, survey companies, government, education researchers, marketing organizations, data miners, and others. All the responses obtained from the questionnaires are entered into the software. First, the variables or the questions are entered in the data view, then, the responses are entered into the software from the various data entered into the software, the frequency can be found which is used to determine the relative importance factor.

SPSS data View: The Questioner Survey responses were reported in an excel file. After opening data, SPSS displays them in a spreadsheet-like fashion as shown in below figure 6. The excel file was exported in data View and checked the values and other information in a spreadsheet.

Sr.No	Name	Cost_of_project	Time	Tensile_strength	Compressive_strength	Environment_impact	Drawings	Team	Data_collection	Expertise	Team_member	Labour	Project_cost	Precast_Prel
1	ADITYA KALE	1	1	1	1	1	1	1	1	1	1	1	1	1
2	ADITI SONAWANE	1	1	2	2	1	2	2	1	4	1	2	1	
3	NEHA PATIL	1	2	1	1	1	1	1	1	1	1	1	1	
4	VISHAL LOKHANDE	1	1	4	4	4	1	1	3	3	1	2	1	
5	VALLABESH SANE	2	2	2	2	1	4	4	2	1	5	3	1	
6	AJINUYA GAIKWAD	1	1	3	3	3	1	1	1	1	1	1	5	
7	OMKAR POL	1	1	2	2	3	5	1	4	4	1	5	3	
8	MRUNAL JOSHI	1	2	3	3	2	4	3	3	1	2	4	1	
9	SHASHANK MESHR...	1	1	5	5	5	2	1	1	1	4	1	4	
10	SUCHITA BARAHATE	1	1	2	2	1	5	5	1	1	5	1	2	
11	SUSHIMITA RANE	3	1	3	3	3	1	1	3	1	1	2	1	
12	NIKITA KULKARNI	1	1	1	1	2	5	1	2	3	1	3	1	
13	NEHA PARATE	1	4	4	4	4	1	1	1	1	1	1	1	
14	PRANJALI THANDE	2	2	1	1	3	1	3	3	1	1	1	1	
15	SANKET KULKARNI	1	1	5	5	1	1	1	1	1	1	1	3	
16	MAYURESH KANSE	1	1	1	1	1	5	1	2	1	1	1	1	
17	ANURAG PATIL	1	4	5	5	1	1	1	1	1	1	1	1	
18	AAKANSHA NOKJA	1	2	2	2	2	2	1	1	1	1	2	1	
19	DAMINI RANGARI	1	4	5	5	5	5	1	1	3	1	3	4	
20	NIVEND BHARNE	1	1	1	1	1	1	1	2	1	3	1	1	
21	SHREYASH GONDE	2	2	2	2	5	1	1	1	1	1	1	3	
22	GAURAV DAMAR	1	1	1	1	1	1	1	1	1	1	1	1	

Figure 4.1: SPSS Data View

SPSS Variable View: An SPSS data file always has a second sheet called variable view. It shows the meta-data associated with the data. Meta-data is information about the meaning of variables and data values. In Variable View, different columns are displayed. Each line corresponds to a variable. A variable is simply a quantity of something, which varies and can be measured, such as height, weight, number of children, educational level, gender, and so forth.

SPSS Data analysis: SPSS can open all sorts of data and display them and their metadata in two sheets in its Data Editor window. In our data containing a variable holding respondents' on ferrocement related questions, we can compute the frequency by navigating to Descriptive Statistics. For better understanding and detailed study, the pie charts option is also selected.

SPSS Output Window: After clicking Ok, a new window opens up, the SPSS output viewer window. It holds a nice table with all statistics on all variables we chose. Output Viewer window has a different layout and structure than the Data Editor window we saw earlier. Creating output in SPSS does not change our data in any way; unlike Excel, SPSS uses different windows for data and research outcomes based on those data.

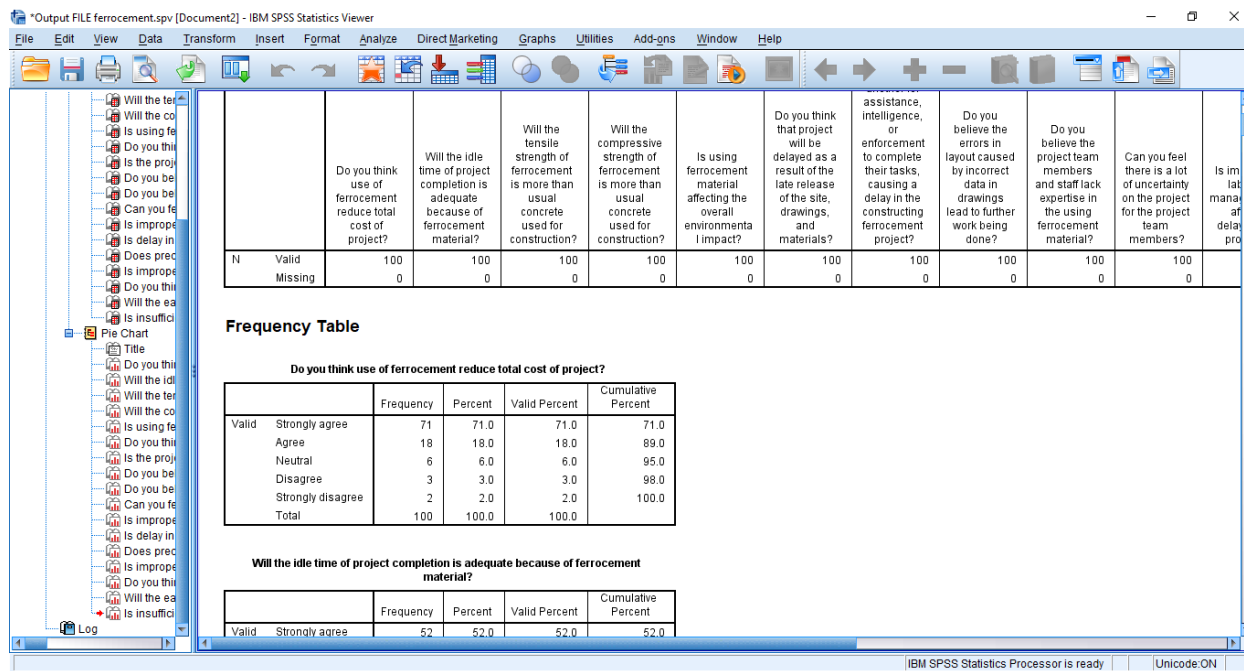


Figure 4.2: SPSS output window

Among the many available methods in collecting data two methods were adopted; these are literature review and questionnaires. The first step involves general information collection, including both first-hand and second-hand data, to identify major themes from the literature. In the second step, with the literature review and unstructured interviews, important factors of safety were identified. With these factors, a questionnaire was formed and Survey was conducted. The questionnaires were distributed through various electronic media platforms to a variety of respondents working around the construction projects. About 100 people have responded to the questionnaire survey.

4.4 RII Method

The sample for this study is relatively small. As a result, the analysis had combined all groups of respondents (clients, consultants, contractors, and regulatory boards) to obtain significant results. Data were analyzed by calculating frequencies and the Relative Importance Index (RII). In this project, the RII technique approach is used for data analysis. This technique is used to determine the relative importance of the various factors affecting the waste generation working on construction sites. The data analysis was carried out using SPSS software. SPSS was used to generate the frequency (fi) of the response category index for the cause and effect factors. The relative importance index (RII) for each factor was calculated using the frequency data for each response category generated from SPSS.

Assessment of questionnaire was carried out using three-point Likert scale from 1 to 5 representing can be not at all, no, most of the times, yes respectively. Data analysis was done calculating the Relative Important Index (RII) by the following formula. Ranking of the various factors according to their significance, and calculating their Relative Importance Index (RII)

$$RII = \frac{\sum W}{A} * N$$

Where, W = weight given to each factor by respondents

$$\sum W = 5 \times W_5 + 4 \times W_4 + 3 \times W_3 + 2 \times W_2 + 1 \times W_1$$

A = highest weight (i.e. 5)

N = total number of respondents (N=100)

5. CONCLUSION

This study includes a questionnaires survey in which we can find out the factor affecting the construction cost which directly related to the material used in construction projects. The factors affecting the construction cost and time were identified through the literature based on previous research.

The completion of the project with the mitigation and acceleration has resulted in a cost-saving as more delays would have meant that the budget would go out of control. The cost for the works should include additional provisions for subcontractors if the product is likely to come from abroad to take care of any inflation or fluctuations in currency. The nomination of subcontractors has to be done on time to prevent any delays. Due to the delay and project being put on hold, the reputation of the client would be badly affected. Clients should have enough funds to complete a project if a financial crisis affects the system.

6. REFERENCES

- [1]. Dhruv Gor, Dr. Jayeshkumar Pitroda, "The Impact of Supply Chain Management Practice on Construction Project Performance in Central Gujarat", IJTICES, vol 04,2455-2585,2018.
- [2]. Muhammad SherGabol, Dr. Danish Ahmed Siddiqui, "The factors impacting the success of supply chain management in the construction industry of Pakistan", SSRN Electronic Journal, 2019.
- [3]. Dr. S Kanchana, Ms. Sneha P "A study on supply chain management in construction project", IRJET, vol 05,2395-0072,2018.
- [4]. V.C. Jagadeesh Kumar, S.Nandhini, R.JeyaPriya "Investigation Of Supply Chain Management In Construction Companies", IRJET, vol 04,2395-0072,2017.
- [5]. Alfredo Serpell And Boris Heredia, " Supply chain management in construction: Diagnosis and Application issue." Research Gate,2004.
- [6]. Amade, B, Akpan, E.O.P., Ubani, E.C.and Amaeshi, U.F. "Supply Chain Management, and Construction Project Delivery: Constraints to its Application" PM world journal, vol v,2016.
- [7]. T.Subramani, S.Tamizhanban, "Supply Chain Management In Construction Site By Using SPSS Software" IJETCS, vol 05, 2278-6856,2016.
- [8]. Anders Segerstedt, Thomas Olofsson, "Supply chains in the construction industry" An International Journal, vol 15,347-353,2010.
- [9]. Joby George and V. Madhusudanan Pillai, "A study of factors affecting supply chain performance" ICAME, 1742-6596,2019.
- [10]. Lana LovrenčićB, AlicaG, JosipM "Supply Chain Management in the Construction Industry – A literature review" Research Gate,798-811,2016.
- [11]. Ruben Vrijhoef and L.Koskela, "Roles of Supply Chain Management in Construction" 133-146,1999
- [12]. Assaf, & Al-Hejji. (2006). Causes of delay in large construction projects. International Journal of Project Management, 24(4), 349-357.
- [13]. Odeh, & Battaineh. (2002). Causes of construction delay: traditional contracts. International Journal of Project Management, 20(1), 67-73.
- [14]. González, P., González, V., Molenaar, K., & Orozco, F. (2013). Analysis of causes of delay and time performance in construction projects. Journal of Construction Engineering and Management, 140(1), 04013027.
- [15]. Bubshait, A., & Cunningham, M. (1998). Comparison of Delay Analysis Methodologies. Journal of Construction Engineering and Management, 124(4), 315-322.
- [16]. Kao, & Yang. (2009). Comparison of windows-based delay analysis methods. International Journal of Project Management, 27(4), 408-418.
- [17]. Ala-Risku, & Kärkkäinen. (2006). Material delivery problems in construction projects: A possible solution. International Journal of Production Economics, 104(1), 19-29.