

Supply Chain Management: Implications on Project and Delay Aversion Tactics

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Abstract: The construction industry is one of the most dynamic industries in present day scenario. To expand India's infrastructure and for job creation, the Indian government has launched ₹103 trillion infrastructure projects along with about ₹1.70 trillion for transport infrastructure in the 2020-2021 union budget. On one hand, it provides a greater opportunity for each Construction Industry worker. While on the other hand, it also raises a question as well as a challenge to the management and procurement capabilities of the Civil Sector. This research has been carried out to recognize the causes and the symptoms of the problem and check its relevancy to non-utilization of a proper Supply Chain. Industry personnel at various positions and holding various amount of experience have been surveyed. The data received has been sorted and analyzed by Reliability test method in SPSS and then the factors have been recognized and ranked by RII method. Top 10 contributing factors have been recognized and recommendations have been made. Future scope has been mentioned keeping in mind a big issue of the global pandemic of COVID-19 prevailing during the time of this research.

Index Terms – Supply Chain Management, Construction and Project Management, Factor Analysis, RII, SPSS

I. INTRODUCTION

A Supply Chain is the back and forth of goods and services. It includes all the involved processes of obtaining raw material and turning it into final commodities and then their distribution. The concept of Supply Chain Management originated from the Manufacturing Industry. It remains largely unaltered since its origin in the late 19th century in the armory practices and then later on in the production systems of Henry Ford in the 1920s. A Supply Chain is a representation of how the flow of resources begins from the very first supplier to the very last client. SCM is a strategy that details how to administer individual supply chains in a unified manner in an organization for maximum profit returns. The main aim of implementing this strategy is to assure maximum client satisfaction at the best price primarily by keeping in check the flow of resources and information.

Although there have been great achievements of erecting spectacular structures in record time by many Indian firms, the ugly truth of the industry still stays that delays in project completion are no new thing. According to recent statistics, 75-80% of all construction Projects are running over time. One of the major causes for this delay is inappropriate and inadequate procurement plan.

Managing a supply chain requires total knowledge of the categorization and understanding of products and services as well as organizations and resources that convert raw materials into a finished product. With the change from traditional ways to more contemporary ways of execution in the construction industry, the possibility and necessity of a proper management team for the long-term relationships and organizational influence has also increased. According to recent researches, around 60% of the projects lag behind due to unavailability of labor, machinery, materials or manpower at the right time. To fill this developing crack in the civil sector, the usage of Supply Chain Management is considered.

II. NEED FOR STUDY

For most part in conventional practices, the governing factor in the link between a contractor and a supplier regarding specific products or services has been favoring the lowest bidder. Thus, a number of different players have worked simultaneously with clients under differing contracts. To overcome the hassle thus presented, a move towards cohesive supply chains wherein the parties involved create continuing relationships.

The advantages of such a supply chain procurement process include:

- Higher profit returns at lower initial cost
- Reduction in equipment maintenance margins
- Increased possibility of repeat pairing with clients
- Improvement in planning and coordination for long-term
- Better receptiveness from delivery facilities
- Possibility of overall decrease in faulty material
- Increase in client satisfaction
- Improvement in firm image and status

III. OBJECTIVE AND SCOPE

This research has been carried out with the aim to recognize the factors that hinder the application and proper execution of Supply Chain Management in the Construction Industry. The research is focused on uncovering the sources and the indications of the lack of enthusiasm around the subject studied in the Construction sector.

IV. RESEARCH METHODOLOGY

4.1 Methodology Chart

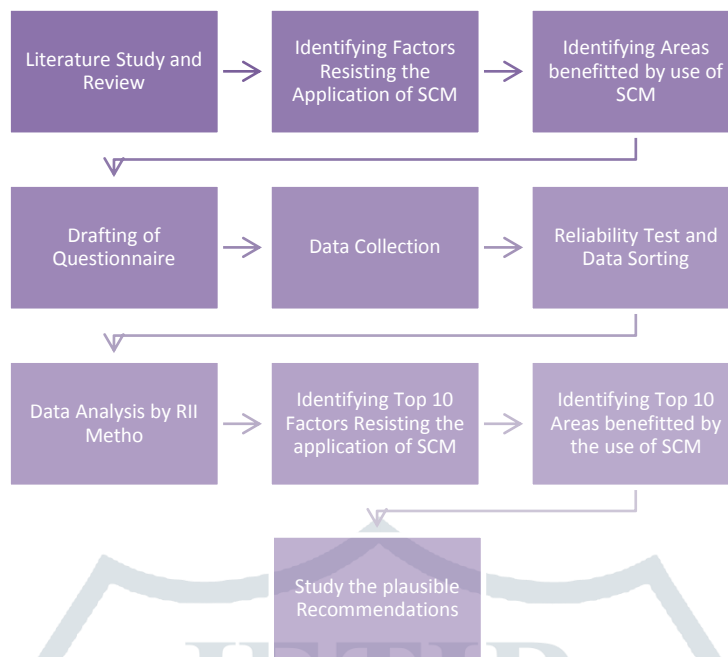


Fig 1: Methodology flowchart

4.2 Material and Methodology

Literature review of 25 papers showed that the traditional form of project execution had its reasons and outcomes based upon the customary practices at the time. In today’s scenario, a change of ways has become essential to give the lagging projects a much-needed boost of proper procurement techniques. Up to 60% reduction could be observed in the time of procurement and finished goods by proper utilization and updating the Supply Chain Management techniques. In spite of this, the usage of Supply Chain is hindered not only from a lower level. Issues arise from not just the firm but exterior factors also cause unwanted issues. Proper execution of a Supply Chain is highly dependent on communication. An inept Information sharing platform or hub is also a factor in hinderance of proper execution. Inventories can be decreased which in turn will decrease wastage. With reduced inventories, problems occurring due to poor storage and handling conditions can be reduced. Resource Planning or Resource Management are an integral part of an enterprise. Appropriate demand forecasting, quantity evaluation and valuation are also contributing factors to Supply Chain Management. The review of the literatures referred helped in shaping the questionnaire. The basic issues identified in the literatures were assessed and picked up to jumpstart the data collection process.

V. DATA COLLECTION BY QUESTIONNAIRE

Data collection is the procedure of collecting and computing information on beset variables in an established system, which then enables to answer relevant questions and to evaluate outcomes. Primary data was collected in reference to literature review and need for study by studying the existing data and literature papers. Cases were studied by Observation Method for Qualitative Data. However, this method of data collection did not prove much helpful in getting to the desired results.

On studying the Literatures and discussions with some area experts, a Likert Scale Questionnaire with 2 section consisting of 25 Barriers and 12 Beneficiary Areas respectively was identified as the right fit.

Survey was to be conducted by the aid of a total of 80 Questionnaire results for an extensive Quantitative data collection, along with existing data from previous researches. However, on calculation, a sample size of 50 was to be collected.

5.1 Sample Size Calculation

For a representative population statistical sample, the formula shown below:

$$SS = \frac{Z^2 * p * (1-p)}{C^2}$$

Where, Z = statistic value for the confidence level (e.g. 1.96 for 95% confidence level)
 p = Percentage picking a choice, expressed as decimal (0.5 used for sample size needed)
 C = Confidence interval, expressed as decimal (e.g. 0.1)

The prepared questionnaire was distributed physically among 50 Construction industry workers holding various positions. The main idea for the research was to get a proper idea as to how much each person working in the industry, irrespective of their position, can tell about the problems in the implementation of Supply Chain Management and its effects. Along with this, an online survey was also given out on a larger platform as well as personal messages.

Table.1: Evaluation Criteria for Likert Scale Questions

Score Interval (Mean)	Significance
1.00-1.79	Very Low Level
1.80-2.59	Low Level

2.60-3.39	Moderate Level
3.40-4.19	High Level
4.20-5.00	Very High Level

VI DATA ANALYSIS

To carry out the analysis, the data was first put through a Reliability test in the SPSS software. A Reliability test analyses the internal consistency in the data to ensure that the chosen data set is reliable for further analysis. The reliability coefficient i.e. the Cronbach's Alpha ranges from 0 to 1. The Closer it is to 1, the greater is the reliability of the data.

Table.2: Data collected for Section 1 of Questionnaire

Factors Resisting application of SCM	Mean	Standard Deviation	Mode
Understanding and Knowledge of Procurement team	4.64	0.63	5.00
Lack of professionals with adequate knowledge to implement	4.52	0.74	5.00
Skepticism of inappropriate quality in long run	4.50	0.89	5.00
Demand Forecasting	4.46	0.76	5.00
Suppliers capacity to maintain the required chain	4.46	0.71	5.00
Difficulties of management of stock	4.46	0.86	5.00
Top management is not open to changes	4.44	0.99	5.00
Mistrust in suppliers	4.42	0.88	5.00
Top management is unaware of the concept	4.38	0.95	5.00
Price oriented approach of the firm	4.38	0.85	5.00
Inadequate information technologies on supplier side	4.38	0.70	5.00
Managing transparency is an issue	4.38	0.78	5.00
Suppliers readiness to deliver quality	4.28	0.99	5.00
Lack of consultants to guide the firm with the issue	4.26	0.88	5.00
Suppliers are stationed far away causing high transport cost	4.24	0.85	5.00
Suppliers are not interested in long term cooperation	4.22	1.09	5.00
Project based production strategy is implemented	4.22	0.82	5.00
Organizational Structure is not supportive	4.18	0.96	5.00
Insufficient resources for information sharing	4.16	0.96	5.00
Resistance from suppliers due to risks	4.16	0.96	5.00
Prevalence of hostile relations in construction process	4.12	0.82	4.00
Logistics issues	4.08	0.97	4.00
Not seen as fit for a dynamic industry	4.08	0.99	5.00
Unhealthy competitiveness spread out in the industry	4.00	0.99	4.00
Business owners and employers are more important	3.98	0.94	5.00

Table.3: Data Collected for Section 2 of Questionnaire

Areas Benefitted by SCM	Mean	Standard Deviation	Mode
Lead time	4.56	1.25	5.00
Workflow	4.42	1.07	5.00
Image of firm	4.34	0.98	5.00
Storage issues	4.22	1.13	5.00
Cost overruns	4.20	0.93	5.00

Time overruns	4.20	0.97	5.00
Unwanted time buffers	4.14	1.21	5.00
Quality	4.14	1.20	5.00
Better work environment	4.14	1.11	5.00
Earned Value	4.02	1.33	5.00
Logistic expenses	3.98	1.10	4.00
Productivity	3.86	1.68	5.00

6.1 Reliability test with SPSS Software

Analysis is done by the SPSS software to analysis the questionnaire responses with RII analysis with the help of graphical method. These analyses have determined that the all the questions in survey form are given that analysis result to identify each question response. This will help me to find out the result of my survey.

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	50	100.0
	Excluded ^a	0	.0
	Total	50	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.946	25

Reliability

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Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	50	100.0
	Excluded ^a	0	.0
	Total	50	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.879	12

Results of Reliability Test of Acquired Data For both Sections of Questionnaire

After the calculation $\alpha_1 = 0.946$ and $\alpha_2 = 0.879$, hence the data is highly reliable.

6.2 Relative Importance Index method of Analysis

On confirming the reliability of the data, the frequencies of the responses were analyzed and RII (Relative Importance Index) method was used for the ranking of top 10 factors in each of the two sections of the study. Due to the questionnaire following a Likert Scale model, RII method of analysis was deduced to be the most befitting.

The following formula was utilized to determine the relative index:

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

Where W is the weightage assigned to each response category.
 A is the maximum weightage and
 N is the total number of samples.

6.2.1 Results of RII Analysis

Table.4: Top 10 Factors Resisting the Application of SCM

Factors Resisting the application of SCM	Rank	ΣW	RII
Understanding and Knowledge of Procurement team	1	232	0.928
Lack of professionals with adequate knowledge to implement	2	226	0.904
Skepticism of inappropriate quality in long run	3	225	0.9
Demand Forecasting	4	223	0.892
Suppliers capacity to maintain the required chain	5	223	0.892
Difficulties of management of stock	6	223	0.892
Top management is not open to changes	7	222	0.888
Mistrust in suppliers	8	221	0.884
Top management is unaware of the concept	9	219	0.876
Price oriented approach of the firm	10	219	0.876

Graph.1: Graphical Representation Relative Importance Index for Section 1

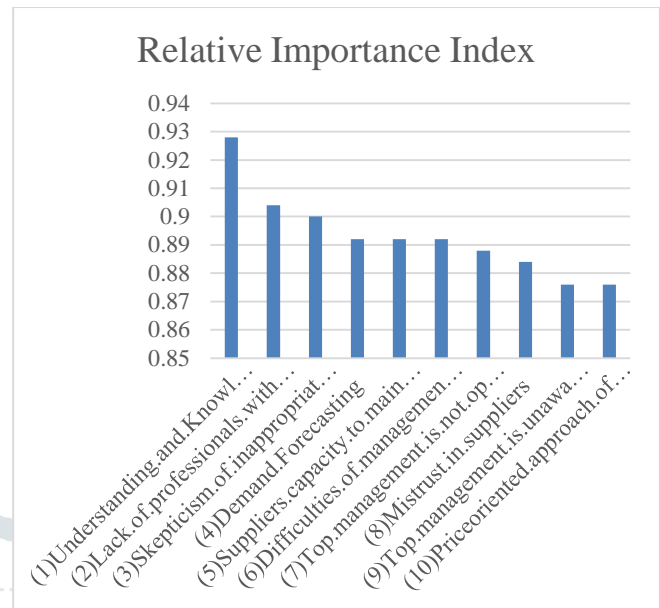
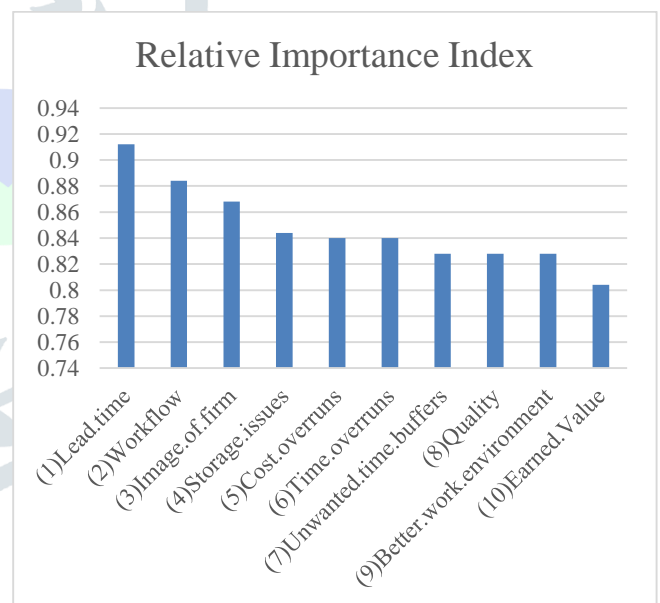


Table.5: Top 10 Areas Benefitted by use of SCM

Areas Benefitted by Use of SCM	Rank	ΣW	RII
Lead time	1	228	0.912
Workflow	2	221	0.884
Image of firm	3	217	0.868
Storage issues	4	211	0.844
Cost overruns	5	210	0.84
Time overruns	6	210	0.84
Unwanted time buffers	7	207	0.828
Quality	8	207	0.828
Better work environment	9	207	0.828
Earned Value	10	201	0.804

Graph.2: Graphical Representation Relative Importance Index for Section 2



VII CONCLUSION

The study conducted throws light on the problem areas in the sector along with highlighting the positive effects of appropriate usage of Supply Chain Management. The most significant barrier to the application of supply chain management is lack of knowledge and of awareness among the working parties. Mistrust and skepticism among the stakeholders regarding quality is also a key problem in the execution. Lack of consultants to guide the contractor in creating a supply chain partnering is one of the key problems in industry. Short-term and price-oriented approaches in the sector unfavorably affect the management methods of both contractors and suppliers. Short-term goals caused by project-based production, price-orientation, lack of mutual trust and hostile relationships result in short-term relationships. Management of contracting firms are subject to conservative approaches. Therefore, respondents believe that both top management of contractors and suppliers would oppose new systems and changes.

The recommendations for the stated factors would be:

- Hiring a team of professionals apt in the techniques and methods of executing an excellent chain for proper implementation.
- Allocating a right people at right places to make the workflow smooth and easy.
- Thorough study and analysis before supplier selection should be done to avoid unwanted issues.

- Renewal of company strategies after proper consideration towards a more modern and appropriate way of execution.

The research proposes a significant increment in timely execution of projects based upon the conducted studies.

Most of this research had been carried out at a time when the world was going through one of the (if not THE) biggest trouble in economic, physical as well as psychological terms. The external factors responsible for the successful execution of a Supply Chain went through a lot of changes during the time that this research was processed. The world was engulfed in a global pandemic of COVID-19, resulting in a standstill in most areas of development. Studying the global market in accordance to global supply chains in the aftermath of the pandemic holds a great scope to work on in the future studies.

VIII REFERENCES

- [1] Alfredo Serpell and Boris Heredia, Supply Chain Management in Construction: Diagnosis and Application Issues, Excerpt from "Ethical and Sustainable Supply Chain Management in a Global Context", 2005.
- [2] Barnes, J., & Liao, Y., (2012) "The Effect of Individual, Network, and Collaborative Competencies on the Supply Chain Management System", International Journal of Production Economics. Vol. 140, No. 2, pp. 888–899.
- [3] Amin, S. H., & Zhang, G., (2012), "An integrated model for closed-loop supply chain configuration and supplier selection: Multi-objective approach", Expert Systems and Applications, Vol. 39, No. 8, pp 6782-6791.
- [4] Chen-Tung Chena, Ching-Torng Linb, Sue-Fn Huangb, (2006) "A fuzzy approach for supplier evaluation and selection in supply chain management", Int. J. Production Economics, Vol. 102, pp 289-301.
- [5] Daniel Jack, Performance management in construction industry by utilizing the initiatives of construction supply chain management, International Journal Online Of Humanities (IJOHMN), 2015.
- [6] Dr. Dawei Lu, Fundamentals of Supply Chain Management, 2011.
- [7] Dr. Mohamed Baymout, ERP Systems in Supply Chain Management, International Journal of Advance Research, IJOAR, 2014.
- [8] Dr. S Kanchana, Ms. Sneha P., A Study on Supply Chain Management in Construction Projects, International Research Journal of Engineering and Technology (IRJET), 2018.
- [9] Ebrahim Salami, Serkan Aydinli, Emel Laptali Oral, Barriers to Implementation of Supply Chain Management, International Journal of Science and Research (IJSR), 2016.
- [10] K.L Choy, W.B Lee, V Lo, (2003a,b) " Design of an intelligent supplier relationship management system: a hybrid case based neural network approach", Expert Systems with Applications, Vol. 24, No. 2, pp. 225–237. International Journal of Managing Value and Supply Chains (IJMVSC) Vol.5, No. 1, March 2014 32.
- [11] Kalyan Vaidyanathan, Case Study in Application of Project Scheduling System for Construction Supply Chain Management, Proceedings IGLC-10, 2002.
- [12] Phong Thanh Nguyen, Vi Nguyen Nguyen, Luan Hong Pham, Thu Anh Nguyen, Quyen Le Hoang Thuy To Nguyen, Vy Dang Bich Huynh, Application of Supply Chain Management in Construction Industry, Advances in Science and Technology Research Journal, 2018.
- [13] Ruben Vrijhoef and Lauri Koskela, Roles of Supply Chain Management in Construction, Proceedings IGLC-7, 1999
- [14] Sahil Kaushik, Use of Information Technology in Construction Industry for Supply Chain Management, International Research Journal of Engineering and Technology (IRJET), 2018.
- [15] Satyajeet D. Khutale, Dr.Mrs. Shusma S. Kulkarni, Improvement in Supply of Construction Material for Construction Industry- By Applying Supply Chain Management Tool, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), 2013.
- [16] Shilpa Parkhi, Sourabh Joshi, Shubham Gupta, Mridu Sharma, A Study of Evolution and Future of Supply Chain Management, AIMS International Journal of Management, 2015.
- [17] V.C. Jagadeesh Kumar, S.Nandhini, R.Jeya Priya, Investigation Of Supply Chain Management In Construction Companies, International Research Journal of Engineering and Technology (IRJET), 2017.
- [18] Vorst, J. V., & Beulens, A. (2002). Identifying sources of uncertainty to generate supply chain redesign strategies. International Journal of Physical Distribution & Logistics Management, 32 (6), 409-30.
- [19] W. C. Benton, Jr. and Linda F. McHenry, Construction Purchasing and Supply Chain Management, The McGraw Hills Company, 2010.
- [20] Xiaolong Xue, Yaowu Wang, Qiping Shen, Xiaoguo Yu , Coordination mechanisms for construction supply chain management in the Internet environment, International Journal of Project Management, 2007.