Implementation and Challenges of Supply Chain Management in the Construction Sector

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***Abstract*—The construction industry is one of the most dynamic yet fragmented sectors, often facing challenges in coordination, resource management, and timely project delivery. Effective Supply Chain Management (SCM) plays a crucial role in addressing these inefficiencies by integrating various stakeholders, processes, and technologies. This study aims to understand the concept, significance, and current status of SCM practices within the construction industry. A comprehensive questionnaire-based survey was conducted among industry professionals to identify the major challenges and barriers affecting SCM implementation. The study further analyzes existing supply chain practices, focusing on the level of technological adoption and collaboration among contractors, suppliers, and clients. Microsoft Project (MSP) is utilized to demonstrate its application in planning, scheduling, and managing supply chain operations, emphasizing its potential to enhance coordination, streamline resource allocation, and improve overall project performance. The findings highlight those digital tools like MSP can significantly strengthen construction supply chains by promoting transparency and real-time monitoring. Finally, the research proposes strategic recommendations for the effective adoption of digital supply chain management systems, contributing to improved productivity, reduced project delays, and better decision-making across the construction sector.**

***Index Terms*—Supply Chain Management, Construction Industry, Microsoft Project (MSP), Digitalization, Project Efficiency**

I. INTRODUCTION

The construction industry plays a pivotal role in the economic development of any nation, contributing significantly to infrastructure growth, employment generation, and urbanization. However, despite its importance, the sector is often characterized by fragmented operations, poor coordination among stakeholders, cost overruns, time delays, and inefficiencies in resource utilization. In recent years, the concept of Supply Chain Management (SCM) has emerged as a strategic approach to address these challenges and enhance overall project performance.

The successful implementation of Supply Chain Management (SCM) in the construction industry faces several unique challenges due to the industry's project-based nature, fragmented structure, and high dependency on external stakeholders. Unlike manufacturing, construction projects are temporary, location-specific, and involve multiple independent organizations, making coordination and integration difficult. The major challenges can be broadly categorized as follows.

1. Fragmentation of the Industry

The construction sector consists of various independent entities such as clients, contractors, subcontractors, suppliers, and consultants who often work on a short-term contractual basis. This fragmentation limits long-term collaboration, leading to poor coordination and communication among stakeholders. As a result, supply chain efficiency is compromised, and delays or cost overruns become common.

2. Lack of Integration and Collaboration

Effective SCM requires seamless integration of activities across all participants in the supply chain. However, in construction, stakeholders often operate in isolation, focusing on their individual objectives rather than the project as a whole. The absence of

collaborative planning, information sharing, and mutual trust hinders the development of an integrated supply chain network.

3. Inefficient Communication and Information Flow
Timely and accurate information is crucial for decision-making in supply chain operations. Many construction projects still rely on traditional communication methods, resulting in delays, data loss, or misinformation. The lack of digital platforms for real-time information sharing leads to poor visibility of material status, delivery schedules, and resource availability.

4. Poor Planning and Scheduling
Inadequate planning at the early stages of the project often causes material shortages, overstocking, or mismatched delivery schedules. When supply chain activities are not properly aligned with project timelines, the entire construction process is disrupted. This challenge highlights the need for advanced planning tools such as Microsoft Project (MSP) to synchronize supply and demand effectively.

5. Lack of Awareness and Training
Many professionals in the construction sector are unaware of modern SCM principles or lack training in digital tools and analytical techniques. This knowledge gap prevents organizations from adopting innovative practices and limits their ability to optimize the supply chain.

6. Resistance to Technological Adoption
Despite the availability of advanced software tools like BIM, ERP, and MSP, many firms hesitate to implement them due to high initial costs, lack of expertise, or fear of change. The resistance to adopting digital technologies results in continued reliance on outdated manual systems, which reduces efficiency and transparency.

7. Uncertain Demand and Supply
Fluctuations in material availability, transportation issues, or supplier performance can significantly affect construction schedules. Unlike manufacturing, where supply chains are repetitive and predictable, construction supply chains face uncertainties due to project-specific requirements and changing site conditions.

8. Financial and Contractual Issues
Financial instability, delayed payments, and unclear contractual responsibilities often lead to disputes among stakeholders. These issues disrupt the flow of materials and services, resulting in inefficiencies and strained relationships within the supply chain.
9. Logistics and Transportation Constraints
Transportation delays, inadequate storage facilities, and inefficient handling of materials can cause bottlenecks in the supply chain. In large construction projects, managing logistics effectively is crucial, yet often neglected, leading to waste and increased project costs.

10. Lack of Standardization
Every construction project is unique in terms of design, materials, and processes. The absence of standardized procedures for procurement, documentation, and quality control makes it difficult to implement uniform SCM practices across projects.

11. External Factors
External conditions such as market fluctuations, regulatory changes, labor shortages, and environmental constraints can severely affect supply chain performance. These factors are often beyond the control of project managers and require flexible and adaptive management strategies.

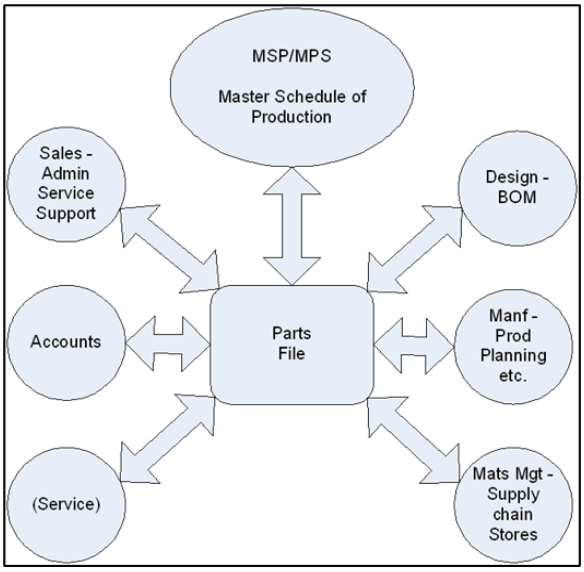


Fig 1 Supply Chain Management

A. Need for The Study

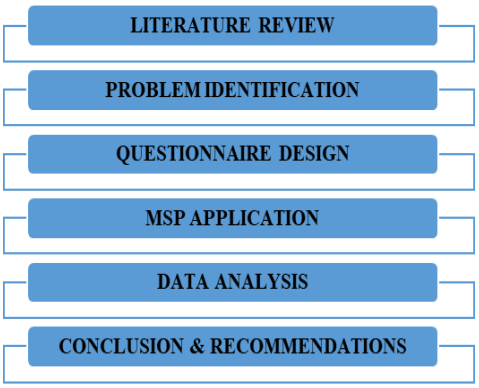
The construction industry faces continuous challenges in managing complex supply chains involving multiple stakeholders, diverse materials, and dynamic project conditions. Inefficiencies in communication, material flow, and coordination often result in cost overruns, project delays, and resource wastage. Despite the proven advantages of Supply Chain Management (SCM), its practical implementation in the construction sector remains limited due to poor integration, lack of awareness, and minimal use of digital tools.

B. Advantages of a Good Supply Chain

- The management gets to concentrate on core issues rather than distribution and supply as it controls the supply chain from above rather than from within.
- The stock is stored lower in the supply chain, i.e closer to the consumer.
- Higher discounts can be made available to the intermediary as volumes are high.
- Short Lead Time for retailers.
- Retailers can concentrate on smaller operations.
- Transportation is cheaper.

II. METHODOLOGY

The study aims to understand the current practices, challenges, and technological interventions in supply chain management (SCM) within the construction industry. The research process involves literature review, problem identification, questionnaire survey, case study using Microsoft Project (MSP), data analysis, and formulation of conclusions and recommendations.



III. ANALYSIS OF THE QUESTIONNAIRE SURVEY

The purpose of this survey was to understand the existing practices, barriers, and the level of technological adoption in managing supply chain activities within infrastructure projects. The responses were collected from professionals working in the Digha, Navi Mumbai region to reflect realistic industry conditions.

The survey aimed to capture the opinions of engineers, project managers, site supervisors, and procurement personnel regarding various SCM aspects such as integration, coordination, communication, material management, and technology usage. A total of 37 valid responses were obtained and considered for analysis in this study.

Table 1 Challenges of Supply Chain Management RII Ranking

Sr	Group	Challenges of Supply Chain Management	RII	Ranking
1	Fragmentation of the Industry	The construction industry is highly fragmented with many short-term participants.	0.589	19
		Collaboration among different stakeholders (contractors, suppliers, consultants, clients) is limited.	0.589	19
		Fragmentation leads to poor coordination and miscommunication in projects.	0.6	17
		Short-term contracts reduce trust and long-term relationships between partners.	0.562	21
		Fragmentation negatively affects the efficiency of the overall supply chain.	0.605	16
2	Lack of Integration and Collaboration	Different parties in the construction project work in isolation.	0.568	20
		There is minimal sharing of project information among stakeholders.	0.616	15
		Collaborative planning between suppliers and contractors is lacking.	0.638	11
		Integration of project activities across the supply chain is poor.	0.632	12

		Lack of mutual trust affects teamwork and cooperation in SCM	0.681	4
3	Inefficient Communication and Information Flow	Communication gaps between project participants cause delays.	0.638	11
		Most information exchange still occurs through manual or traditional methods.	0.622	14
		There is no centralized digital platform for tracking materials and deliveries.	0.627	13
		Delayed or inaccurate information often affects project decisions.	0.665	7
		Lack of visibility in supply chain status leads to coordination problems	0.616	15
4	Poor Planning and Scheduling	Project schedules are often not aligned with supply chain activities.	0.546	23
		Poor planning results in material shortages or overstocking.	0.595	18
		There is inadequate use of planning tools such as Microsoft Project (MSP).	0.622	14
		Lack of synchronization between procurement and project timelines causes delays.	0.616	15
		Early-stage planning is not given enough attention in most projects.	0.622	14
5	Lack of Awareness and Training	Many professionals lack awareness of supply chain management concepts.	0.622	14
		SCM-related training programs are rarely provided in organizations.	0.654	9
		Staff are unfamiliar with analytical or digital SCM tools.	0.665	7
		Lack of knowledge prevents adoption of best supply chain practices.	0.67	6
		Continuous professional development in SCM is not encouraged.	0.692	3
6	Resistance to Technological Adoption	Construction firms are hesitant to adopt modern SCM technologies.	0.595	18
		High initial investment costs discourage digital adoption.	0.627	13
		Employees resist change from manual to digital systems.	0.654	9
		There is a lack of expertise in implementing ERP/BIM/MSP systems.	0.703	1
		Reliance on outdated processes reduces SCM transparency and efficiency	0.681	4
7	Uncertain Demand and Supply	Material availability fluctuates unpredictably during projects.	0.659	8
		Supplier delays disrupt the planned project schedule.	0.676	5
		Sudden demand changes lead to unbalanced material flow.	0.67	6
		Weather or site conditions often affect supply chain operations.	0.676	5
		Demand and supply uncertainties increase overall project costs.	0.643	10
8	Financial and Contractual Issues	Payment delays from clients affect supplier relationships.	0.595	18
		Financial instability among contractors impacts procurement efficiency.	0.622	14
		Unclear contract terms cause disputes and confusion.	0.616	15
		Budget constraints limit supply chain optimization.	0.676	5
		Lack of financial transparency disrupts SCM operations	0.681	4
9	Logistics and Transportation Constraints	Transportation delays frequently occur due to poor planning.	0.605	16
		Inadequate storage facilities at construction sites cause material damage.	0.659	8
		Poor coordination in logistics leads to wastage and rework.	0.67	6

		High transportation costs significantly affect project budgets.	0.697	2
		Inefficient material handling increases project delays.	0.638	11
10	Lack of Standardization	Procurement procedures vary significantly from project to project.	0.557	22
		There is no standard documentation system for SCM activities.	0.6	17
		Lack of quality standardization causes inconsistency in material supply.	0.616	15
		Absence of standard SCM processes reduces operational efficiency.	0.654	9
		Each project's unique approach hinders learning and best practice replication	0.676	5
11	External Factors	Fluctuations in material prices affect project profitability.	0.6	17
		Changes in government regulations disrupt supply chain planning.	0.654	9
		Labor shortages delay material handling and installation.	0.659	8
		Environmental constraints limit logistics and storage options.	0.638	11
		External market instability adds risk to supply chain continuity.	0.665	7

Observation

- Lack of expertise in implementing ERP/BIM/MSP systems (RII = 0.703 – Rank 1) This is the highest-rated challenge, showing that many construction firms face a serious shortage of skilled professionals capable of using digital project integration tools. This limits automation, data sharing, and project tracking efficiency across the supply chain.
- High transportation costs significantly affect project budgets (RII = 0.697 – Rank 2) Transport expenses form a major portion of total project costs. Inefficient logistics planning, fuel price fluctuations, and long-distance sourcing of materials directly strain budgets, reducing project profitability.
- Continuous professional development in SCM is not encouraged (RII = 0.692 – Rank 3) The lack of ongoing training prevents construction professionals from updating their SCM knowledge and adapting to new tools or methods, leading to outdated practices and lower productivity.

IV. MSP IMPLEMENTATION

A. Project Details

- Project- Data Center Located at Thane Maharashtra
- Client - AGP DC Infra Two Private Limited.
- Length- 600 mtr
- Budget – 10 Cr

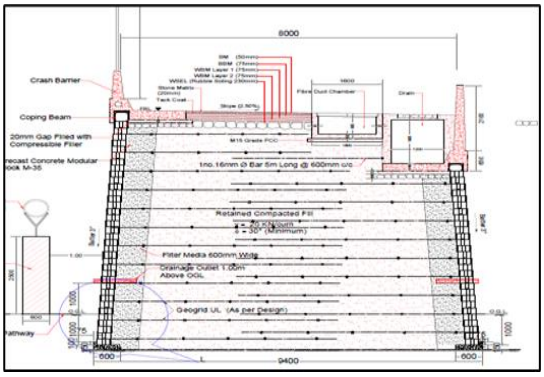


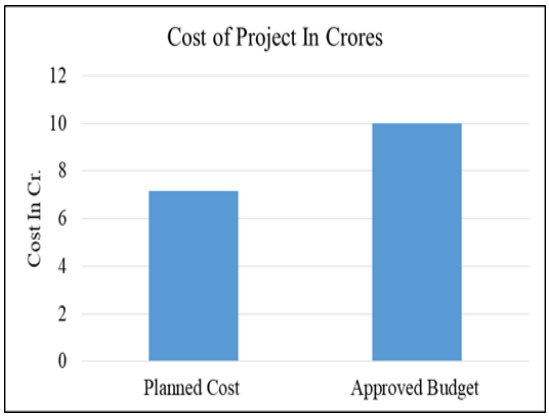
Fig 6.3 Typical Cross Section of WBM Road (Re Wall Section for Max.Height) Applied for Section- From Ch.-320.00 To 588.00

Task Mode	Task Name	Duration	Start	Finish
	DATA CENTER THANE	**416 days**	**Mon 02-09-24**	**Tue 30-12-25**
	Pre-Construction Works	**26 days**	**Mon 02-09-24**	**Tue 01-10-24**
	Site Surveying & Layout	13 days	Mon 02-09-24	Mon 16-09-24
	Traffic Diversion & Barricading	13 days	Tue 17-09-24	Tue 01-10-24
	Utility Shifting (if any)	12 days	Tue 17-09-24	Mon 30-09-24
	Earthwork & Foundation	**44 days**	**Wed 02-10-24**	**Thu 21-11-24**
	Excavation for Formation	18 days	Wed 02-10-24	Tue 22-10-24
	Foundation Preparation & Trimming	13 days	Wed 23-10-24	Wed 06-11-24
	Drainage Layer Preparation	13 days	Thu 07-11-24	Thu 21-11-24
	Reinforced Earth Backfill + Geogrid	**151 days**	**Fri 22-11-24**	**Fri 16-05-25**
	Layer-1 Soil Filling + Compaction	22 days	Fri 22-11-24	Tue 17-12-24
	Geogrid Layer-1 Placement	22 days	Wed 18-12-24	Sat 11-01-25
	Layer-2 Filling + Compaction	18 days	Mon 13-01-25	Sat 01-02-25
	Geogrid Layer-2 Placement	21 days	Mon 03-02-25	Wed 26-02-25
	Layer-3 Filling + Compaction	28 days	Thu 27-02-25	Mon 31-03-25
	Geogrid Layer-3 Placement	19 days	Tue 01-04-25	Tue 22-04-25
	Final Trimming & Leveling	21 days	Wed 23-04-25	Fri 16-05-25
	Filter Media (600 mm)	24 days	Sat 17-05-25	Fri 13-06-25

Fig 6.4 Scheduling in MSP-1

Task Mode	Task Name	Duration	Start	Finish
	Base & Sub-Base Layers	**68 days**	**Sat 14-06-25**	**Mon 01-09-25**
	WMM Layer 150 mm	25 days	Sat 14-06-25	Sat 12-07-25
	WBM Grade III Layer 75 mm	25 days	Mon 14-07-25	Mon 11-08-25
	Profile Checking & Rolling	14 days	Tue 12-08-25	Mon 01-09-25
	Paver Block Pavement Works	**63 days**	**Tue 02-09-25**	**Thu 13-11-25**
	Bedding Sand Layer 50 mm	23 days	Tue 02-09-25	Sat 27-09-25
	Paver Block Laying 80 mm	25 days	Mon 29-09-25	Mon 27-10-25
	Vibratory Compaction + Joint Filling	15 days	Tue 28-10-25	Thu 13-11-25
	Side Structures & Barriers	**70 days**	**Fri 22-11-24**	**Tue 11-02-25**
	Modular Block Wall Both Sides	30 days	Wed 18-12-24	Tue 21-01-25
	Crash Barrier Installation	18 days	Wed 22-01-25	Tue 11-02-25
	Drain Construction & Chamber Work:	24 days	Fri 22-11-24	Thu 19-12-24
	Quality Control & Finishing	**40 days**	**Fri 14-11-25**	**Tue 30-12-25**
	Road Markings & Signage	18 days	Fri 14-11-25	Thu 04-12-25
	Final Inspection + Reports	18 days	Fri 05-12-25	Thu 25-12-25
	Client Handover	4 days	Fri 26-12-25	Tue 30-12-25

Fig 6.4 Scheduling in MSP-2



Graph 4.1 Cost of Project

The total duration of the construction project is 416 calendar days, starting from 02 September 2024 and finishing on 30 December 2025, as generated through the Microsoft Project scheduling process. The duration has been calculated based on the logical sequencing of activities, resource availability, and working calendar constraints.

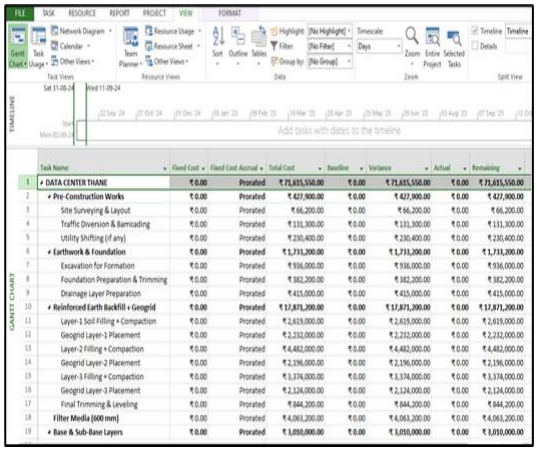


Fig 6.5 cost of Project in Planning

During the planning phase of the project, all activities were scheduled and cost-loaded using Microsoft Project. The cost for each task was calculated based on allocated resources such as material, labour, machinery, and transportation requirements. When these values were aggregated across the entire project duration, the Total Planned Cost was computed as ₹7,16,15,550.

The project is being executed under an approved budget of ₹10 Crores sanctioned by the client. This means that the estimated cost obtained from planning is lower than the approved financial allocation.

There is a cost surplus of about ₹2.84 Crores, which can be utilized for future financial risks or cost uncertainties The difference between the planned cost and the approved cost works as a contingency margin, which is essential in major infrastructure projects where variations may arise due to changes in design, delays, market rate fluctuations, or unforeseen site conditions. Hence, the cost planning performed in MSP demonstrates good cost control and ensures that the project remains financially viable throughout its construction lifecycle.

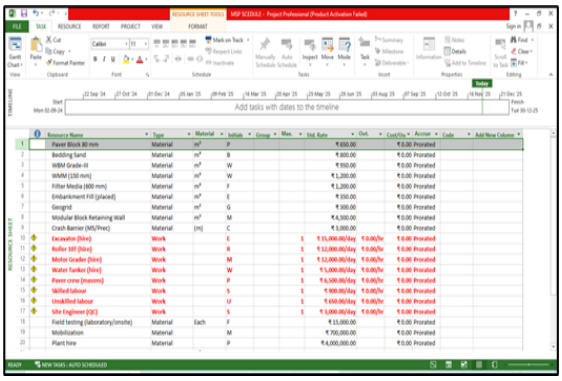


Fig 6.6 Resources Over Allocation

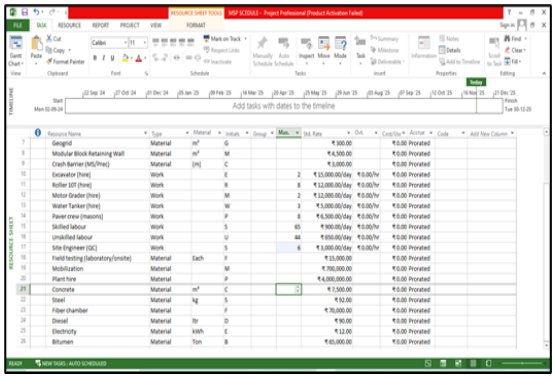


Fig 6.7 Resources Requirement

Figure represents the Resource Sheet created in Microsoft Project for the proposed construction work. All the required material, machinery and manpower resources are listed with their corresponding standard rates, units of measurement, and accrual methods. This resource sheet is used for cost loading and resource assignment to each activity in the MSP schedule.

V. CONCLUSION

The study highlights the critical role of effective supply chain practices in enhancing the efficiency, cost-effectiveness, and overall success of construction projects. Through an in-depth review of SCM concepts, coupled with a questionnaire-based survey of 34 industry professionals, this research identified key challenges that currently hinder the optimal implementation of SCM in the construction sector. Among the primary obstacles were the lack of expertise in digital tools such as ERP, BIM, and Microsoft Project, high transportation costs, insufficient continuous professional development, and financial opacity, reliance on outdated processes, supplier delays, and external uncertainties like weather and site conditions.

- Supply Chain Management (SCM) is essential for ensuring timely, cost-effective, and coordinated execution of construction projects.
- Efficient SCM improves resource utilization, reduces delays, and enhances overall project performance.
- Construction projects involve multiple stakeholders, materials, labor, and machinery that must be integrated systematically for project success.
- Adoption of digital tools and technology in SCM is critical for improving transparency, planning, and operational efficiency.
- Effective cost planning and contingency management are key to mitigating risks and maintaining financial viability in large infrastructure projects.

A. Questionnaire Conclusion

- The survey highlighted that the lack of expertise in digital tools (ERP/BIM/MSP) is the most critical barrier to implementing SCM (RII = 0.703).
- High transportation costs significantly impact project budgets (RII = 0.697).
- Continuous professional development in SCM is insufficient, affecting workforce capability (RII = 0.692).
- B. Microsoft Project (MSP) Conclusion
- MSP facilitates systematic resource planning, allowing precise tracking of materials, labor, and equipment for construction projects.
- Linking procurement and project activities in MSP ensures just-in-time delivery, reducing storage costs and preventing workflow disruptions.
- MSP enhances cost control, providing contingency margins and improving financial planning.

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