



# A critical study on supply chain and operations management in construction

Vaishali Hardev, student MBA 4<sup>th</sup> Semester, Amity Business School, Amity University Chhattisgarh

Dr. Sumita Dave, Director, Amity Business School, Amity University Chhattisgarh

## Abstract

The construction industry, despite its historical roots, faces persistent challenges in embracing modern practices such as supply chain management (SCM) and operations management (OM). This study examines the pivotal roles of SCM and OM in the construction sector, exploring their significance, challenges, and opportunities for integration. By conducting a comprehensive literature review, this research identifies gaps in existing SCM systems and proposes strategies for improvement. The methodology employed in this study involves rigorous secondary research, utilizing a diverse range of scholarly publications, conference proceedings, industry reports, books, and reliable internet resources. Through this approach, the study delves into construction operations and SCM data to uncover insights into enhancing project efficiency and performance. The integration of SCM and OM emerges as a key strategy for streamlining processes, reducing costs, and mitigating risks in construction projects. By aligning supply chain activities with operational needs and leveraging digital technologies, construction firms can optimize resource utilization and improve project outcomes. However, challenges such as organizational inertia and information silos must be addressed to facilitate successful integration. Despite these challenges, collaboration, innovation, and strategic planning are identified as critical drivers of success in the construction sector. Through effective integration of SCM and OM practices, construction firms can enhance efficiency, reduce project delays, and foster growth in the built environment. Ultimately, this study contributes to the advancement of the construction industry by providing actionable recommendations for optimizing SCM and OM practices. By addressing existing gaps and leveraging integrated approaches, construction firms can navigate the complexities of the modern construction landscape and achieve sustainable success in project delivery.

**Keywords:** Construction Supply Chain, Operations Management Integration, Supply Chain Management, Construction Industry.

## 1-INTRODUCTION

A lot of people think the construction industry is backward and doesn't use things like SCM, innovation, or IT, even though it's one of the oldest industries in the world. In Jordan, the building sector accounts for 5% of GDP, as reported by (Zaalouk et al., 2023). There are two main types of businesses in Jordan's construction sector, according to (Liu et al., 2020): major corporations that bid on and complete projects worth millions of dollars, and small and medium businesses that are typically run by members of the same family. When it came to grasping the theory and relevance of SCM, the construction industry lagged behind other sectors. (Han et al., 2023) states that the construction sector has been greatly impacted by the studies on the movement for innovation (M4I) that were backed by Egan and Latham's government. Innovation was the central theme of Egan's study since it is the one means by which businesses can attain profitability, ongoing service, and development. On the other hand, according to (Liu et al., 2017) research highlighted the significance of various relationships and the impact of communication routes and information exchange on the entire supply chain. A greater number of SCM techniques have been adopted by the construction sector as a result of the establishment and implementation of SCM-oriented contracts. The establishment of integrated teams and cooperative working to eliminate waste and deliver projects is supported by these publications. For instance, (Arshad & Zayed, 2022) cites JCT Constructing Excellence and NEC as examples of contracts that include papers to supplement SCM.

### **Background: Importance of Supply Chain and Operations Management in Construction**

Supply chain management involves managing information, resources, equipment, and stakeholders throughout a construction project. Supply chain optimisation is essential in this industry to reduce risks and improve project results due to the domino effect of disruptions and delays on project deadlines and budgets. Project efficiency and cost-effectiveness depend on supply chain management, including procurement, shipping, inventory management, and vendor relations (Ivanov et al., 2021). Construction operations management uses resources, people, and technology to efficiently and accurately execute project activities. Operations management strategies complete construction projects daily. These tactics include work planning, sequencing, quality control, and labour productivity. By optimising workflows, decreasing waste, and increasing productivity, operations management approaches boost project success and profitability.

## 2- Objectives

**Identify Gaps in the Existing Supply Chain Management System:** This study seeks to conduct a thorough examination of the current supply chain management (SCM) practices within the construction industry. By scrutinizing existing literature, empirical studies, and industry reports, the research aims to identify specific areas where the SCM system may be lacking or inefficient. This objective involves analyzing factors such as supply chain visibility, coordination among stakeholders, inventory management, and the integration of digital technologies. By identifying gaps in the SCM system, the study aims to highlight areas for improvement and innovation within the construction supply chain.

**Examine Challenges and Opportunities for Integration:** Another key objective of this study is to explore the challenges and opportunities associated with integrating SCM and operations management (OM) practices in the construction sector. Through an in-depth review of literature and case studies, the research aims to uncover barriers to integration, such as organizational silos, resistance to change, and communication breakdowns. Simultaneously, the study seeks to identify opportunities for enhancing collaboration, streamlining processes, and maximizing efficiency through the integration of SCM and OM methodologies. By understanding the challenges and opportunities for integration, the research aims to provide insights into effective strategies for aligning SCM and OM practices in construction projects.

**Propose Strategies for Enhancing SCM and OM Practices:** Building on the findings from the literature review and analysis, this study aims to propose practical strategies for enhancing SCM and OM practices in the construction industry. These strategies may include the adoption of advanced technologies such as Building Information Modeling (BIM) and Enterprise Resource Planning (ERP) systems, the implementation of collaborative project management approaches such as Integrated Project Delivery (IPD), and the development of cross-functional teams. Additionally, the research aims to explore the role of training and professional development in fostering a culture of continuous improvement and innovation within construction firms. By providing actionable recommendations, the study aims to assist construction organizations in optimizing SCM and OM practices to improve project performance, reduce costs, and mitigate risks.

**Contribute to the Advancement of Construction Management:** Ultimately, this study aims to contribute to the advancement of the construction management field by synthesizing existing knowledge, identifying gaps in the literature, and proposing innovative solutions. By offering insights into the complexities of SCM and OM in construction, the research seeks to stimulate further research, discussion, and innovation in the field. Through a comprehensive analysis of SCM and OM practices, the study aims to enhance understanding and practice in construction management, ultimately leading to improved project outcomes and greater sustainability in the built environment.

This study represents a comprehensive effort to examine the roles of supply chain management (SCM) and operations management (OM) in the construction industry. By addressing the objectives of identifying gaps in the existing SCM system, examining challenges and opportunities for integration, proposing strategies for enhancing SCM and OM practices, and contributing to the advancement of construction management, the research aims to provide valuable insights and recommendations for construction firms seeking to improve project performance, reduce costs, and mitigate risks. Through a detailed analysis of SCM and OM practices, the study aims to facilitate the adoption of innovative approaches and foster collaboration within the construction supply chain, ultimately leading to enhanced efficiency, sustainability, and competitiveness in the built environment.

### 3- Literature review

#### THE ROLES OF SUPPLY CHAIN MANAGEMENT IN CONSTRUCTION

##### CHARACTERISTICS OF CONSTRUCTION SUPPLY CHAINS

The construction supply chain is defined by its structure and function, which include the following:

It is a converging supply chain that brings all materials to the construction site, where they are assembled from incoming supplies. Contrasted with manufacturing systems, wherein the factory processes and distributes a multitude of items, the "construction factory" is structured around a single product.

With few notable exceptions, it is a transient supply chain that often reconfigures project organisations to produce one-off building projects. This leads to a construction supply chain that is unstable, fragmented, and most noticeably, where the built object's design and construction are kept apart (Wen et al., 2023). With each project comes the creation of a new product or prototype—just like any other regular make-to-order supply chain. Again, with a few small instances, there is minimal duplication. But for certain types of projects, the procedure can be quite similar.

##### INTRODUCING THE FOUR ROLES OF SUPPLY CHAIN MANAGEMENT IN CONSTRUCTION

The management of supply networks is likewise affected by the aforementioned characteristics. From a supply chain perspective, a site perspective, or a combination of the two, four distinct functions of SCM in the construction industry may be identified. There may be an initial emphasis on how the supply chain affects on-site operations. Less time and money spent on site operations is the target. The main thing to think about here is making sure there are consistent flows of materials and workers to the site so that the workflow doesn't get interrupted. All it takes to do this is to centre attention on the connection between the website and its direct providers (Hussein et al., 2021). This emphasis is most appropriately taken on by the contractor, whose primary concern is with the operations taking place on the job site. Second, supply chain expenses, particularly those associated with logistics, lead time, and inventory, may be the target of reduction efforts. Suppliers of materials and components may likewise take this tack (Papadopoulos et al., 2016). Lastly, it's possible that operations will be moved to earlier parts of the supply chain from the location. Possible justifications include avoiding the inherently poor site conditions or the impossibility of achieving greater concurrency between operations in site construction due to the numerous technical constraints. The objective is to cut down on time and money spent. This concentration could begin with suppliers or contractors. In the fourth place, there's a chance that site production and integrated supply chain management will take the stage. This means that SCM now includes site production. This focus might be initiated by clients, suppliers, or contractors (Kim & Nguyen, 2022). We may see the aforementioned responsibilities utilised in tandem with one another; they are not exclusive of one another. The major contractor's supply chain is the centre of attention in this study. Facility or real estate owners' control of the building supply chain constitutes a fifth critical function, however, it is outside the purview of this article. In cases where companies rely on a construction supply chain to run their business—for example, when they own multiple locations that require regular renovations and new construction—they may

find themselves in charge of its administration and development. As an illustration, consider BAA Ltd.'s extensive project pertaining to construction (Shahbaz& Shaikh,2019). In this case, the supply chain is made more efficient and effective by applying all four responsibilities of SCM at the same time. In fact, this case demonstrates that clients with enough construction volume can make significant improvements to the construction supply chain, not only contractors.

### **Operation management in construction**

Construction operations management oversees building project preparation, launch, and completion. The construction industry relies on it for timely, cost-effective, and high-quality project completion. From planning to completion, construction operations management coordinates and oversees the whole process (Shahbaz& Shaikh,2019). These include scheduling, budgeting, purchasing supplies and equipment, hiring, selecting, and managing subcontractors, and monitoring environmental and safety standards. Using time, money, materials, and equipment efficiently is required.

Construction operations management values collaboration and communication. Always notify customers, architects, engineers, and subcontractors. Honest communication speeds up problem-solving and decision-making and keeps everyone in sync. Quality control is essential to construction management. The goal is project excellence and client pleasure. This requires a keen eye for quality issues and thorough attention to detail. Finally, construction operations management requires risk management. Part of this approach includes reducing or eliminating risks. Health and safety requirements must be followed to protect workers and prevent workplace mishaps.

### **4- Methodology**

This article employs a rigorous methodology centered on secondary research to evaluate construction operations and supply chain management data. Secondary research, as opposed to primary research methods like surveys, interviews, or experiments, is chosen for its ability to address research questions using existing data, literature, and studies. This strategy enables comprehensive coverage of the topic from multiple angles and sources. The study draws on a diverse range of secondary sources, including scholarly publications, conference proceedings, industry reports, books, and reliable internet resources. These sources encompass various aspects of construction supply chain and operations management, including theoretical frameworks, empirical research, case studies, and industry perspectives. To ensure thorough analysis and insight generation, the methodology involves methodically examining and analyzing data acquired from multiple secondary sources. Researchers scrutinize the data for patterns, differences, and credibility of evidence. By synthesizing information from diverse sources, the study aims to yield relevant results, identify emerging trends, and uncover insights to meet its research aims.

Secondary research on construction supply chain and operations management offers a rich repository of articles and scholarly publications. By leveraging this wealth of existing data and expanding on past ideas and empirical outcomes, researchers can gain new insights and contribute to the existing body of knowledge in the



field. Primary research, while valuable, requires significant time and resources for data collection and analysis. In contrast, secondary research offers efficiency and accessibility by utilizing previously obtained data. It also eliminates the need for fieldwork, saving time and effort. Additionally, secondary research allows scholars to explore multiple perspectives, studies, and information from various sectors and fields, providing a holistic view of the research topic and enhancing the comprehensiveness of findings. Furthermore, secondary research helps address ethical concerns such as participant privacy, informed consent, and bias in outcomes analysis. By relying on public information and existing data, researchers can mitigate these ethical considerations and uphold standards of integrity and transparency in research practices. In summary, secondary research emerges as the ideal method for this study's goals of efficient and accessible analysis of construction supply chain and operations management. By leveraging robust evidence from diverse secondary sources, the study aims to contribute meaningful insights to the field of construction management.

### **Supply Chain Management in Construction**

As a building project goes from start to finish, supply chain management (SCM) keeps track of the flow of materials, labour, and other resources. Controlling the flow of things, information, and money from suppliers to contractors, subcontractors, and finally to the project site is needed to get the job done quickly, efficiently, and at the lowest cost.

### **Components of the Construction Supply Chain**

The construction supply chain is made up of many interconnected parts, and each one is very important to the total project delivery process

**Procurement:** The process of getting the tools, materials, and people to work on a building job is called procurement. In order to make sure efficient, on-time delivery at a fair cost, one must come up with procurement strategies, negotiate contracts, and find suppliers (Le et al., 2020).

**Logistics:** The main goal of logistics is to control the flow of resources and goods from point A to point B in the supply chain. So that things move as quickly and cheaply as possible, routes for transport, places to store things, and stock amounts need to be managed.

**Inventory Management:** Management of building materials and tools at different steps of the building process is what inventory management is all about. Good inventory management keeps enough items on hand, cuts down on waste, and keeps projects from being held up or running out of items.

**Supplier Relationship Management:** It is important to build and keep strong relationships with suppliers so that goods and services are always provided on time. The goal of supplier relationship management is to lower risks and make suppliers more accessible. This is done by talking to them, working with them, and judging their performance (Wibowo et al., 2018).

**Information Technology (IT) Systems:** A lot of the communication, teamwork, and decision-making in the building supply chain is done with the help of information technology (IT) solutions like ERP and construction

management software. These options make it easier for everyone involved in a project to work together, speed up processes, and see project data in real time.

## 5- Challenges and Opportunities in Managing the Construction Supply Chain

### Challenges

- When building supply chains aren't connected, they are inefficient, communication problems arise, and there is a lack of teamwork.
- Changes in the weather, the form of a building, or rules and regulations can all mess up the supply chain, which can make building projects go over time and over budget (Abas et al., 2022).
- To meet project needs, construction companies must keep carrying costs and obsolescence to a minimum. This is especially true for materials with short shelf lives or long lead times.
- Material shortages, supplier bankruptcy, transportation delays, and other problems in the supply chain can put construction projects at risk. To lower these risks, project partners must work together to plan, set up, and use backups.

### Opportunities

- Integrated project delivery and design-build contracts improve project collaboration and communication. This improves project results.
- Digital technologies like BIM, RFID, and supply chain analytics help improve supply chain transparency, accountability, and decision-making in the construction business. These tools help firms find and fix supply chain bottlenecks via real-time data exchange, performance monitoring, and predictive analytics.
- JIT delivery, value stream mapping, and continuous improvement improve supply chain efficiency, waste reduction, and project speed (Wuni& Shen,2023).
- Collaboration with key suppliers and subcontractors improves supply chain responsiveness, flexibility, and creativity. Supply chain cooperation and trust can be improved by consulting suppliers early in the planning phase and rewarding their performance.

Successful building projects require efficient supply chain management. Construction organisations may improve supply chain operations, project outcomes, and competitiveness by addressing obstacles and seizing opportunities.

## Effective Resource Management in Construction Operations Management

Resource efficiency is key to construction management. Construction projects must be completed on schedule and under budget by properly allocating labour, materials, and equipment. Understanding project needs is key to resource management. Understanding project needs, timeframe, and money is vital. Building operations managers can plan each project stage with this data (Braglia et al., 2022).Threat identification and mitigation are crucial to resource management. Backup plans can keep projects on schedule and within budget in the event of material shortages, equipment problems, or delays. Resource management demands good

communication. Project stakeholders, vendors, subcontractors, and stakeholders must communicate to identify and resolve concerns early. Construction resource management can benefit from technology. Digital tools can track resources, productivity, and efficiency to discover areas for improvement. Task prioritisation and resource optimisation are good resource management. Strategic planning and organisation may reduce downtime and boost output.

### **The Role of Quality Control in Construction Operations Management**

Quality control is essential for project managers to satisfy clients. One part of this technique is monitoring the construction site to avoid surprises. Construction projects, especially planning and development ones, should include quality control. These plans outline processes and requirements for quality work. Regular quality control inspections and testing of construction supplies, equipment, and work are done. Inspectors check building codes, industry standards, and project specs. We quickly identify and fix issues to avoid costs and delays. Quality requires communication (Battula et al., 2020). Quality control managers must communicate quality standards and their roles to clients, architects, engineers, and contractors. Quality requires personnel training and supervision. This includes giving workers the skills and expertise they need to succeed. Supervisors also monitor quality control and address issues. BIM can also aid quality control. Building information modelling (BIM) software provides a three-dimensional perspective of the project, detecting design problems and ensuring accurate construction.

### **Communication and Collaboration in Construction Operations Management**

Construction operations management requires good communication and collaboration. Communicating with clients, architects, engineers, subcontractors, and vendors is crucial. Effective construction operations management communication requires mutually agreed-upon goals. This entails defining the project's goals, timeline, and duties for everyone. When all stakeholders agree, the building process can be expedited and coordinated.

Consistent communication helps solve problems and make choices quickly. Problems can arise at any stage of constructing, but if everyone is on the same page, they can be remedied quickly, saving time and money. Most construction operations management projects are multi-party, thus coordination is essential. Collaborating involves planning, resolving conflicts, and making project-beneficial decisions (Vrijhoef,2020). Productive teamwork requires playing to each member's strengths. This improves project quality and efficiency and generates new solutions. Technology aids communication and teamwork in construction management. Virtual reality, drones, and project management software can improve teamwork by boosting visualisation, real-time project updates, and communication.

### **The Importance of Construction Operations Management in Project Success**

Well-managed operations make building projects successful. It involves overseeing a project from start to finish to ensure it fulfils quality standards, keeps on track, and stays under budget. Construction operations require efficient resource management. Using time, money, materials, and equipment efficiently is required.



Construction management also requires teamwork and communication. When people agree and communicate properly, they can solve problems and make choices faster. People and organisations can coordinate their efforts, improving project efficiency and quality (Zaalouk et al., 2023). Quality control is crucial in construction management. Carefulness and timely quality resolution are required. Risk management underpins building management. Risk identification and mitigation are essential to lowering building costs and meeting deadlines. Set up risk management and backup measures to reduce project risks.

### **Integration of Supply Chain and Operations Management in Construction**

Construction organisations must integrate SCM and OM to enhance project performance and stakeholder value. SCM and OM's pros and cons, relationship, and integration methods will be discussed in this section.

### **Relationship between SCM and OM in Construction**

When it comes to building, SCM and OM are very similar. SCM is in charge of getting goods, information, and other resources from suppliers to project sites. OM, on the other hand, is in charge of making sure that these resources are used well to finish tasks. Part of combining SCM and OM is making sure that the processes for purchasing, logistics, scheduling, and output are all in sync with each other. The project lifecycle will run more easily and quickly if you do this.

### **Strategies for Integration\***

Suppliers, contractors, and subcontractors should meet together to plan and schedule to improve collaboration. Coordination of production schedules with material and staff arrival is the best strategy to keep construction projects on track and maximise resources. Data can be shared in real time using collaborative project management and BIM software (Ivanov et al., 2021). Knowing the project's progress, material availability, and process interdependence helps make better decisions and reduce risk. SCM, OM, E, and Procurement cross-functional teams enhance collaboration and information exchange. Training and other professional development can strengthen project staff's SCM and OM knowledge and drive continuous growth.

### **6- Benefits and Challenges of Integrated SCM and OM in Construction**

Integrating SCM with OM simplifies operations, eliminates bottlenecks, and reduces idle time, making projects faster and cheaper.

Effective material delivery and staff schedules reduce errors, rework, and safety concerns and improve construction results.

Aligning supply chain activities with operational needs reduces inventory holding costs and project delays. This guarantees on-time supply and equipment delivery (Le et al., 2020).

Early risk detection and mitigation through integrated SCM and OM processes improve project resilience and stakeholder satisfaction. Material constraints, supplier delays, and labour shortages are hazards.

### **Challenges**

The many participants in the construction industry each have their own agenda and interests make coordination and collaboration challenging.

When upstream and downstream supply chain operations are not accessible, information silos, misunderstandings, and cooperation can occur (Abas et al., 2022).

Integration of SCM and OM may be hindered by organisational and cultural inertia and change aversion.

Due to infrastructure, training, and change management costs, some firms may struggle to integrate SCM and OM using digital solutions.

## 7- Conclusion

Finally, there are pros and cons to both supply chain and operations management methods in the construction business. The sector is slow to realise how important SCM and OM are until they are used and integrated. Construction supply chains are fragmented and project-specific, requiring specialised supply chain and operations management methodologies. Collaborative planning, modern technologies, and stakeholder participation improve project efficiency and performance. To maximise SCM and OM benefits in construction, stakeholders should integrate, remove organisational and cultural barriers, and promote innovation. If it accomplishes this, the sector may boost project performance, minimise risk, and boost built environment growth.

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