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Review of Logistics Challenges within the Construction Industry

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Abstract: This study offers a comprehensive analysis of logistics functions in the construction industry and the challenges that affect project performance. In contrast to prior studies emphasizing logistics solutions, this study concentrates on identifying the challenges impeding efficient logistics management, which frequently result in delays and cost overruns. The study reviews 40 knowledge sources through a critical literature review to identify key logistics functions and their associated challenges. The logistics functions and associated challenges in the construction industry are categorized and analyzed through a systematic review of the literature. The study identifies six major logistics functions: planning and resource allocation, communication and coordination, materials management, inventory management and warehousing, transportation, and reverse logistics. Each function is associated with specific challenges, such as poor integration with suppliers and a lack of clarity regarding responsibilities in communication and coordination. By highlighting these challenges, the study aims to improve construction performance and address a gap in the existing literature, which often prioritizes solutions over the identification of underlying logistical issues. The findings offer a valuable foundation for researchers to further investigate these challenges and formulate targeted solutions and mitigation strategies, ultimately contributing to improved productivity and cost management in the construction sector.

Keywords: Construction Logistics, Construction Logistics Management, Logistics Challenges, Construction.

Type: Research paper

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1. Introduction

Construction firms must manage logistics professionally to ensure operational efficiency, reduce costs, and improve productivity. Logistics functions pertain to managing information alongside the acquisition, control, and organization of materials, resources, and machinery according to project requirements—delivered at the right time, to the correct location, and with the necessary quality (Lundesjo, 2015; Luong Le et al., 2021; Katsaliaki et al., 2021). Compared to other industries, construction logistics remains underdeveloped, presenting numerous challenges related to suboptimal practices, weak management, and inconsistent performance (Luong Le et al., 2021). Key issues linked to poor practices include low efficiency (Fredriksson et al., 2021) and ineffective management (Ekeskar and Rudberg, 2020; Sundquist et al., 2018). Recent studies have emphasized that neglecting logistics as a critical component of construction projects is a significant oversight (Ekeskar and Rudberg, 2020; Lam et al., 2024). Moreover, limited experience and inadequate information sharing adversely impact the efficiency and performance of construction logistics (Janne and Rudberg, 2020; Fredriksson et al., 2021), hindering firms from achieving competitive advantages (Hosie, 2012; Janne and Fredriksson, 2019; Shemov et al., 2020). These shortcomings contribute to project delays and cost overruns (Sundquist et al., 2018). Additionally, Chawathe et al. (2023) found that poor logistics management results in one-third of workers' time being wasted. Reports from England indicate approximately 30 percent losses in labor productivity and machinery utilization due to inefficient logistics.

To address these inefficiencies, several initiatives—including proposed solutions and critical success factors—have been introduced to enhance logistics operations. These include the implementation of terminals or consolidation centers (CCs), the integration of checkpoints based on just-in-time (JIT) principles, outsourcing to third-party logistics providers (TPL), and the adoption of the Last Planner System (LPS) (Hedlund and Telese, 2019; Fredriksson et al., 2021; Luong Le et al., 2021). Some firms reported cost reductions of up to 20 percent through improved logistics practices and the mitigation of logistical challenges (Ying et al., 2018). However, these initiatives have often proven inadequate due to limited understanding and suboptimal implementation (Fredriksson et al., 2021; Sundquist et al., 2018). This may stem from the industry's tendency to overlook logistics functions and their interdependencies (Hedlund and Telese, 2019). Furthermore, the limited exploration of logistics functions, challenges, and their root causes has impeded the effective adoption of logistics initiatives (Janne and Fredriksson, 2019). Therefore, greater effort is needed—particularly in understanding the underlying logistics challenges—to realize the full potential of such initiatives in improving logistics efficiency (Fredriksson et al., 2021; Guerlain et al., 2019). In response, this paper investigates the logistics challenges affecting productivity in the construction sector to (i) develop a comprehensive understanding of current logistics practices and (ii) identify the specific logistical obstacles impeding productivity within the industry.

2. Literature Review

This study employs the Systematic Literature Review (SLR) approach—a rigorous and structured methodology that follows a clearly defined sequence of stages to generate robust and reliable conclusions (Kock and Hadaya, 2018). The SLR method has previously been applied to investigate logistics practices in the construction sector and their influencing factors (Lam et al., 2024; Janne and Fredriksson, 2019; Luong Le et al., 2021), as well as to address specific research questions. The process adopted in this study follows five distinct stages: (i) question formulation, (ii) literature identification, (iii) study selection and quality assessment, (iv) data analysis, and (v) results reporting (Le-Hoai et al., 2008).

In the first stage, research questions were formulated to guide the study toward its objectives. The second stage involved locating relevant literature sources. While there are varying perspectives on the selection of research databases, Scopus, ScienceDirect, and Web of Science are widely regarded as reliable sources for systematic reviews (Kock and Hadaya, 2018). These databases were used to ensure the comprehensiveness and reliability of the study. To further minimize the risk of omitting relevant literature, Google Scholar was employed as a supplementary tool.

The SLR covered literature published between 2000 and July 2024. The year 2000 was chosen as the starting point due to the significant rise in scholarly attention toward logistics issues in construction during that period (Fredriksson et al., 2021). Keyword selection played a critical role in the review process. Frequently used keywords and search terms included construction logistics, construction logistics management, and logistics challenges in construction. These terms were applied to filter results based on the titles, abstracts, and keywords of the publications, ensuring both breadth and specificity aligned with the study's research questions.

The third stage involved the collection and evaluation of studies using clearly defined inclusion and exclusion criteria. The exclusion criteria focused on scope relevance—specifically excluding studies that did not address logistics management or practices within the construction sector. Articles focused on unrelated fields such as healthcare, genetics, and agriculture logistics were omitted. Only full-text, English-language papers were included to facilitate a thorough and consistent content analysis. Further filtering was supported by established inclusion benchmarks, and the final corpus was limited to peer-reviewed journal articles and international conference proceedings to maintain academic rigor (Arvianto et al., 2021).

In the analysis stage, content analysis methods were employed to evaluate the selected studies and extract data relevant to the research questions. This process identified key components contributing to logistics practices and challenges in the construction industry. The overall SLR procedure for this study is illustrated in Figure 1.

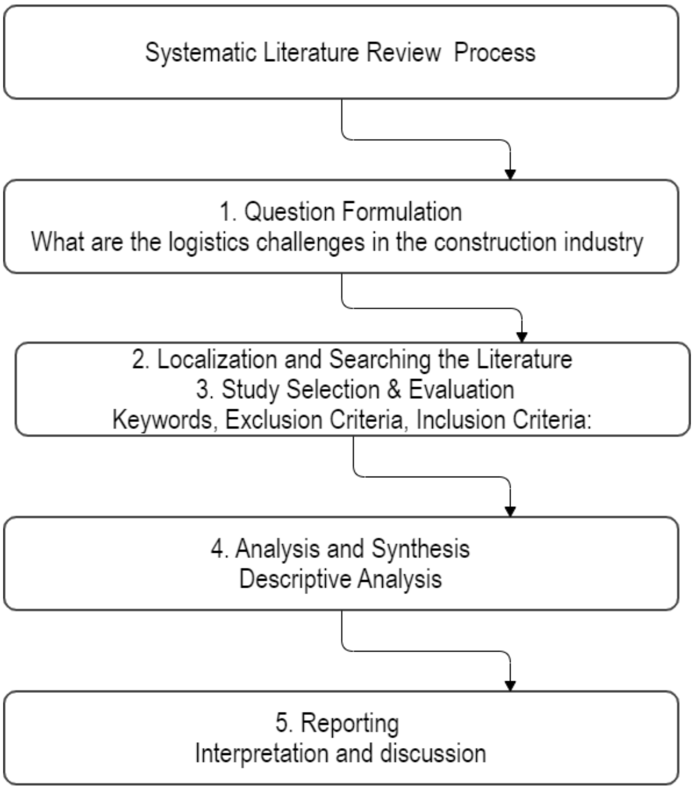

Figure 1: Summary of the systematic literature review process.

The study also utilized the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to document the review process. As shown in Figure 2, 1,495 publications were initially identified. After reviewing their titles, abstracts, and keywords, a preliminary screening was conducted. In the eligibility phase, 113 papers were selected based on the inclusion and exclusion criteria. A total of 77 studies were excluded due to factors such as language, lack of full-text access, or irrelevance to construction logistics. The final selection consisted of 40 papers—drawn from an initial set of 54 suitable documents—that were deemed most appropriate for detailed analysis, specifically addressing construction logistics, associated challenges, and performance implications.

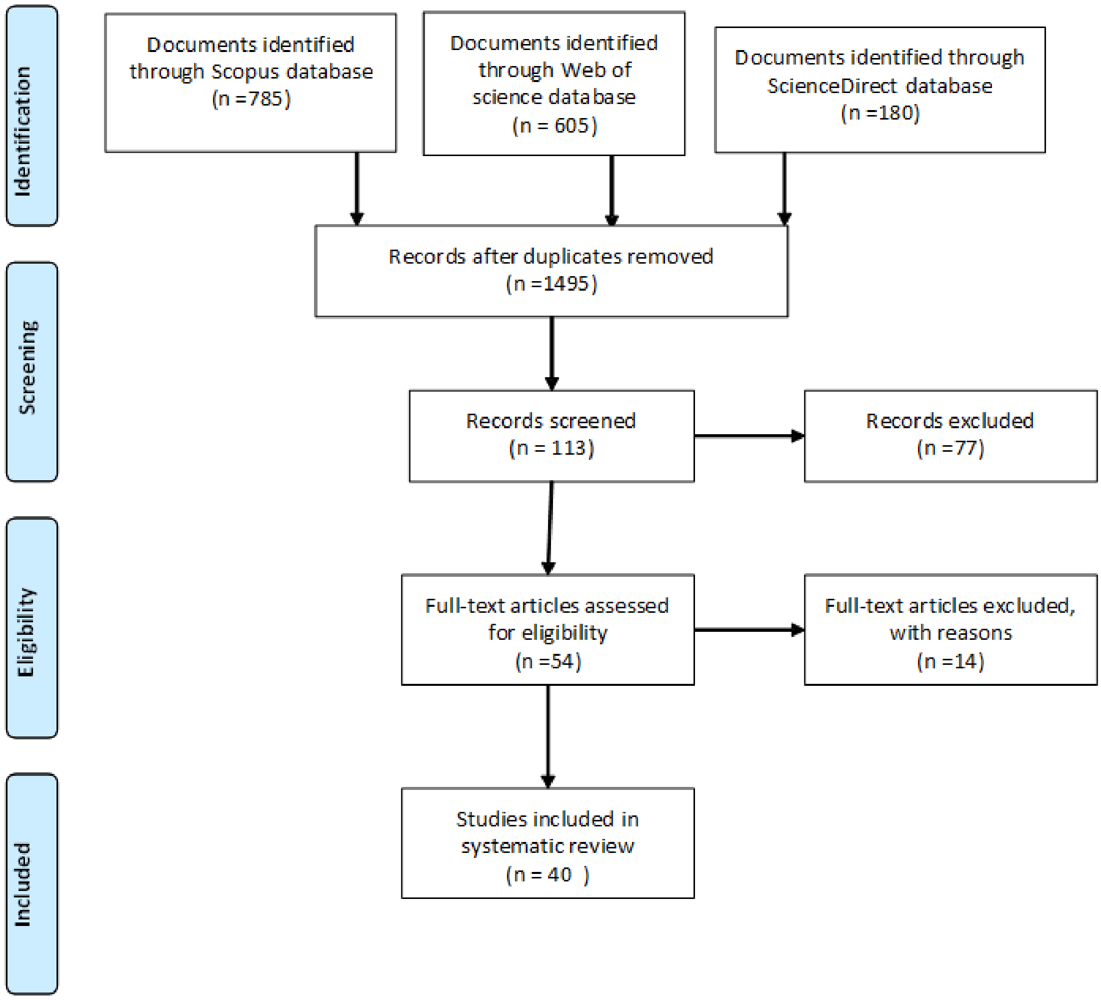

Figure 2: PRISMA four-phase flow diagram illustrating the selection of knowledge sources.

3. Literature Findings Analysis

This study adopts the thematic analysis method to examine the literature findings in alignment with the research objectives—specifically, exploring logistics practices and identifying logistics challenges that impact productivity . Thematic analysis enables a comprehensive interpretation and synthesis of findings. Braun and Clarke (2006) advocate for this method as particularly well-suited to research domains with broad and inconsistent terminology, such as construction logistics, where terms are often used interchangeably with varying meanings. Their framework supports systematic coding and categorization of data into meaningful themes. Braun and Clarke's approach provides a transparent and iterative process for thematic development, involving key stages such as data familiarization, code identification, initial theme generation, theme refinement, and final theme definition and synthesis. This process is illustrated in Figure 3 (Creswell, 2009).

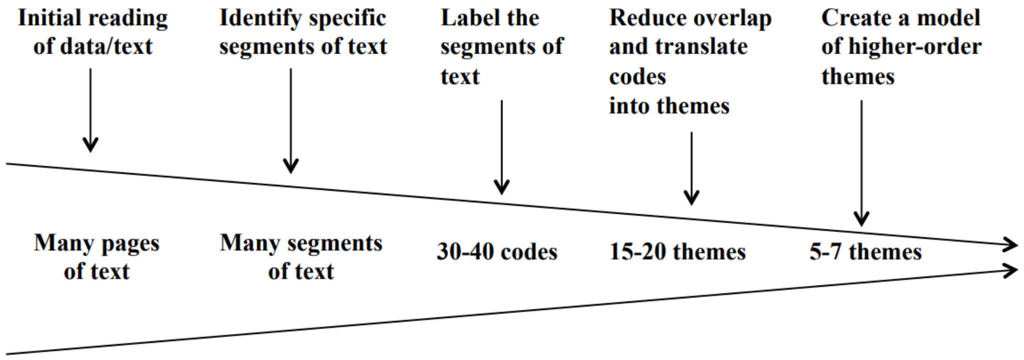

Figure 3: The process of thematic analysis and synthesis.

Theme development in this study followed Creswell's (2014) guidelines. Initial codes were generated based on both prior literature and the researchers' expertise. A combination of manual coding and computer-assisted analysis using NVivo software was employed to identify textual segments relevant to logistics functions and their associated challenges within the construction sector. This dual-method approach ensures comprehensive coverage of the various dimensions of logistics in construction (Creswell, 2014).

Themes were subsequently developed around logistics functions and the specific challenges linked to each function. This thematic structuring facilitated the effective presentation of data, allowing for a detailed examination of how logistics challenges manifest within construction logistics operations. Ultimately, this approach supports the overarching aim of the research: to summarize, capture, and contextualize logistics challenges in construction and assess their implications for productivity.

4. Construction Logistics Functions

Sundquist et al. (2018) describe the supply chain as a system that integrates people, information, activities, knowledge, resources, and suppliers to meet customer requirements while enhancing an organization's competitive advantage. Within this system, logistics is recognized as a core component responsible for the planning, controlling, and management of required resources—ensuring quality, minimizing costs, and promoting operational efficiency (Luong Le et al., 2021).

In the context of construction, logistics operations are typically categorized into offsite and onsite activities (Dubois et al., 2019). Offsite logistics includes planning, procurement, resource acquisition, transportation, and material delivery (Ekeskar and Rudberg, 2020). In contrast, site logistics focuses on the flow of information and the monitoring and control of resources necessary for construction operations (Hedlund and Telese, 2019). Additional site logistics responsibilities include defining work procedures, ensuring safety, developing site and work layouts, and resolving conflicts among stakeholders (Sundquist et al., 2018).

Despite their importance, previous studies have reported a general lack of understanding and low levels of investment in logistics functions within the construction industry (Chawathe et al., 2023; Sundquist et al., 2018). Lam et al. (2024) argue that the sector continues to underutilize logistics functions, thereby missing out on potential competitive advantages such as productivity improvements. This study investigates logistics challenges by analyzing them through the lens of logistics functions in construction—an approach that supports the thematic classification of challenges.

Several authors have identified key logistics functions in the construction sector, as summarized in Table 1.

Table 1: Logistic functions within the construction industry

	Primary						Secondary		
Author	Planning including resource allocation	Transportation	Inventory and warehousing management	Material management	Communication and coordination	Reverse logistics	Waste management	Safety management	Security
Dey (2001)		×		×	×		×		
Navon and Berkovich (2004)			×		×	×			
Kasim et al., (2008)	×			×			×		
Moura et al. (2007)			×		×	×			×
Le-Hoai et al. (2008)	×	×			×				×
Sohrab and Donyavi (2009)			×		×	×			
Ameh et al. (2010)	×						×	×	×
Patel and Vyas (2011)		×		×	×		×	×	
Lindholm and Behrends (2012)			×						
Thunberg et al. (2014)		×							×
McKinnon (2015)	×								
Ahmed and Zhang (2017)				×	×	×	×	×	
Shigute and Nasirian (2014)						×			×
Ghanem et al. (2018)				×				×	
Ekeskar and Rudberg (2020)			×			×			×
Sundquist et al. (2018)	×	×		×	×		×	×	×
Kock and Hadaya (2018)						×			
Thunberg and Fredriksson (2018)			×						
Fredriksson et al.(2019)									
Hedlund and Telese (2019)			×		×	×			×
Luong Le et al. (2021)	×	×	×	×	×				
Arvianto et al. (2021)									
Fredriksson et al.(2021)	×	×					×		×
Ekeskar and Rudberg (2020)			×		×	×	×		

Vrijhoef (2018)									
Janne and Rudberg (2020)		×		×	×		×	×	×
Balasubramaniana and Shuklab (2017)									
Fredriksson and Huge (2022)			×	×	×	×		×	
Chawatheet al. (2023)			×		×		×		×
Ahmed and Zhang (2017)	×	×			×		×		×
Luong Le et al., (2024)	×								
(Lam et al. (2024)	×	×							×

A total of 40 studies were analyzed to identify the logistics functions present in the construction industry. The analysis involved coding references to logistics practices, functions, and processes. Based on this, six primary logistics functions were identified: Planning and resource allocation, Transportation, Inventory and warehousing management, Material management, Communication and coordination, and Reverse logistics. In addition, the study recognized three secondary functions: Waste management, Safety management, and Security

These logistics functions form the foundation for the subsequent section, which presents a detailed discussion of each function and the specific challenges associated with them within the construction industry.

5. Construction Logistics Challenges

The construction industry faces numerous logistical challenges, which have been widely examined and debated in academic literature. However, divergent perspectives among scholars continue to fuel discussions around the root causes and consequences of these challenges. A detailed and critical analysis of logistics challenges—mapped to specific logistics functions—helps clarify the factors impeding construction performance.

5.1. Planning and Resource Allocation

Numerous studies emphasize the central role of planning in construction logistics and its influence on achieving project objectives (Ying et al., 2018; Halldorsson and Vural, 2019). Planning involves identifying, sorting, and scheduling resources so that they are available at the right time and in accordance with project specifications and quality standards (Janne and Fredriksson, 2019). Importantly, logistics planning must be closely integrated with the overall construction schedule to ensure coordination and efficiency (Halldorsson et al., 2015). Several key challenges affecting planning and resource allocation are identified below:

Lack of Expertise in Construction Logistics

The shortage of logistics expertise is a major concern. Moura et al. (2007) argue that the traditional focus on engineering skills in the construction sector has led to insufficient investment in logistics education. Fredriksson et al.(2021) assert that this knowledge gap hinders effective logistics management, contributing to delays and cost overruns. Conversely, Luong Le et al. (2024)contend that the problem lies not in the absence of knowledge but in its underutilization. Fredriksson et al.(2021) further note that many professionals do possess logistics knowledge but are constrained by rigid industry norms and resistance to change. These differing views highlight the need to both improve logistics education and promote the effective application of existing knowledge within the industry.

Inadequate Planning for Logistics Processes, Including Resource Management
Logistics planning is complicated by the dynamic and unpredictable nature of construction projects. Ekeskar and Rudberg (2020) advocate for more adaptive and flexible planning frameworks that can accommodate on-site variability. Fredriksson and Huge (2022) argue that logistics is often excluded from the early stages of project planning, undermining coordination. Similarly, Ahmed and Zhang (2017) states that the persistent oversight of logistics planning results in misalignment between logistical activities and project timelines. These findings underscore the need to embed logistics considerations into the planning phase and develop flexible planning mechanisms.

Management's Insufficient Commitment to On-Site Logistics Operations
Senior management often overlooks logistics in favor of focusing on design and cost-related priorities. Sundquist et al. (2018) argue that this lack of focus leads to the under-allocation of resources for logistics operations. Janne and Rudberg (2020) support this view, linking managerial neglect to inefficiencies in project execution. However, Ekeskar and Rudberg (2020) suggest that perceived managerial disinterest may instead reflect the challenge of balancing competing demands. Fredriksson and Huge (2022) posit that it is not neglect, but the difficulty of making strategic resource allocation decisions that leads to logistical shortcomings. This debate highlights the importance of elevating logistics in strategic project management discussions.

Inadequate Alignment Between Construction Schedules and Logistics Practices
A recurring challenge is the poor alignment between construction schedules and logistics planning. Kock and Hadaya (2018) argue that this disconnect often results in materials arriving too early or too late, creating storage problems and project delays. They stress the importance of integrating logistics planning into the scheduling process from the outset. Ekeskar and Rudberg (2020) attribute the issue to rigid scheduling practices that are unable to accommodate logistical variability. Luong Le et al. (2024)recommend more adaptable scheduling frameworks that respond to changing logistical needs. The core issue remains whether to prioritize schedule flexibility or better synchronization between construction and logistics planning.

Inefficient Site Layout
The logistics implications of inefficient site layout are widely acknowledged. Shigute and Nasirian (2014) highlight that poorly designed layouts result in unnecessary material handling, time waste, and increased safety risks. They advocate for more meticulous site planning and layout optimization. Sundquist et

al. (2018) suggest that poor site layouts reflect broader logistical deficiencies, such as weak planning and inadequate resource coordination. Fredriksson et al.(2021) caution that improving layout alone cannot resolve systemic issues. This debate raises the question of whether the focus should be on localized improvements or on addressing underlying structural inefficiencies.

Poor Material Identification and Estimation
Accurate material identification and estimation are critical to minimizing waste and inefficiency. Fredriksson et al. (2021) argue that failures in this area contribute significantly to cost overruns. They propose improved tools and training for material management. Luong Le et al. (2024), however, link the issue more to organizational weaknesses—particularly poor communication and coordination within project teams. Addressing this challenge requires both technological improvements in material tracking and enhancements in organizational processes and team collaboration.

Ineffective Monitoring and Control of Logistics Activities
Challenges in logistics monitoring and control are widely recognized, though scholars differ on solutions. Fredriksson et al.(2021) emphasize the lack of real-time monitoring systems, which limits visibility and responsiveness in logistics operations. They advocate for the adoption of advanced tracking technologies. In contrast, Luong Le et al. (2024) identify the absence of standardized processes and protocols as the root cause, arguing that technology alone is insufficient. Lam et al. (2024) echo this view, suggesting that without standardized industry practices, even sophisticated technologies will have limited impact. The consensus is that improvements in both technology and process standardization are necessary to enhance logistics oversight.

This section demonstrates that logistics challenges in construction are multifaceted and often interconnected. While technological solutions are frequently proposed, many challenges are rooted in organizational, educational, and planning-related issues. The following section continues this analysis by examining the challenges associated with other logistics functions, including transportation, inventory management, material handling, communication, and reverse logistics.

5.2. Transportation

Transportation involves the movement of materials from storage locations (e.g., suppliers, material providers, warehouses, or subcontractors) to their destination at the construction site, using an appropriate and efficient mode of transport (Ying et al., 2018). In construction, transportation accounts for approximately 10–20% of total project costs and is a critical component of construction logistics, given the high volume of material and resource movements involved (Halldorsson and Vural, 2019). Transportation in construction logistics is typically classified into two categories:

- Offsite transportation, which refers to the processes for storing and transferring materials and resources to centralized storage areas in

preparation for delivery to the construction site (Janne and Fredriksson, 2019).
- Onsite transportation, which involves the movement of materials from storage areas to the precise location where construction activities are carried out (Lam et al., 2024).

Effective transportation planning in construction requires consideration of several key factors, including transport size and route type, construction activity schedules, material handling requirements, and the number and types of vehicles required (Fredriksson et al., 2021). Despite its importance, several recurring challenges in the transportation function adversely affect logistical efficiency:

Lack of Real-Time Tracking of Fleet and Equipment

The absence of real-time tracking systems for fleet and equipment poses a significant challenge to the efficiency of construction logistics. Hedlund and Telese (2019) argue that the inability to monitor fleet operations in real time results in inefficiencies, delays, and higher operational costs. Fredriksson and Huge (2022) further emphasize that this lack of visibility leads to suboptimal resource utilization and hindered decision-making. Proponents such as Chawathe et al. (2023) advocate for the integration of advanced tracking technologies—such as GPS and IoT devices—to provide real-time visibility and improve operational responsiveness. However, Luong Le et al. (2021) question whether the challenge is purely technological. They suggest that organizational resistance, limited user education, and concerns over data privacy may hinder adoption, even when the technology is available. According to this perspective, technological advancement alone is insufficient without a culture that supports its use.

Sundquist et al. (2018) echo this view and recommend a more holistic approach that combines technological implementation with organizational change management. Such integration is necessary to ensure not only the adoption but also the effective utilization of real-time tracking systems.

Use of Inappropriate Types of Vehicles for Transportation

Another key issue relates to the misalignment between vehicle types used and the specific transportation needs of construction projects. Ghanem et al. (2018) argue that deploying vehicles unsuited to particular tasks—either too large or too small—leads to inefficiencies, increased fuel consumption, equipment damage, and bottlenecks in material flow. Ekeskar and Rudberg (2020) highlight the need for strategic vehicle selection tailored to the specific logistical demands of each project. They argue that a more deliberate matching of vehicle capacity to task requirements would enhance efficiency and reduce operating costs. However, Chawathe et al. (2023) expand the scope of the issue, asserting that inappropriate vehicle use often stems from inadequate logistics planning and poor coordination across functions. Kock and Hadaya (2018) further argue that last-minute schedule changes or unanticipated site conditions frequently lead to the use of whatever vehicle is available, regardless of its suitability. Thus, while vehicle selection is crucial, many scholars advocate for improving logistics planning frameworks to be more robust and adaptable. Enhancing flexibility in transportation planning can allow construction teams to respond effectively to project variability, reducing reliance on suboptimal transport options. This analysis reveals that challenges in transportation logistics stem from both technological and managerial shortcomings. Addressing these issues requires not only investment in tools and systems but also a broader strategic focus on organizational readiness, cross-functional coordination, and flexible logistics planning. The next section will continue by discussing logistics challenges associated with inventory management and warehousing.

5.3. Inventory and Warehousing Management

Inventory and warehousing management involve the storing and safeguarding of materials and products to ensure they meet quality standards and are available at the right time. Construction firms aim to maintain sufficient inventory levels to support uninterrupted project execution (Ekeskar and Rudberg, 2020). Construction materials are typically classified into two categories: non-storable and storable (Luong Le et al., 2024). The latter requires effective planning to prevent disruptions in workflow and to manage fluctuations in material quantity or price (Luong Le et al., 2021). Effective inventory management encompasses the planning, procurement, receipt, sorting, storage, and monitoring of materials in alignment with construction schedules (Janne and Rudberg, 2020). Several challenges hinder the effectiveness of inventory and warehousing practices:

Inaccuracy of Goods Received from Suppliers

Discrepancies between ordered and delivered goods are a persistent challenge in construction logistics, often resulting in delays, increased costs, and material waste (Ekeskar and Rudberg, 2020). Scholars attribute these issues to poor communication and coordination between construction firms and suppliers (Ghanem et al., 2018). Solutions such as barcoding, RFID technology, clearer contractual terms, and improved communication protocols have been proposed to improve accuracy (Janne and Rudberg, 2020). Fredriksson et al.(2021) argue that supplier-related errors are only part of the issue; inaccuracies also originate within construction firms. Miscommunication, vague specifications, and last-minute changes contribute significantly to mismatches in material orders (Luong Le et al., 2024). This view suggests that responsibility for accuracy lies with both suppliers and construction teams. Improvements in internal ordering procedures, clearer specifications, and better supplier collaboration are necessary to address this challenge.

Inaccurate Inventory Records

Inaccurate inventory records can lead to material shortages, overstocking, and inefficiencies during project execution (Kock and Hadaya, 2018). Manual data entry errors and outdated inventory systems are primary contributors to these inaccuracies (Janne and Rudberg, 2020). The adoption of automated inventory systems and real-time tracking technologies has been advocated to improve record accuracy. However, Fredriksson and Huge (2022) caution against over-reliance on technology. Even advanced systems may fail if human factors—such as insufficient training, poor oversight, and inconsistent procedures—are not addressed (Ghanem et al., 2018). Thus, achieving inventory accuracy requires both technological solutions and improvements in human practices, including regular audits, process standardization, and personnel development.

5.4. Material Management

Material management is a critical component of construction logistics, directly influencing waste reduction, cost control, and productivity enhancement (Brag, 2011). It involves all tasks required to ensure the timely and cost-effective delivery of the right materials, in the required quantities and quality (Kasim, 2008). Given that material costs account for approximately 60% of total construction project costs (Frodell et al., 2008), efficient material management is essential. Poor practices can lead to material shortages, excessive waste, and productivity losses—particularly through inadequate distribution and handling procedures. Luong Le et al. (2024)estimate that inefficient material handling contributes to a 40% loss in workers' time. Key challenges in this area include:

Neglecting Quality Considerations in Purchasing

Procurement processes often prioritize cost over quality, which can result in the acquisition of substandard materials (Ahmed and Zhang, 2017). This tendency contributes to rework, delays, and increased project costs (Hedlund and Telese, 2019). Scholars advocate for a more balanced procurement strategy that equally considers quality and price, supported by rigorous supplier evaluations and quality control mechanisms. Fredriksson and Huge (2022) suggest that the problem is exacerbated by the complexity of the construction supply chain, which pressures procurement teams to compromise quality in order to meet deadlines. Ekeskar and Rudberg (2020) expand the scope of responsibility to include on-site handling and storage practices, arguing that quality degradation can occur even after purchase. Therefore, improving quality outcomes requires a coordinated, end-to-end approach to procurement and logistics management.

Material Waste Due to Inefficient Handling

Ineffective material handling—including improper storage, poor site organization, and untrained staff—leads to significant material waste (Patel and Vyas, 2011). Thunberg and Fredriksson (2018) argue that improved handling protocols and workforce training can significantly reduce losses. Technology-based solutions, such as automated handling systems and real-time tracking, are also recommended (Fredriksson and Huge, 2022). However, Ekeskar and Rudberg (2020) contend that material waste often originates upstream, during planning and procurement. Over-ordering and ordering incorrect materials result in excess stock that is later mishandled or discarded. This perspective advocates for a supply chain-wide approach, emphasizing accurate forecasting, integrated procurement and inventory planning, and better coordination between offsite and onsite teams.

Fluctuating Prices of Construction Materials and Components

Volatility in material prices presents a major risk to project budgets. Janne and Rudberg (2020) identify external factors—such as global supply chain disruptions and market fluctuations—as key drivers of price instability. Fredriksson and Huge (2022) recommend mitigation strategies such as forward contracts, hedging, and long-term supplier partnerships to stabilize costs. However, Chawathe et al. (2023) warn that financial instruments are not fail-safe and may carry their own risks. Luong Le et al. (2021) further argue that these strategies can be costly or difficult to implement, especially for smaller firms. Ekeskar and Rudberg (2020) highlight the importance of strengthening internal processes, such as cost estimation and budgeting, to better manage price variability. Ultimately, firms must balance external risk-mitigation strategies with robust internal financial controls.

Duplication and Errors Caused by Excessive Paperwork

The continued reliance on paper-based processes creates logistical inefficiencies through data duplication, input errors, and communication breakdowns (Sundquist et al., 2018). Manual documentation processes are time-consuming and error-prone (Patel and Vyas, 2011). Digitization is widely supported as a solution, offering streamlined workflows and improved data accuracy. However, Luong Le et al. (2021) caution against viewing digitization as a cure-all. Fredriksson and Huge (2022) emphasize that transitioning to digital systems must be carefully managed to avoid resistance, user errors, or disruptions. Ahmed and Zhang (2017) further warns of overdependence on digital tools, which may introduce cybersecurity risks or system failures. Therefore, while digital transformation is essential, it must be accompanied by effective change management, user training, and contingency planning.

This section highlights the interconnected nature of inventory, warehousing, and material management challenges in construction logistics. Addressing these challenges requires a combination of technological integration, process optimization, and organizational adaptation to improve efficiency and reduce waste across the construction supply chain.

5.5. Communication and Coordination

Effective construction logistics depends heavily on precise communication, coordination, and information exchange to avoid project delays and inefficiencies (Fredriksson et al., 2021). Communication in this context refers to the sharing of knowledge and instructions among stakeholders—whether in person, via phone, or through digital platforms (Janne and Fredriksson, 2019; Janne and Rudberg, 2020). This function serves as a vital link that integrates all construction phases and actors. To avoid misunderstandings and conflicts, communication must be clear, documented, and detailed (Ekeskar and Rudberg, 2020). Numerous studies identify poor communication and coordination as core contributors to logistics inefficiency in construction (Fredriksson et al., 2021; Guerlain et al., 2019). Efficient logistics requires reliable systems that facilitate information flow across all parties involved (Janne and Fredriksson, 2019). Key challenges include:

Lack of Coordination and Integration with Suppliers

The lack of coordination with suppliers is frequently cited as a critical issue, with varying perspectives on its causes and consequences. Thunberg et al. (2014) argue that fragmented supply chains lead to delays, material shortages, and cost overruns. Patel and Vyas (2011) highlight the lack of standardized processes for integrating suppliers into construction workflows. To improve coordination, scholars advocate for long-term supplier partnerships, integrated supply chain systems, and collaborative planning (Luong Le et al., 2021). Lam et al. (2024) propose that the issue extends beyond supplier relationships to broader supply chain mismanagement. Sundquist et al. (2018) emphasize that suppliers are often excluded from the early stages of project planning, which leads to unrealistic expectations and delayed deliveries. These authors suggest more proactive supply chain practices, including early supplier involvement, just-in-time delivery, and improved communication channels.

Inadequate Communication Among Internal Parties

Internal miscommunication between project management, procurement, and site teams can result in misunderstandings, delays, and logistical errors (Patel and Vyas, 2011). Ahmed and Zhang (2017) attributes this issue to a lack of cross-functional collaboration. Janne and Rudberg (2020) recommend cross-functional teams and regular coordination meetings, supported by integrated project management tools to enable real-time visibility. Luong Le et al. (2021)add that the issue is not just about whether communication exists, but whether it is clear, coherent, and actionable. Poorly structured communication—even when frequent—can lead to confusion and errors. Improving both the quality and effectiveness of internal communication is essential.

Ineffective Coordination Among Internal Stakeholders

Poor coordination among internal stakeholders—such as project managers, logistics staff, and site supervisors—leads to misaligned goals, duplicated efforts, and wasted resources (Janne and Rudberg, 2020). Luong Le et al. (2021)emphasize the need for clearly defined roles and workflows, supported by coordination tools like Gantt charts and scheduling software. Ghanem et al. (2018) argue that organizational culture and leadership are foundational. Without strong leadership and a collaborative culture, coordination tools alone will not yield results. Leadership development and a culture of accountability are needed to reinforce and sustain coordination mechanisms.

Delays in Decision-Making by Consultant Engineers

Consultant engineers are often cautious and reliant on extensive review processes, resulting in delays that negatively affect logistics operations (Luong Le et al., 2021). Janne and Rudberg (2020) note that while quality and compliance are important, delayed decisions can lead to missed deadlines and cost escalations. Luong Le et al. (2021)propose empowering site engineers, streamlining approval processes, and setting clear decision-making timelines. However, Patel and Vyas (2011) highlight that delays are also caused by incomplete or unclear information provided to consultants. Ensuring timely, accurate communication with consultants is therefore equally important for improving decision timelines.

Ambiguity in Logistics Responsibilities Within Construction Teams

Unclear logistics roles often lead to confusion, delays, and inefficiencies (Fredriksson et al., 2021). Defining responsibilities and appointing logistics coordinators can ensure accountability and streamline operations. However, Ameh et al. (2010) argue that the inherent uncertainty of construction projects makes rigid roles impractical. Fredriksson et al.(2019) suggest that even well-defined roles can become blurred due to shifting project demands. This highlights the need for a dual approach: establishing clear roles while promoting adaptability and responsive management strategies that reflect the dynamic nature of construction logistics.

5.6. Reverse Logistics (RL)

Reverse logistics (RL) is an essential yet often underdeveloped component of construction logistics. RL refers to the processes involved in identifying, sorting, and returning or replacing defective or excess materials delivered to the site (Ghanem et al., 2018). Despite its importance, RL is poorly implemented across the construction sector (Hedlund and Telese, 2019). Many construction firms do not incorporate RL systems into their operations, reflecting a significant management gap (Janne and Rudberg, 2020). Hosseini et al. (2014) and Fredriksson et al. (2021) argue that the primary reason is the perceived cost burden of returns—including labor, handling, and transport expenses. As a result, RL is often overlooked unless the materials involved are highly valuable or critical to the project. Lam et al. (2024) stress that when expensive or specialized materials are defective, the absence of an effective RL system can disrupt the project timeline and budget. Chawathe et al. (2023) support the view that a well-structured and reliable RL system is essential for ensuring quick returns and replacements, maintaining project flow, and avoiding costly downtime.

Table 2 presents a summary of the logistics challenges affecting construction productivity, organized by their corresponding logistics functions.

6. Discussion

The literature confirms that logistics practices in construction are vital, serving as a foundational element for executing construction activities. Construction processes cannot proceed effectively without robust logistical planning and coordination. In particular, planning and resource allocation are considered prerequisites for initiating any construction activity. When these functions are poorly managed or delayed, construction schedules are disrupted, leading to significant time losses and inefficiencies.

Proper supervision and management of logistics activities are therefore essential. However, it is evident that some construction firms delegate logistics responsibilities to inexperienced or unqualified personnel, resulting in inadequate work plans and poorly designed site layouts. This lack of professionalism generates avoidable disruptions, material waste, and productivity losses.

Among logistics functions, communication and coordination are especially critical, as they ensure the smooth flow of information and knowledge between stakeholders. Ineffective communication often results in misunderstandings of project requirements. For example, suppliers or subcontractors may deliver unsuitable materials due to unclear or incomplete information communicated by underqualified staff within the construction firm.

Furthermore, material management is identified as one of the most essential logistics functions in construction. Given that materials can account for approximately 80% of total project costs, poor material management significantly undermines project efficiency (Ekeskar and Rudberg, 2020). Key issues include inadequate planning for material quantity and quality, prioritizing low-cost procurement over relationship-building with reliable suppliers (Janne and Rudberg, 2020), and the use of inappropriate handling methods. These shortcomings may lead to material damage and delays, as workers are often left idle while waiting for corrections or replacements (Janne and Fredriksson, 2019).

Table 2: Logistics challenges

Logistics function (Theme)		Authors																																					
Theme	Challenges	Dey (2001)	Navon and Berkovich (2004)	Kasim et al., (2005)	Moura et al., (2007)	Le-Hoai et al. (2008)	Sohrab Donyavi (2009)	Ameh et al. (2010)	Patel and Vyas (2011)	Lindholm and Behrends (2012)	Lindholm and Behrends (2012)	Thunberg et al. (2014)	(McKinnon, 2015)	Ahmed (2017)	Shigute and Nasirian (2014)	Ghanem et al. (2018)	Ekeskar and Rudberg (2016)	Sundquist et al. (2018)	Kock and Hadaya (2018)	(Thunberg and Fredriksson, 2018)	Janne and Fredriksson (2019)	Hedlund and Telese (2019)	Schuldt, & Carvalho, 2020;	Centobelli et al. (2020)	Fredriksson et al. (2021)	Luong Le et al. (2021)	Arvianto et al., 2021	Janne and Fredriksson (2021)	Ekeskar and Rudberg (2020)	Vrijhoef, 2020)	Janne and Rudberg (2020)	Rad et al., 2022	Le & Nguyen, 2022	Balasubramaniana and Shuklab, 2017	Fredriksson and Huge, 2022	Le and Nguyen, 2023	Le and Nguyen (2023)	Chawatheet al. (2023)	Pivaa, 2024	Luong Le et al., 2024	(Lam et al., 2024),
Planning and resources allocation	A lack of expertise (or knowledge) in construction logistics			×	×	×		×	×				×			×	×	×							×	×		×	×								×		×		
Communication and coordination	lack of coordination and integration with suppliers	×				×			×			×						×								×		×			×		×						×		×
Planning and resources allocation	Inadequate planning for logistics processes, including resource management	×	×		×		×			×				×			×			×		×			×	×		×	×						×			×			
Planning and resources allocation	Management's insufficient commitment to on-site logistics operations	×		×		×			×					×		×		×								×			×		×				×		×				
Material management	Neglecting the understanding of quality in purchasing processes	×	×		×	×	×		×					×				×				×			×	×			×		×				×			×	×		
Planning and resources allocation	Inadequate alignment between construction schedules and logistics practices		×		×		×				×			×	×		×		×			×							×						×	×					
Communication and coordination	Inadequate communication among internal parties	×	×	×				×	×					×				×							×			×	×		×							×	×		
Communication and coordination	Ineffective coordination among internal parties							×	×					×		×		×													×				×		×		×		
Planning and resources allocation	Inefficient site layout				×	×		×				×			×		×	×				×			×			×			×		×			×		×	×		×
Material management	waste of materials due to inefficient material handling	×		×		×			×					×		×		×		×						×			×						×				×		
Planning and resources allocation	Poor material identification and estimation				×			×				×		×	×		×								×			×	×				×		×	×		×			×
Transportation	lack of real-time tracking of fleet and equipment used in construction logistics	×				×	×		×					×				×		×		×				×			×						×				×		
Planning and resources allocation	Ineffective monitoring and control of logistics activities			×			×			×		×			×	×						×						×	×				×			×	×				×
Communication and coordination	Delays in decision-making by the consultant engineer	×	×	×				×	×					×		×									×	×			×		×				×		×				
Communication and coordination	Ambiguity in logistics responsibilities for the construction team					×	×	×										×			×				×						×								×		
Transportation	The use of inappropriate types of vehicles in transportation	×		×	×		×									×	×		×			×				×			×								×	×			
Material management	The fluctuating prices of construction materials and components					×		×			×			×			×	×							×				×		×				×			×	×		
Material management	Duplication and errors caused by excessive paperwork	×				×	×		×					×				×				×				×									×				×		
Inventory and warehouse management	Accuracy of goods (orders) received from suppliers			×			×					×			×	×						×		×				×	×				×			×	×				×
Inventory and warehouse management	Inaccurate inventory records	×	×	×				×	×					×		×			×							×					×				×		×				
Reverse logistics	Inefficient management of the return process for purchased materials		×		×	×	×							×			×					×		×					×						×			×			

The role of inventory and warehousing management is closely linked to material management and may be considered a complementary function (Hedlund and Telese, 2019). The primary challenge in this area is ensuring the timely availability of materials (Janne and Fredriksson, 2019). Poor inventory practices and substandard warehouse conditions can result in material deterioration or disqualification for use, especially when stored in environments that are not properly controlled (Ghanem et al., 2018). Such outcomes inevitably cause delays and inflate project costs.

The transportation function is also integral to construction logistics and is associated with two major challenges: (i) loss of visibility due to inadequate tracking systems, and (ii) the use of inappropriate vehicles for material transport. Both issues are strongly linked to productivity losses. A lack of real-time visibility compromises the ability to develop accurate and practical work schedules. It also inhibits timely decision-making among stakeholders who lack access to current logistical information (Janne and Fredriksson, 2019).

Lastly, the reverse logistics (RL) function is increasingly recognized as essential in preventing cost overruns. Accepting defective or unqualified materials can significantly disrupt construction processes and lead to unnecessary expenditures. Effective RL systems enable the timely return or replacement of such materials, thereby maintaining workflow continuity and safeguarding project budgets (Luong Le et al., 2021).

7. Conclusion

Due to its complexity, high-risk environment, and fragmented structure, the construction industry faces numerous logistical challenges that significantly affect project efficiency, cost, and delivery timelines. This study identified 16 key challenges through a critical review of the literature. These challenges span multiple logistics domains, including planning, resource management, transportation, inventory control, communication, and reverse logistics. Core issues include poor coordination between logistics and construction processes, inadequate supervision of logistics activities, insufficient planning and control of resources and materials, and the failure to employ dedicated logistics personnel. Other issues include reliance on inexperienced staff, substandard work plans, unclear role definitions, cost-focused outsourcing, inappropriate material handling and storage methods, material market volatility, unsuitable vehicle use, and the absence of systems to manage unqualified or surplus materials. These findings highlight gaps in current logistics practices across material procurement, supply chain integration, on-site logistics, and technological adoption. While this study contributes valuable insights, it also identifies areas where further exploration is needed to enhance logistics efficiency and resilience in construction projects.

7.1. Limitations

Despite the scope of this research, several critical aspects of construction logistics remain underexplored. The use of real-time data analytics for optimizing logistics decisions is still in its early stages, with limited empirical evidence regarding its implementation and effectiveness.

While technologies such as IoT and AI are frequently mentioned, their practical deployment in construction logistics is hindered by challenges related to data security, system interoperability, and the adaptability of construction teams to these digital tools.

The impact of global supply chain disruptions, such as those triggered by pandemics or geopolitical tensions, has not been sufficiently examined. Current literature often overlooks the development of strategies to enhance supply chain resilience.

The logistics of sustainable construction, including the procurement, transport, and management of green materials, is also inadequately addressed, despite the industry's growing commitment to sustainability.

These limitations suggest the need for further empirical and theoretical work to support the advancement of logistics practices in the construction sector.

7.2. Potential Research Opportunities

Based on the gaps identified, several future research directions are recommended:

- Integration of Real-Time Data Analytics: Future studies could focus on developing frameworks that embed real-time analytics into construction logistics. Research could explore how firms use data to optimize resource allocation, improve visibility, and support decision-making. Barriers to technology adoption and strategies for overcoming them also warrant further investigation.

- Supply Chain Resilience: Research into how construction firms can respond to global disruptions is critical. Topics might include diversified sourcing strategies, local procurement models, and contingency planning frameworks to enhance operational resilience.
- Sustainable Logistics Practices: As sustainability becomes a priority, further studies are needed to assess the implications of green logistics in construction. This includes investigating the cost, efficiency, and timeline impacts of adopting environmentally friendly materials and developing best practices for their management.
- Collaborative Logistics Models: Exploring collaborative logistics—where multiple firms or stakeholders share logistics resources and information—may offer innovative approaches to cost reduction and efficiency gains. Research could assess the feasibility, benefits, and risks of such shared logistics strategies within the construction context.

This study advances the understanding of logistics challenges in the construction industry and underscores the dynamic and multifaceted nature of these issues. While it contributes a detailed analysis of current obstacles, it also emphasizes the need for ongoing research to address emerging concerns and support continuous improvement.

Addressing the identified knowledge gaps will enhance the resilience, efficiency, and sustainability of construction logistics systems. As construction plays a pivotal role in global infrastructure development, the industry's ability to innovate in logistics management is crucial for its future growth. Engaging with diverse scholarly perspectives will empower professionals to develop more adaptive and effective logistics strategies.

In conclusion, the discussion around logistics in construction must continue. Through sustained academic inquiry and industry collaboration, the sector can evolve toward more intelligent, coordinated, and sustainable logistics practices.

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