

**IMPROVING CONSTRUCTION PROJECT PERFORMANCE THROUGH
STREAMLINED LOGISTICS SOLUTIONS**

**ПІДВИЩЕННЯ ЕФЕКТИВНОСТІ БУДІВЕЛЬНИХ ПРОЄКТІВ
ЗАВДЯКИ ОПТИМІЗОВАНИМ ЛОГІСТИЧНИМ РІШЕННЯМ**

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This article provides an overview of the importance of efficient logistics solutions in construction projects and explores strategies to enhance project performance. It examines key areas such as streamlining material procurement and implementing just-in-time delivery practices to improve cost-efficiency and minimize delays. The article offers insights and recommendations for optimizing logistics operations in the construction industry. The publication focuses on the importance and prospects of efficient logistics management in the construction process and explores the application of multi-objective optimization methods to achieve sustainable results. The research highlights the challenges associated with logistics in the context of construction and emphasizes the need for a comprehensive approach to addressing them. By employing multi-objective optimization methods, the article proposes strategies for optimizing logistics operations, such as transportation, inventory management, and supply chain coordination. The study aims to provide valuable insights and practical recommendations to enhance efficiency in implementing construction projects. The conclusions of this research contribute to expanding knowledge in the field of logistics management and offer valuable recommendations for further practices in building supply chains during construction and reconstruction projects.

Keywords: logistics management, construction industry, supply chains in construction, building project efficiency

Introduction. Immediately after a victory, the question arises regarding the restoration of industry and the rapid creation of construction products. Industrial building reconstruction attracts significant attention due to its potential for revitalizing existing infrastructure and promoting sustainable development. Successful and, importantly, fast implementation (in terms of rapid recovery) of

such projects requires efficient logistics management to ensure timely delivery of materials, stakeholder coordination, and minimizing negative environmental impact. The application of multi-objective optimization methods is a promising approach to addressing complex logistical tasks associated with industrial building reconstruction while considering the principles of sustainable development.

Stable supply chains in construction organizations have always been considered a positive trait, indicating reliability and successful project implementation. However, when it comes to the reconstruction of industrial buildings, unconventional considerations arise due to the existing structure, restricted access, and the need to minimize disruptions to ongoing operations. Therefore, conventional logistics approaches may not fully account for the intricacies and specific requirements of these projects. As a result, there is a need for advanced optimization models that can balance multiple objectives, including economic efficiency, time optimization, resource allocation, and environmental sustainability.

The use of multi-objective optimization methods offers a comprehensive approach to solving unique challenges related to the reconstruction of industrial buildings. These methods allow for the integration of diverse objectives, such as economic efficiency, time optimization, resource allocation, and environmental sustainability, ensuring a harmonious combination among them. Considering the specific requirements of construction projects enables the balancing of various stakeholders' interests and facilitates optimal decision-making. This opens up broad prospects for achieving high efficiency in logistics management during the construction process and contributes to the sustainable development of these projects [1].

Sustainable logistics management pertains to a management approach aimed at achieving long-term sustainability in logistics processes and enterprise activities. This entails the efficient utilization of resources, process optimization, and ensuring environmental, economic, and social sustainability.

State of the issue and research objectives. The analysis of research in the field of supply chain integration for construction organizations indicates that the implementation of logistics management systems and supply control requires further investigation and holds significant potential for the industry.

In [2], A. Al-Musawi emphasizes the importance of the interrelationship between goal setting, prioritization, and project completion stages, revealing a significant correlation and positive impact on project success and team morale. By aligning goals and establishing priorities during the project initiation phase, teams can effectively plan, execute, and close projects. Such a structured approach enhances efficiency, motivation, and overall project outcomes. The research findings underscore the importance of goal setting and prioritization in project management, highlighting their role in creating a cohesive and productive work environment.

After conducting a detailed analysis, researchers Magill L.J. and Jafarifar N. present recommendations for integrating 4D BIM (Building Information Modeling) into supply chain management processes in construction projects for all stakeholders. Early adoption of 4D BIM allows for construction process modeling and efficient resource allocation. Forward-thinking leadership should prioritize training and awareness building regarding 4D BIM and ICSCM (Information and Communication Technologies for Supply Chain Management) while aligning them with organizational values. Combining advanced planning with 4D BIM ensures time certainty, reduces conflicts, and enhances project efficiency. A robust IT infrastructure enables optimization of BIM management and project coordination. Contractors play a vital role in integrating and utilizing these transformative changes, collaborating with stakeholders and the supply chain. Further improvement in logistics management can be achieved through studying third-party logistics with transparent cost models. By implementing these practices, construction projects can achieve increased efficiency, reduced delays, and successful outcomes [3].

In his research on resource utilization in construction projects [4], Ukrainian researcher Kulik M.V. emphasizes that scheduling is a key management tool in construction, enabling the technical and economic assessment of projects. The study highlights the need for the development of advanced models to effectively simulate and verify organizational and technological processes during project development and execution. This opens up opportunities to enhance the quality and performance of construction projects by optimizing resource utilization and reducing risks through supply chain optimization.

Based on the review of available literature [1-9], it can be concluded that there is a notable lack of research in the field aimed at creating optimal models to enhance collaboration and cooperation for reducing costs in the logistics component.

The aim is to explore the potential of multi-objective optimization for improving logistics management in construction. By integrating key logistic elements such as transportation, supply chain coordination, and inventory management, a framework can be developed to optimize operations and achieve sustainable outcomes. The article focuses on identifying and addressing logistics-related issues in the construction industry, emphasizing the need for a comprehensive approach to problem-solving and enhancing logistics processes in construction to achieve optimal results.

The research methodology consists of analyzing and reviewing scientific publications, journals, developments, and other sources related to logistics management in the construction industry. By systematically analyzing and synthesizing information, the main constraints, obstacles, and shortcomings in existing scientific research and materials are identified to determine the directions for future research and provide recommendations.

work with, cost estimates provide a framework for optimized supply management, preventing profit loss due to price exceedance. These insights highlight the significance of supply optimization in reducing costs and optimizing project estimation, underscoring the importance of a comprehensive approach to supply chain management in the construction industry.

It is crucial to establish an advanced logistics application layer that enables seamless communication and rapid information transmission across different regions. This application layer aims to facilitate the sharing of local network resources, centralized information processing, and intelligent management of logistics operations such as vehicle loading and dispatch. To achieve these objectives, logistics applications leverage cutting-edge technologies like cloud computing and data warehousing.

By utilizing cloud computing and data warehousing, logistics applications can effectively integrate and manage logistics information resources in a centralized manner. This integration leads to the creation of a dynamic data resource library that is constantly updated in real-time, catering to the specific needs of various logistics businesses.

Through the integration of information, logistics statuses and operations can be monitored in real-time, providing a unified information resource support system for the development of logistics business within the building construction industry. This integration also facilitates seamless connectivity with other logistics applications, ensuring a comprehensive and interconnected logistics ecosystem [6].

This aspect is particularly relevant in today's construction industry, where efficient resource planning is crucial for project success. For example, by accurately estimating the cost and duration of specific tasks, construction companies can allocate the appropriate number of workers, machinery, and materials, thereby avoiding underutilization or overallocation of resources. This not only helps in optimizing project timelines and minimizing costs but also ensures that the project proceeds smoothly without unnecessary delays or disruptions.

By utilizing accurate cost estimates as a basis for planning, construction companies can achieve greater efficiency, cost savings, and improved project performance, ultimately leading to increased profitability and client satisfaction.

This information will be subsequently transmitted to the construction site, where supervisors and foremen need a clear understanding of the required resources and their scheduling based on the project's scope.

To facilitate this, a work schedule in the form of a Gantt chart is developed [7], providing a visual representation of the project's timeline and resource allocation. The Gantt chart allows for effective coordination and management of construction activities, ensuring that the right resources are available at the right time. By utilizing this scheduling tool, construction teams can optimize resource utilization, minimize downtime, and enhance overall project efficiency.

The Gantt chart (fig. 2) serves as a valuable communication tool, enabling stakeholders to visualize the project's progress, identify dependencies, and make informed decisions to ensure timely completion and successful project outcomes.

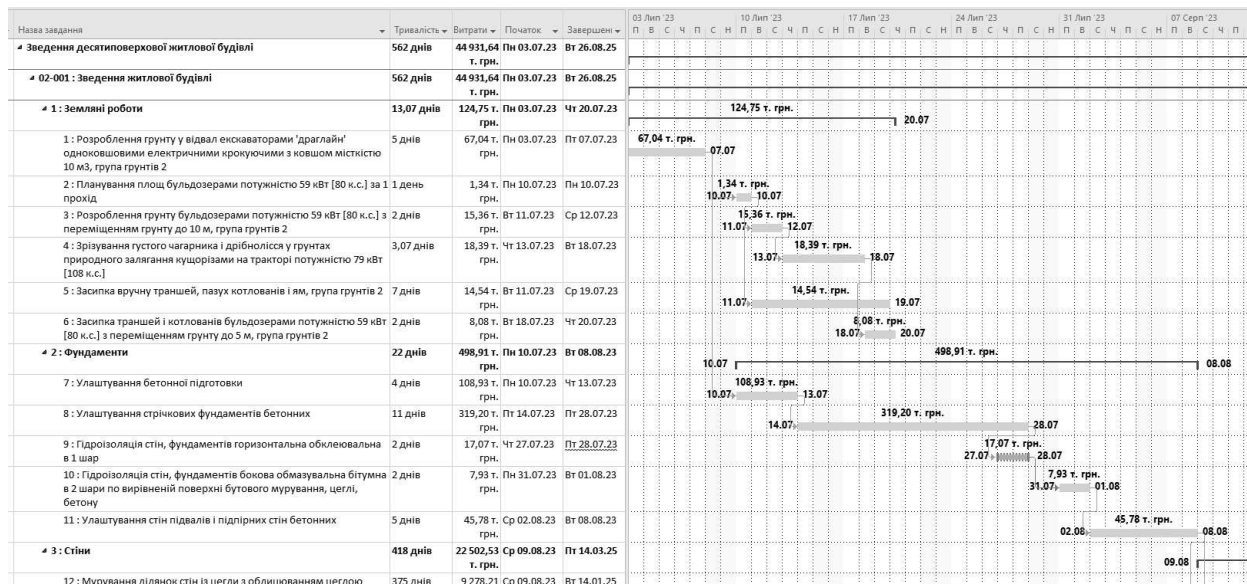


Figure 2 – Using Gantt chart in Microsoft Project software for residential building construction

Figure 2 shows a schematic view of a Gantt chart in which each subsequent task follows the completion of the previous one. The chart displays the timeline (dates in days, weeks, months), and each subsequent task starts upon the completion of its predecessor (some tasks may have no predecessors). An example of pouring foundations is considered for the first week. From the estimate, it is necessary to link the materials, their requirements, and expenditures specifically to this timeframe. Modern software tools, such as Microsoft Project, enable automated calculations.

Based on the initial data, budget planning becomes possible, which is a topic for a separate article on construction organization. In addition to the budget, the calendar plan provides insights into the specific quantity and type of materials required. This information creates opportunities for supply optimization during the preliminary planning stage. Some types of construction materials (bulk materials, formwork) can be delivered to the site initially, while others can be delivered "just-in-time" or on the day of the task execution. This strategy is aligned with the principles of lean supply chains, particularly relevant for security concerns or the installation of expensive materials and equipment, such as metal structures and fasteners.

In the research conducted by C. Whitlock and F. Henry Abanda [8], Figure 3 depicts the findings of a quantitative survey that targeted 170 professionals actively engaged in the construction field. Of these participants, a total of 69 individuals responded, resulting in a response rate of 40.6%, which is considered satisfactory within the industry. The graph visually represents the breakdown of experience

levels among the respondents, with the majority showcasing expertise in construction, followed by CLM (construction logistics management), and finally BIM (building information modeling). These outcomes are consistent with expectations, considering that BIM, being a relatively novel concept, encounters resistance during its integration into the construction sector.

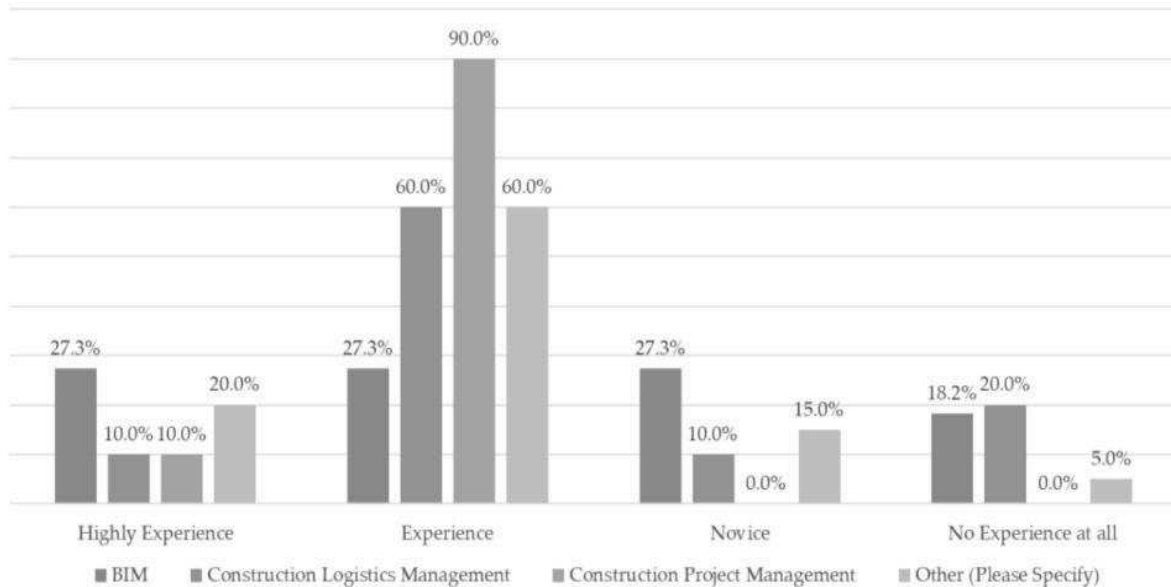


Figure 3 – The results of the survey of professionals who have experience in the construction industry [8]

By understanding the existing landscape, industry stakeholders can develop strategies to promote wider adoption of logistic and BIM, fostering improved logistics management and enhanced project outcomes.

Building Information Modeling (BIM) scheduling software plays a crucial role in construction consolidation centers and material logistics management in the supply chain. By integrating supply chain management techniques with 4D model data, it becomes possible to visualize and monitor the flow of materials throughout the project. The continuous updating of the 4D BIM model allows logistics coordinators to accurately identify the required quantities of materials at each stage of the project, as well as track the materials already installed. This level of visibility and control enhances the efficiency of material management, minimizes waste, and improves overall project coordination. By leveraging BIM scheduling software, construction organizations can optimize their supply chain processes, streamline material logistics administration, and achieve cost savings through improved resource allocation and inventory management.

Analyzing the impact of logistics service changes on stakeholders in the construction industry is crucial as it provides insights beyond the information presented in invoices. While invoices provide a clear picture of service costs, they fail to capture actual costs, cost savings, or the potential benefits derived from the services utilized. Additionally, they do not reflect the influence on the contractor's construction efficiency. As the construction sector undergoes transformations in

logistics structures, it becomes essential to explore how these changes affect various stakeholders. Conducting logistics cost analysis offers a viable approach to evaluating the implications of these changes, enabling a comprehensive assessment of their effects on all parties involved. By delving into cost-related factors, this analysis sheds light on the broader impact of logistics service offerings in the construction industry [9].

While optimizing logistics in construction projects offers numerous benefits, it is important to acknowledge potential drawbacks and challenges that may arise during implementation. Firstly, integrating new logistics models and technologies may require substantial investment in infrastructure, software, and training. Coordinating with multiple suppliers and subcontractors may pose coordination challenges, especially in complex construction projects with tight deadlines.

Effective supply management creates all the necessary conditions for seamless project execution. One important aspect of this is the implementation of efficient logistics solutions for material procurement and cost tracking. These solutions involve the delivery of material kits directly to specific workstations, enabling workers to have convenient access to the required materials [10].

Conclusions. Understanding the implications of logistics service changes and their impact on stakeholders in the construction industry holds paramount importance beyond what is evident from mere invoices. The conventional logistics approaches may fall short in effectively addressing challenges arising from limited accessibility, structural constraints, and the critical need to minimize disruptions during ongoing operations.

Thus, embracing advanced optimization models becomes imperative to strike a harmonious balance between multiple objectives in this dynamic environment. As construction organizations grapple with larger and more complex projects, streamlining supply processes gains significance.

Based on the analysis of scientific materials, developments of foreign and domestic scientists, literature, we can outline the main recommendations for stakeholders to optimize the construction:

1. Emphasize early adoption of 4D BIM. Implementing 4D BIM (Building Information Modeling) in construction projects enables effective resource allocation and process modeling.

2. Foster collaboration and integration. Transparent cost models and logistics studies of third-party logistics providers can further enhance logistics management.

3. Invest in a reliable IT infrastructure to optimize BIM management and project coordination. This includes leveraging technologies like cloud computing and data warehousing to centralize logistics information resources, ensuring real-time updates and integration for efficient logistics operations.

4. Delegate supply management responsibilities to specialized personnel for better resource allocation.

5. Implement logistics cost analysis. This analysis provides valuable insights beyond the information presented in invoices, helping stakeholders assess the implications of logistics service changes.

Continuous improvement and adaptation drive logistics optimization in construction. This article serves as a foundational piece for further research in the field of logistics in construction. The complexities and challenges associated with supply management, cost analysis, and stakeholder impacts necessitate continued exploration and investigation. By recognizing the significance of logistics optimization and the need for advanced models, researchers can delve deeper into this subject matter, uncovering new insights and developing innovative strategies. Continued study in this area holds the potential to enhance construction logistics practices, improve resource allocation, and ultimately contribute to the overall advancement of the construction industry.

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