

Material Management in Construction Projects: An Investigation of Material Procurement, Storage, and Inventory Control

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Abstract: *Material management is one of the most important aspects of construction project management because it influences project productivity, quality, and schedule performance. A systematic process of planning, procurement, transportation, storage, inventory control, handling, distribution, and utilization is required in construction projects. Inefficient material management results in material shortages, excessive inventory, damage, and increased project costs. The success of construction projects depends on the effectiveness of material management practices. This study examines the role of material procurement, storage, and inventory control in construction projects. The material management activities examined in the study include procurement planning, supplier selection, purchasing processes, material receiving, storage practices, inventory monitoring, inventory tracking, and forecasting of material requirements. Major factors influencing material management effectiveness in construction projects are identified through a literature review. The study also examines the challenges associated with material handling and control at construction sites and their implications on project cost, time, and quality. Data for the study were collected through a structured questionnaire. The Relative Importance Index (RII) method was used to determine the importance of various material management factors. Proper storage facilities, material tracking systems, inventory monitoring, and requirement forecasting were identified as major contributors to effective material management. According to the findings, efficient material procurement practices ensure the timely availability of construction materials. Storage management reduces material deterioration, theft, and wastage. Inventory control techniques help maintain optimum inventory levels, reduce carrying costs, and support better decision-making. Modern technologies such as Building Information Modeling (BIM), Radio Frequency Identification (RFID), and computerized inventory management systems can improve material management effectiveness. The study concludes that systematic material management practices help reduce material waste, achieve cost savings, improve project execution, enhance productivity, and support accurate project forecasting. Successful project outcomes can be achieved through effective coordination among project stakeholders. Material management strategies, advanced inventory control techniques, and technology-driven monitoring systems are recommended by the study.*

Keywords: Material Management, Construction Projects, Material Procurement, Storage Management, Inventory Control, Material Planning, Material Tracking, Construction Productivity, Material Wastage, Cost Savings, Project Execution, Resource Management, Project Forecasting, Construction Supply Chain Management, Construction Management.

1. Introduction

1.1 Background of the Study

The development of a country is dependent on the construction industry. Construction projects involve the effective utilization of resources. The influence of materials on project productivity, quality, and schedule performance is significant [1]. Ensuring the smooth execution of construction activities depends on the availability of materials. Material management involves planning, procurement, transportation, storage, inventory control, handling, distribution, and utilization of materials throughout the project lifecycle. Ensuring that the right materials are available in the right quantity, at the right place, at the right time, and at the minimum possible cost is the main objective of material management [1]. Effective material management can improve project performance. Cement, steel, aggregates, bricks, concrete products, electrical components, plumbing materials, finishing products, and various specialized construction items are required for construction projects. More than one-half of the total construction cost can be accounted for by these materials [2]. Inefficiencies in material management can affect project profitability.

Larger project sizes, tighter schedules, and greater stakeholder involvement have made construction projects more complex. Due to this complexity, effective material management practices have become more important. Poor coordination of material-related activities can cause delays in material availability, inventory shortages, excessive inventory, material deterioration, theft, and wastage [3]. Project schedules can be affected by these issues. Material procurement is one of the most important functions of material management. Ensuring timely delivery of materials to construction sites is one of the key objectives of procurement. Effective procurement planning helps avoid delays caused by material shortages and contributes to cost savings through efficient supplier management [3]. Material storage is another critical aspect of construction material management. The quality of construction materials can be affected by environmental conditions. Improper storage practices may lead to damage, deterioration, and theft. Storage planning helps protect materials and facilitates efficient handling [4].

Inventory control helps maintain an optimum balance between material availability and cost. Proper inventory management helps ensure that materials are available when required. Economic Order Quantity (EOQ), ABC analysis, reorder level systems, and computerized inventory tracking systems are some of the techniques used to improve material

utilization [5]. Information technology has improved material management practices. The ability of project teams to monitor material movement and inventory levels in real time has been enhanced through the use of technology [7]. These technologies contribute to better planning, forecasting, and decision-making. The increasing emphasis on cost control, productivity improvement, and sustainable construction practices highlights the need for effective material management systems. Construction organizations continuously seek ways to reduce material wastage, improve procurement efficiency, and strengthen inventory control. Understanding the relationship between material management practices and project performance is necessary to improve the efficiency of construction projects [1].

1.2 Need for the Study

Materials are an important component of construction projects. Despite advancements in project management techniques, many construction projects still face problems related to procurement delays, material shortages, and poor storage conditions [3]. Increased project costs, reduced productivity, and delays in project completion are often caused by these issues. The management of construction materials has become more difficult due to the growing complexity of projects. Construction organizations are under constant pressure to complete projects within budget and schedule. Material management is important for achieving these objectives [1].

When essential materials are not available, construction operations are interrupted. Poor inventory control can result in shortages, while improper storage can lead to material losses. Such inefficiencies directly affect project performance and profitability [4], [6]. There is a need for this study to identify ways to improve construction project outcomes. The study aims to provide insights into strategies that can reduce wastage, improve resource utilization, enhance forecasting accuracy, and contribute to successful project execution by investigating material procurement, storage, and inventory control practices [7].

1.3 Problem Statement

Construction projects frequently encounter challenges related to material management. Poor coordination, inefficient storage systems, and inadequate inventory control can cause disruptions in construction activities. Project performance can be affected by inefficiencies in material management because materials account for a significant portion of project costs [2]. Material shortages can create operational difficulties. Excessive inventory can increase storage and carrying costs. Improper storage conditions may lead to damage, deterioration, and theft of materials [4]. Incorrect forecasting of material requirements can result in inefficient purchasing decisions [5]. Maintaining an appropriate balance between material availability and inventory costs remains a challenge. A systematic approach to material management that integrates procurement planning, storage management, and inventory control is needed. This study examines the factors affecting material management effectiveness [1].

1.4 Objectives of the Study

The purpose of the study is to examine material procurement, storage, and inventory control in construction projects. The specific objectives of the study are:

- 1) To study material procurement practices in construction projects.
- 2) To evaluate material storage management practices at construction sites.
- 3) To analyze inventory control techniques used in construction projects.
- 4) To determine the impact of material management on project performance.
- 5) To identify strategies for improving material management practices.

1.4 Scope of the Study

Material procurement, storage, and inventory control are the primary areas focused on in this study. The study examines how these three components influence project performance through efficient management of construction materials. The study investigates procurement planning, supplier management, storage facilities, inventory monitoring, inventory control, and material tracking. Their effects on project cost, schedule performance, productivity, and resource utilization are evaluated. The research is limited to building construction projects and includes responses from construction professionals. Labour management, equipment management, and financial management activities are considered only in relation to their interaction with material management functions.

1.6 Significance of the Study

Material management is an essential function in construction project management because it directly influences project cost, time, quality, and productivity. Material shortages or delays can disrupt construction activities and result in inefficient utilization of resources [1]. A better understanding of material procurement, storage, and inventory control practices in construction projects is expected to be provided by the findings of this study. Project managers may improve planning and coordination through the insights generated. Contractors may benefit from improved procurement strategies, better inventory management practices, and enhanced storage systems [4]. The study provides practical information for the construction industry. The recommendations developed through this research may support the implementation of more efficient material management systems [7].

Table 1: Benefits of Effective Material Management

Material Management Function	Expected Benefit
Procurement Planning	Timely availability of materials
Supplier Management	Improved delivery performance
Storage Management	Reduced material damage and losses
Inventory Control	Lower inventory and carrying costs
Material Tracking	Improved forecasting and planning
Waste Management	Reduced material wastage
Resource Utilization	Improved productivity
Integrated Material Management	Better project execution

2. Literature Review

2.1 Introduction

Material management has become an important area of study in construction project management because materials represent a major portion of the total project cost. Proper management of construction materials ensures that the materials are available at the right time. Effective material management can help reduce project delays [1]. The construction industry depends on the availability of materials. Material-related problems are among the major causes of cost overruns, schedule delays, and productivity losses in construction projects [2]. Significant attention has been given to procurement planning, storage systems, inventory control techniques, and material tracking technologies. In this chapter, the role of material procurement, storage, and inventory control is examined. The need for the present study is justified by gaps identified in the existing literature.

2.2 Material Management in Construction Projects

Material management is the planning, organizing, directing, and controlling of activities related to the acquisition, storage, movement, and utilization of materials. It is important that materials are available when required [1]. Kasim et al. reported that material management influences project cost, productivity, and schedule performance [1]. The study stated that effective material management contributes to improved resource utilization. According to the authors, material management should be considered an important part of project management. Construction materials account for a large proportion of project expenditure and therefore require systematic planning and control [2]. The study highlighted the importance of material planning, procurement scheduling, and supplier coordination. Poor material control and inadequate planning can cause shortages, wastage, and cost overruns [3]. The study recommended the adoption of structured material management systems. Caldas et al. reported that effective material management can be achieved through integration between procurement activities, inventory systems, and construction operations [7]. Organizations with formal material management processes achieve better project outcomes.

Table 2: Summary of Previous Studies on Material Management

Author	Year	Focus Area	Key Findings
Kasim et al.	2011	Material Management	Improves project performance and resource utilization
Patel and Vyas	2011	Construction Materials	Effective planning reduces delays and costs
Ayegba	2013	Site Material Control	Poor management leads to wastage and shortages
Kasim	2015	Material Tracking	Improves inventory monitoring
Caldas et al.	2015	Material Management Systems	Improves project efficiency
Korion et al.	2019	Material Management Research	Procurement, storage and inventory control are critical

2.3 Material Procurement, Storage, and Inventory Control

Material procurement is important in construction project management. Ensuring timely delivery of materials to project sites is a key part of procurement. Project success can be achieved by reducing delays associated with material availability [3]. Madhavi et al. reported the impact of procurement planning on project cost performance [4]. Delays in procurement activities can lead to increased project expenditure. Supplier selection is another important aspect of procurement management. Reliable suppliers ensure that materials are delivered on time. Effective supplier management provides significant benefits to construction projects [2]. Construction materials can be stored at project sites. Improper storage practices can cause damage, deterioration, and losses. Material losses can be reduced through proper storage facilities and handling procedures [5].

Monitoring inventory levels and controlling material movement are important components of inventory control. Inventory control helps reduce carrying costs while avoiding shortages. An intelligent material tracking system was developed by Kasim [6]. The study highlighted the benefits of real-time material tracking and inventory monitoring. Economic Order Quantity (EOQ), ABC Analysis, Reorder Level Systems, and Just-in-Time (JIT) are some of the inventory control techniques used in construction projects. Organizations that use these methods are better able to maintain optimum inventory levels [5].

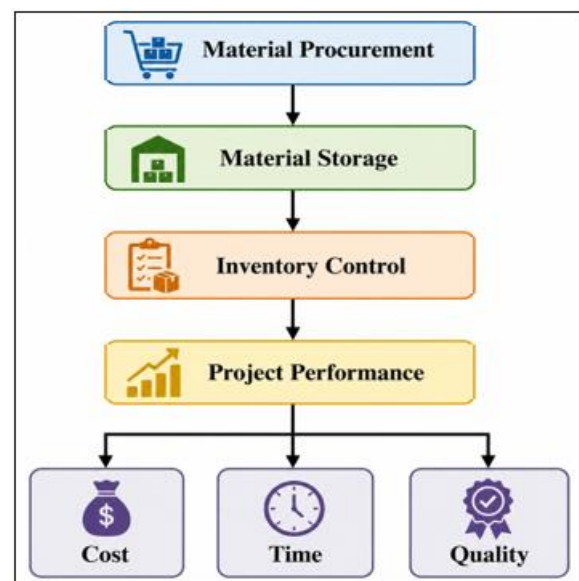


Figure 1: Conceptual Framework

2.4 Impact of Material Management on Project Performance

Project performance is commonly evaluated based on cost, time, quality, and productivity. The relationship between project performance and effective material management is strong. Kasim et al. reported that project cost and schedule performance can be better controlled through systematic material management practices [1]. Proper inventory control and effective procurement planning help reduce delays.

Project delays and cost overruns are often caused by inadequate material management [3]. Poor procurement planning, material shortages, and inefficient storage systems are among the causes of reduced project performance.

Inventory management techniques can help improve forecasting accuracy [5]. Effective inventory control contributes to better financial performance. Caldas et al. reported that communication among project stakeholders and decision-making can be improved through effective material management systems [7]. Technology-based material management systems achieve higher productivity and lower wastage. Koriom et al. reported that recent developments in material management research show that procurement, storage, and inventory control are the most important factors affecting project success [8]. Modern construction projects require integrated material management frameworks.

Table 3: Benefits of Effective Material Management

Benefit	Impact on Project
Reduced Wastage	Lower material losses
Cost Savings	Improved profitability
Better Project Execution	Improved workflow
Improved Forecasting	Better planning
Increased Productivity	Efficient resource utilization
Improved Schedule Performance	Timely completion

2.5 Research Gap

Many studies have examined individual aspects of material management such as procurement planning, storage systems, and inventory control techniques. However, limited studies have examined the combined influence of procurement, storage, and inventory control on project performance. The three components are evaluated in this study as an integrated material management framework. Although previous studies have established the importance of material management, there remains a need to identify the relative importance of procurement, storage, and inventory control factors. The present study seeks to bridge this gap by investigating material procurement, storage, and inventory control together and evaluating their influence on project performance in terms of cost savings, reduced wastage, improved project execution, and enhanced forecasting accuracy.

3. Research Methodology

3.1 Introduction

This chapter describes the methodology used for investigating material management practices. The study examines three dimensions of material management, namely material procurement, material storage, and inventory control, and evaluates their influence on project performance. The methodology was designed to achieve the objectives of the study and provide a systematic approach for collecting, analyzing, and interpreting information. Ensuring the validity and reliability of research findings is an important part of research methodology. It provides a framework through which information can be collected and analyzed to address a research problem. A quantitative

research approach was considered appropriate since the study seeks to evaluate the importance of material management practices from the perspective of construction professionals. Quantitative methods allow the analysis of factors that affect project performance.

The study methodology includes the identification of material management factors through a literature review, the development of a structured questionnaire, the collection of information from construction professionals, and the analysis of responses using the Relative Importance Index method. The influence of material management factors on construction project performance was determined using the results of the analysis.

3.2 Research Design

The study adopted a quantitative descriptive research design. A descriptive survey approach allows the collection of information regarding existing material management practices in construction projects and facilitates evaluation of their impact on project performance. The survey method is commonly used in construction management research because it allows the collection of opinions, perceptions, and experiences from professionals involved in project execution. The purpose of the research was to determine the effectiveness of material procurement, storage management, and inventory control practices in construction projects. These three dimensions represent the core functions of construction material management.

The quantitative approach was suitable because it allows the collection of numerical information that can be analyzed and ranked. Respondents were able to evaluate material management factors through a structured questionnaire. This approach provides consistency in data collection and enables comparison of responses across different categories of construction professionals. The study used a cross-sectional survey design in which information was collected at a specific point in time. The collected information was analyzed to identify the most significant material management factors and to assess their contribution to reducing wastage, achieving cost savings, improving project execution, and enhancing forecasting capabilities.

3.3 Identification of Material Management Factors

An extensive review of published literature was used to identify material management factors included in the study. Previous studies have emphasized the importance of material management. The literature review identified key variables that influence material management effectiveness. The study focused on three dimensions of material management. These dimensions represent the most critical activities associated with the acquisition, protection, monitoring, and utilization of construction materials. According to several researchers, deficiencies in these areas can lead to material shortages, project delays, increased costs, and reduced productivity. Material procurement affects material availability throughout the project. Ensuring timely delivery to project sites is one of the key activities involved. Improved project performance can be achieved through effective procurement practices.

Construction materials are often stored on site before being used in project activities. Damage, deterioration, and theft can result from improper storage practices. Effective storage management helps preserve the quality of materials. Inventory control is important in balancing material availability and inventory costs. Proper inventory management helps maintain optimum inventory levels. Inventory control practices support accurate forecasting and improve decision-making. These three dimensions were considered the most appropriate variables for evaluating the effectiveness of material management practices. The identified factors formed the basis for the study questionnaire.

3.4 Data Collection

The study utilized both primary and secondary sources of data. The use of multiple data sources improved the reliability of the research findings. Secondary information was obtained from published literature and academic sources. A structured survey was administered to professionals involved in construction projects. Project managers, site engineers, procurement officers, store managers, contractors, and supervisors with practical experience in material management activities were provided with the questionnaire. The respondents were selected because of their involvement in procurement planning, material handling, storage management, inventory monitoring, and project execution.

Secondary information was obtained from journals, conference proceedings, textbooks, and published research articles. The literature review provided valuable information regarding theories, concepts, methodologies, and findings related to material management practices. It also helped establish the conceptual framework for the study. The combination of primary and secondary information allowed the study to evaluate both theoretical and practical aspects of material management. Primary information provided insights into real-world construction practices and industry perspectives, while secondary information provided a strong academic foundation.

3.5 Questionnaire Development

Information regarding material management practices and their influence on project performance was collected through a structured questionnaire. The questionnaire was designed based on the literature review and previous studies. The primary focus of the study was on the variables of material procurement, storage management, and inventory control. The questionnaire consisted of two sections. Information about respondents and their professional roles was collected in the first section. Information regarding experience and designation was included to better understand the respondent profile.

The second section focused on material management factors. Respondents were asked to indicate their level of agreement with statements related to procurement planning, supplier performance, storage facilities, inventory monitoring, material tracking, inventory control, and forecasting practices. These factors have been identified as contributors

to project performance in previous studies. A five-point Likert scale was used to measure the responses. The scale provided respondents with a method for expressing their opinions and allowed quantitative analysis of the data.

Table 4: Likert Scale Used in the Study

Scale	Description
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

A structured questionnaire was used to ensure consistency in data collection and the ranking of material management factors.

3.6 Sampling Procedure

The target population for the study consisted of professionals involved in construction projects. Project managers, site engineers, procurement officers, store managers, contractors, and supervisors were among the professionals included in the study. They were considered suitable respondents for evaluating the effectiveness of procurement, storage, and inventory control practices because of their involvement in material management activities. A sample size of 100 respondents was selected. The respondents were chosen from different construction projects. The sample provided adequate representation of key stakeholders involved in material management. A large number of responses were collected within a short period. The responses obtained from the participants were considered sufficient to evaluate the importance of material management factors.

Table 5: Distribution of Respondents

Designation	Frequency	Percentage (%)
Project Managers	15	15
Site Engineers	30	30
Procurement Officers	20	20
Store Managers	15	15
Contractors	10	10
Site Supervisors	10	10
Total	100	100

3.7 Data Analysis Method

The Relative Importance Index (RII) method was used to analyze the data. The relative importance of factors was determined using the Relative Importance Index. The method is widely used for ranking factors according to their significance. The method converts respondent ratings into numerical values. Higher values indicate greater significance, while lower values indicate lesser significance. The technique is commonly used to evaluate management practices. The Relative Importance Index was calculated using the following equation:

$$RII = (\Sigma W)/(A \times N)$$

Where:

RII = Relative Importance Index

W = Weight assigned by respondents

A = Highest possible weight (5)

N = Total number of respondents

The value of RII ranges from 0 to 1. The higher the value, the more important the factor. The factors were ranked according to their relative importance after calculating the RII values.

Table 6: Interpretation of Relative Importance Index Values

RII Range	Importance Level
0.80 - 1.00	Very High
0.60 - 0.79	High
0.40 - 0.59	Moderate
0.20 - 0.39	Low
0.00 - 0.19	Very Low

The analysis focused on the ranking of procurement-related factors, storage-related factors, and inventory control factors. Their influence on project performance was evaluated using the findings.

3.8 Research Framework

The research framework was developed using the variables identified in the literature review. The framework illustrates the relationship between material procurement, material storage, inventory control, and project performance. The study assumes that effective procurement practices improve material availability, proper storage management preserves material quality, and effective inventory control ensures optimum inventory levels. These factors contribute to improved project performance through reduced wastage, cost savings, and better project execution.

4. Results and Discussion

4.1 Introduction

The results of the study are presented in this chapter. The information collected was used to determine the importance of material management factors. The analysis focuses on material procurement, storage management, and inventory control practices and evaluates their contribution to reducing material wastage, achieving cost savings, and improving project execution. The results are presented using tables and rankings. Material management effectiveness and project performance can be improved through factors with higher RII values.

4.2 Respondent Profile

A number of construction professionals participated in the questionnaire survey. Project managers, site engineers, procurement officers, store managers, contractors, and site supervisors were included as respondents.

Table 7: Distribution of Respondents by Designation

Designation	Frequency	Percentage (%)
Project Managers	15	15
Site Engineers	30	30
Procurement Officers	20	20
Store Managers	15	15
Contractors	10	10
Site Supervisors	10	10
Total	100	100

4.3 Material Procurement Factors

Ensuring the availability of construction materials is important for project execution. Factors related to procurement planning, supplier performance, material delivery, quality control, and purchasing procedures were evaluated by the respondents.

Table 8: Ranking of Material Procurement Factors

Procurement Factor	RII	Rank
Timely Procurement Planning	0.89	1
Supplier Reliability	0.87	2
Material Delivery Performance	0.85	3
Material Quality Assurance	0.83	4
Purchasing Procedures	0.8	5

The results show that timely procurement planning achieved the highest RII value and was ranked first. Proper planning of procurement activities is important for construction operations. The second-place ranking of supplier reliability highlights the importance of dependable suppliers. The need for timely delivery of quality materials is reflected in the high ranking of material delivery performance. The RII values also indicate that purchasing procedures remain an important component of procurement management.

4.4 Material Storage Factors

Construction materials need to be protected from damage and deterioration. Storage facilities, material handling, site organization, and protection of stored materials were evaluated.

Table 9: Ranking of Material Storage Factors

Storage Factor	RII	Rank
Adequate Storage Facilities	0.88	1
Protection Against Damage	0.86	2
Material Handling Practices	0.84	3
Site Layout Planning	0.82	4
Material Identification System	0.8	5

Storage facilities achieved the highest RII value of 0.88 and ranked first among the factors related to storage management. Proper storage arrangements are important for preserving material quality. Construction sites are concerned with protecting materials from environmental and physical damage. Material handling practices and site layout planning also affect storage effectiveness.

4.5 Inventory Control Factors

Adequate quantities of materials are made available through effective inventory control. Factors related to inventory monitoring, material tracking, forecasting, and inventory control procedures were assessed.

Table 10: Ranking of Inventory Control Factors

Inventory Control Factor	RII	Rank
Inventory Monitoring	0.91	1
Material Tracking System	0.89	2
Forecasting of Material Requirements	0.87	3
Reorder Level Management	0.84	4
Stock Control Procedures	0.82	5

Inventory monitoring achieved the highest RII value among all inventory control factors. This result demonstrates the importance of continuously monitoring inventory levels. The high ranking of material tracking systems emphasizes the importance of accurate information in material management decision-making. Effective inventory control can improve resource utilization and planning.

4.6 Overall Ranking of Material Management Factors

The most significant factors affecting material management effectiveness were ranked together.

Table 11: Overall Ranking of Material Management Factors

Factor	Category	RII	Rank
Inventory Monitoring	Inventory Control	0.91	1
Material Tracking System	Inventory Control	0.89	2
Timely Procurement Planning	Procurement	0.89	3
Adequate Storage Facilities	Storage	0.88	4
Supplier Reliability	Procurement	0.87	5
Forecasting of Material Requirements	Inventory Control	0.87	6
Protection Against Damage	Storage	0.86	7
Material Delivery Performance	Procurement	0.85	8
Material Handling Practices	Storage	0.84	9
Reorder Level Management	Inventory Control	0.84	10

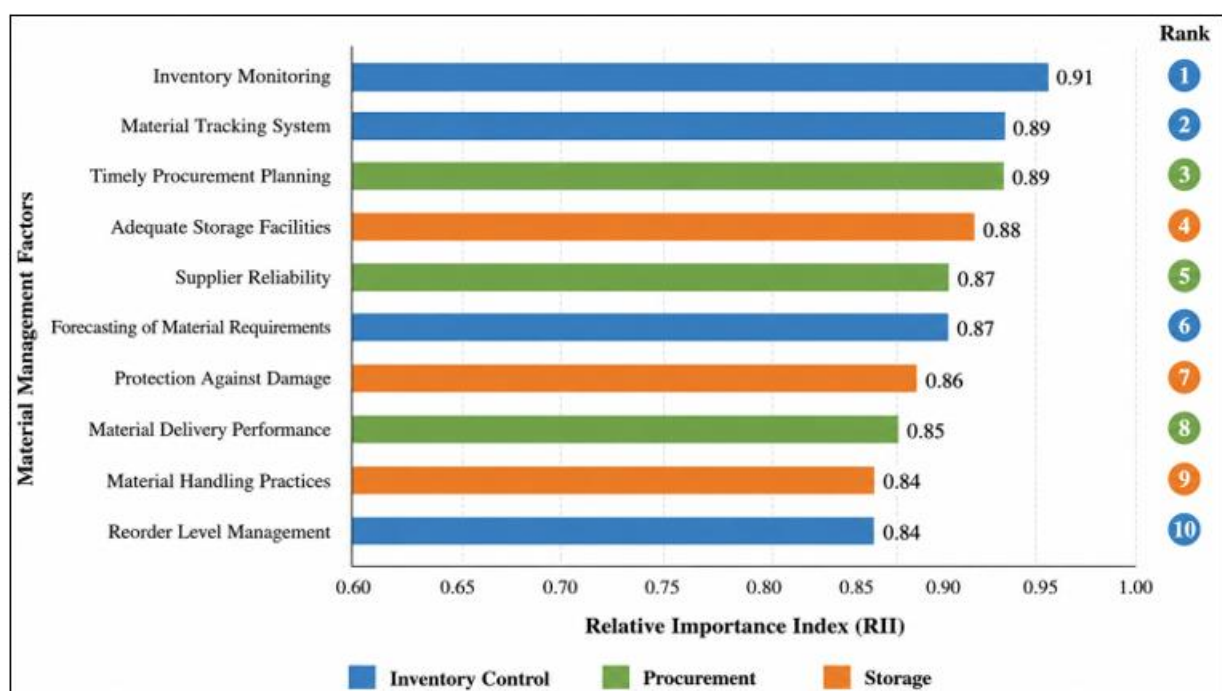


Figure 2: Ranking of Material Management Factors

The top positions are dominated by inventory control factors. Inventory monitoring was identified as the most influential factor affecting material management effectiveness. The high rankings achieved by timely procurement planning and adequate storage facilities highlight the importance of integrating procurement, storage, and inventory management functions.

4.7 Discussion of Findings

The findings show that effective material management is essential for successful project execution. Inventory monitoring, material tracking systems, and procurement planning were identified as the most important factors affecting material management effectiveness. The results are consistent with previous studies on construction material management. Organizations benefit from having accurate information regarding inventory levels and material movement, as reflected in the ranking of inventory

monitoring. Cost savings and improved resource utilization can be achieved through effective inventory management.

Procurement planning depends on effective purchasing processes and supplier coordination. Storage facilities and protection of materials were also identified as important factors for preserving material quality. The practices of procurement, storage, and inventory control contribute to reduced material wastage, lower project costs, improved project execution, and enhanced forecasting capabilities. Construction organizations that adopt systematic material management approaches are more likely to achieve better project performance.

5. Conclusion and Recommendations

5.1 Conclusion

In the present study, material procurement, storage management, and inventory control were investigated. The study evaluated the influence of these factors on project performance and identified effective practices that contribute to cost savings, better project execution, and improved forecasting. The concepts, principles, and practices associated with material management in construction projects were reviewed. The importance of procurement planning, storage systems, inventory control, and material tracking was emphasized in previous studies. The key dimensions of material procurement, storage management, and inventory control were found to influence the effectiveness of material management systems. The survey was administered to construction professionals. The responses obtained from project managers, site engineers, procurement officers, store managers, contractors, and supervisors were analyzed. Material management factors were ranked according to their contribution to project performance.

The study found that effective material management is important in improving construction project outcomes. Inventory monitoring was identified as the most important factor affecting material management effectiveness. The results suggest that continuous monitoring of inventory levels can help prevent material shortages, reduce unnecessary inventory accumulation, and support effective decision-making. Material tracking systems improve visibility of material movement and enhance inventory accuracy. Timely procurement planning was also identified as one of the most influential factors. Proper procurement planning ensures the availability of materials when required. Reliable suppliers contribute by delivering quality materials on time. Storage facilities and protection against material damage were found to be important contributors to material management effectiveness. Effective storage systems help reduce material losses. Proper material handling practices can reduce wastage and improve productivity. The activities of material procurement, storage management, and inventory control directly affect project performance. Better project execution and improved cost performance can be achieved by construction organizations that adopt systematic material management practices. The study demonstrates that effective material management is important for the successful completion of construction projects and should be considered a strategic component of project management.

5.2 Major Findings

The major findings of the study are summarized as follows:

- 1) Inventory monitoring was the most significant material management factor.
- 2) Material tracking systems were identified as highly influential inventory control tools.
- 3) Timely procurement planning was one of the most important factors affecting project performance.
- 4) Material availability is strongly influenced by supplier reliability.
- 5) Material losses can be reduced through adequate storage facilities.
- 6) Improved material utilization and reduced wastage can be achieved by protecting materials during storage.

- 7) Inventory control practices help maintain optimum inventory levels.
- 8) Accurate forecasting of material requirements can improve resource allocation and procurement planning.
- 9) Effective material management practices contribute to cost savings.
- 10) Integrated procurement, storage, and inventory control systems can improve overall project execution.

5.3 Recommendations

The following recommendations are proposed for improving material management practices in construction projects:

- 1) Comprehensive procurement plans should be developed to ensure the timely acquisition of materials.
- 2) Supplier performance evaluation systems should be used to improve supplier selection and management.
- 3) Adequate storage facilities should be provided at construction sites.
- 4) Construction firms should implement systematic inventory control procedures.
- 5) Material tracking technologies should be adopted to improve visibility and control.
- 6) Regular monitoring and auditing of material inventories should be conducted.
- 7) Material planning processes should incorporate forecasting techniques.
- 8) Training should be provided to construction personnel involved in procurement, storage, and inventory management.
- 9) Construction organizations should encourage the use of computerized material management systems.
- 10) Project planning and scheduling systems should be integrated with material management activities.

The implementation of these recommendations can help reduce material wastage, improve resource utilization, achieve cost savings, and enhance the success of construction projects.

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