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## **Optimizing Supply Chain Management Operations in Construction: A Systematic Review of SCM Trends, Challenges, and Innovations**

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### **ABSTRACT:**

This extensive literature study delves into various facets of supply chain management (SCM) within the construction industry, offering a critical review of contemporary theories and practices. The research spans diverse topics such as contract termination management, claims processes, green supply chain management, and the integration of Industry 4.0 technologies. Through systematic literature reviews, analytical studies, and empirical investigations, the study explores challenges, best practices, and emerging trends in SCM. The development of reference models, analysis of key performance indicators, and validation through expert interviews contribute to a holistic understanding of SCM in construction. The study also addresses gaps in research, proposes frameworks, and identifies future directions for sustainable and efficient supply chain practices. The research identifies a gap in the exploration of side-payment contracts for coordinating buffer space and addresses the challenges of applying previous supply chain management (SCM) studies directly to the construction domain. The introduction of the Buffer Space Holding (BSH) strategy as a means to enhance total profit and individual party profits sheds light on potential improvements in SCM practices. The study also underscores the impact of reserving more shelf space on additional sales and greater profit potential. In summary, this literature study contributes a rich understanding of SCM in construction, spanning claims management, contract termination, green practices, and emerging technologies. The findings offer valuable insights for practitioners, policymakers, and researchers, providing a roadmap for future advancements in construction supply chain management.

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**KEYWORDS:** Supply Chain Management, Construction Industry, Contract Termination, Green Supply Chain Management, Sustainability and Smart Construction Objects.

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### **INTRODUCTION:**

In the dynamic landscape of the construction industry, the effective management of the supply chain plays a pivotal role in ensuring project success, cost efficiency, and sustainability. This literature study delves into a comprehensive review of contemporary theories, practices, and models shaping Construction Supply Chain Management (CSCM). Addressing diverse facets such as claims management, contract termination, and the integration of emerging technologies, this review aims to provide a thorough understanding of the challenges, opportunities, and evolving trends in the realm of construction supply chains. The study navigates through a multitude of research methodologies, encompassing systematic literature reviews, content analysis, simulation-based approaches, and surveys, ensuring a robust exploration of the multifaceted dimensions of CSCM. Throughout the review, attention is given to the unique challenges within the construction domain, including the limited applicability of certain Supply Chain Management (SCM) practices and the need for specialized models to address industry-specific concerns. The exploration of barriers, opportunities, and the impact of individual practices on performance effectiveness adds depth to the analysis, offering valuable insights for practitioners, policymakers, and researchers in the construction supply chain.

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### **LITERATURE RIEVIEW:**

*Dimitrios et.al (2018)* presents a process reference model for claims management in construction supply chains, emphasizing the importance of strategic planning and development. The model was developed through a top-down approach, including the adaptation of existing models and practices, and validation through interviews with industry experts. The model offers unique features, such as a focus on contract cancellation management and performance measurement processes and addresses weaknesses in existing approaches. The article highlights the need for formalizing rules for strategic claims management and offers valuable insights for improving efficiency and decision-making in construction projects. Overall, the research provides a comprehensive tool for claims management and offers practical guidance for professionals and researchers in the construction industry.

*Mochamad et.al (2018)* discuss about the "Factors for Implementing Green Supply Chain Management in the Construction Industry" literature review provides the topic of green supply chain management (GSCM) in the construction industry. The authors draw on a range of sources, including academic journals, books, and reports, to provide a comprehensive overview of the current state of research in this area. Some of the key themes that emerge from

the literature review include the importance of stakeholder engagement, the need for effective communication and collaboration across the supply chain, the role of technology in facilitating GSCM, and the challenges associated with measuring and evaluating the environmental performance of supply chain partners. The authors also highlight the importance of considering the unique characteristics of the construction industry when implementing GSCM practices, such as the fragmented nature of the supply chain and the long lifespan of buildings and infrastructure. Overall, the literature review provides a valuable foundation for understanding the factors that are critical to the successful implementation of GSCM in the construction industry.

**Phuoc et.al (2018)** Discuss and provides article and explores the application of supply chain management (SCM) in the construction industry in Vietnam, emphasizing the need for innovations to improve efficiency and increase the competitive advantage of Vietnamese construction companies. It identifies seven major causes that limit the application of SCM in the industry, including the characteristics of the construction industry, lack of SCM knowledge, and inappropriate organization structure. The study underscores the urgency for the construction industry in Vietnam to adopt SCM to compete in the global market and achieve sustainable growth.

**Phong et.al (2018)** Provides about the "Present focuses and future directions of decision- making in construction SCM: a systematic review" The authors conducted a systematic literature review of 123 articles published between 2000 and 2017, and identified the present focuses of decision-making in CSCM, as well as the gaps in implementation when compared to other sectors. The study proposes future directions for decision-making in CSCM, with a more detailed specification of methods and tools that meet new requirements of construction management practices and technological progress. The article offers valuable insights for professionals and researchers in the construction industry, highlighting potential areas for improvement and future research directions in decision-making within CSCM.

**Rafaella et.al (2018)** discuss about the, "Supply Chain Management in Construction from a Production Theory Perspective," provides an analysis of Supply Chain Management (SCM) as an alternative for efficient management of construction production. The paper presents key principles for the successful implementation of SCM in construction and suggests that for SCM to succeed in the best possible manner, all three production theory perspectives need to be considered and promoted. The article also discusses the ambiguity between the definitions of different SCM concepts and how an analysis from a production perspective might help create a better understanding of the concept. Overall, this paper offers insights into the potential benefits of SCM in construction and provides a framework for its successful implementation.

**Sreejith et.al (2018)** The article "Environmental Supply Chain Management in the Construction Sector: A Systematic Review of the UAE" provides a comprehensive investigation into the various facets of environmental supply chain management (ESCM) in the construction sector. The study uses a three-level analysis of the findings, including thematic analysis at the stakeholder level, supply chain level analysis, and macro analysis at the industry/country level. The study provides insights into the key internal and external drivers and barriers/challenges facing different firm types and stakeholders. The findings are useful for policymakers and industry leaders to predict the sector's environmental behaviour and to devise strategies for each stakeholder to promote sector-wide efficient and effective environmental practices' implementation. The article also highlights the need for future investigation on a larger scale and in different country contexts to further validate the findings.

**Yue et.al (2018)** discusses the importance of buffer space hedging and coordination in the supply chain management of prefabricated construction. The paper presents a coordination contract to solve the buffer space hedging issue in the prefabricated construction supply chain management. The study highlights the significance of applying supply chain management principles to coordinate independent entities in the prefabricated construction industry. The paper also reviews the literature related to prefabricated construction supply chain management, buffer space hedging, and supply chain coordination. The authors propose three models with different power structures to investigate the coordination contract's performance. The study concludes that the proposed coordination contract can improve the system performance and benefit each party involved in the supply chain.

**Ajinkya et.al (2019)** presents a simulation-based decision-making framework for construction supply chain management, addressing the limitations of the conventional economic order quantity model. By utilizing a PERT-based simulation model, the authors calculate the optimum re-order point and order size, and analyze the relationships between order size, re- order point, average inventory level, and work-idle time. The study provides a practical approach for procurement managers and store-in-charges to determine the best parameters for running their supply chains, offering a decision-making framework for efficient use of storage space and minimum idling. The proposed model is suggested for further development to incorporate cost aspects of the supply chain, and future research directions include empirical validation of the simulation process and the use of real project data to model the supply chain.

**Po-Han et.al (2019)** presents a BIM-WMS integrated decision support tool for supply chain management in construction. The tool assists in the selection of sustainable construction material sources, taking into account factors such as cost, delivery time, and environmental impact. It streamlines the process of selecting materials for construction projects and calculates location-related credits in green building standards such as LEED. The tool can be customized to fit the specific needs and requirements of different construction projects. The integration of BIM and WMS can contribute to various applications such as vehicle tracking, transportation route planning, and integration with 4D or 5D BIM. The article concludes that the tool can serve as a handy tool and help the user with the selection of sources of multiple materials considering cost and schedule.

**Phuoc et.al (2019)** discuss about the "BIM contributes to construction supply chain management trends" presents a comprehensive study conducted in Canada, utilizing the structured Delphi technique to identify key trends in Building Information Modelling (BIM) and its impact on supply chain management (SCM) in the construction industry. Through a series of rounds involving expert panel members, the study achieves a high degree of consensus, leading to the identification of 15 barriers and 15 enablers, which are clustered into five and four main groups, respectively. The study also highlights the lack of interoperability across the supply chain, emphasizing the barriers that impede both operational and strategic SCM trends. Furthermore, the research assesses the support of BIM for 12 key SCM trends, providing insights into the expected impact level of each trend on business

performance and the contribution level of BIM to these trends. The findings of this study offer valuable insights for construction firms seeking to leverage BIM for improved SCM practices and address the challenges hindering its effective implementation in the industry.

*Sulafa et.al (2019)* discusses and also outline an agenda for future research, emphasizing the need for an end-to-end perspective, engagement with the unique characteristics of the industry, a focus on the ultimate goals of environmental sustainability, and on gaps in practical guidance, use of insights from relevant theoretical perspectives, and expansion to include critical stances.

The article highlights the potential of green SCM to facilitate transformation of the construction sector and address environmental impact.

*Yichuan et.al (2019)* presents a framework that leverages 4D Building Information Modelling (BIM) and Geographic Information Systems (GIS) to optimize construction supply chain management. By integrating these technologies, the framework addresses critical aspects such as supplier selection, material delivery scheduling, and consolidation center allocation. Through case studies and empirical evidence, the effectiveness of this integrated approach is demonstrated in improving the efficiency and cost-effectiveness of construction supply chains. The research also highlights the scarcity of literature on the design and allocation of consolidation centers in the construction industry, emphasizing the significance of this integrated framework in addressing existing gaps in supply chain management practices.

*Yousaf et.al (2019)* focuses on the integration of green supply chain management (GSCM) practices in the construction industry of the China-Pakistan Economic Corridor (CPEC). It begins by highlighting the significance of GSCM in addressing environmental challenges posed by industrialization and emphasizes the need for sustainable practices in the construction sector. The study employed a quantitative survey to gather input from 53 experts working in the construction industry, aiming to identify best practices for incorporating GSCM in CPEC projects. The research methodology involved the use of Fuzzy TOPSIS, a Multi-Criteria Decision-Making (MCDM) tool, to evaluate the data gathered. The article concludes by offering suggestions for the Pakistani government to focus on future integration of GSCM in alignment with the study's findings, emphasizing the importance of environmental responsibility and sustainable practices in the construction supply chain.

*Zhaojing et.al (2019)* provides a comprehensive analysis of the research on Precast Supply Chain Management (PSCM) in the context of off-site construction in the construction industry. It includes a bibliographic investigation of PSCM research, literature synthesis, research gaps, and future research opportunities. The study identifies four thrust areas within PSCM, including precast production of precast components, storage & inventory management, delivery & transport management, and the performance of the entire supply chain. The analysis highlights the dominant published journals, countries, and institutions contributing to PSCM research, as well as the major methodologies used in the existing research. The article concludes by outlining future research directions and opportunities to address the identified gaps in PSCM research.

*Fuat et.al (2020)* explores the application of Analytic Network Process (ANP) model in the context of sustainable construction in Turkey. The authors emphasize the growing demand for natural resources due to global economic and population growth, and the potential adverse effects on the environment and society. The study employs depth interviews, content analysis, and literature review to analyze the inner and inter-relationships among elements of the ANP model, forming clusters and nodes, and computing global weights. The article highlights the importance of sustainable supply chain management and the use of green technologies to mitigate negative environmental and social impacts in the construction industry, providing valuable insights for managerial implications and decision-making.

*Jiuping et.al (2020)* presents a multi-objective optimization model combined with a new evaluation method aimed at reducing pollution in the construction materials sector. It discusses the challenges faced in controlling greenhouse gas emissions and acidification and proposes a practical case study in China to demonstrate the model's efficiency. The paper emphasizes the need for cost minimization and emission rate maximization to develop a more environmentally friendly and sustainable construction materials industry. It also outlines the key problem statement, equilibrium background, and practical suggestions for stakeholders and the government to effectively reduce pollutant emissions. The article concludes by highlighting the importance of achieving a win-win environmental and economic strategy through the proposed optimization model.

*Nkolika et.al (2020)* provides the application of supply chain management (SCM) in the construction industry. It identifies eight major areas of application, including procurement, logistics, models application, information, performance evaluation, customer relationship, environmental management, and sustainability. The review emphasizes the importance of SCM in addressing the complexity and fragmentation of construction projects and highlights the challenges and strategies in each area. The article also discusses the significance of sustainable practices and environmental management in the construction supply chain. Overall, it offers valuable insights into the various aspects of SCM and its impact on the construction industry.

*Roberto et.al (2020)* discusses the challenges and opportunities in supply chain management for the construction and engineer-to-order (ETO) industries. It emphasizes the need for better information management, use of digital technologies, and the integration of clear upfront planning and procurement with project delivery processes. The authors present a framework to categorize the papers in the special issue, highlighting key themes such as procurement, logistics, supplier and supply chain management, engineering changes, innovation, and complexity management. The article also suggests future research directions, including the need for more quantitative studies, further development of appropriate management and governance structures, and research into the innovation potential of small and medium-sized enterprises (SMEs). Overall, the article provides valuable insights into the complexities of supply chain management in the construction and ETO industries and offers a roadmap for future research in this area.

*Soo-Yong et.al (2020)* found that while there were studies about SCM in construction, most of them did not specifically aim to discover the barriers to CSCM implementation. Instead, these studies generally listed some barriers to the implementation of CSCM without delving into detailed analysis. The authors identified 22 barriers to CSCM implementation through their literature review. These barriers included issues such as lack of understanding of

the SCM concept, lack of trust among parties, lack of communication and collaboration, resistance to change, and inadequate technology and information systems. The comprehensive literature review provided a preliminary set of barriers that formed the basis for further investigation through a survey questionnaire and expert opinions.

*Venugopal et.al (2020)* presents a study on the factors influencing the implementation of supply chain management (SCM) in the construction industry, particularly in India. The research aims to identify the barriers to SCM implementation and suggests modifications to improve the organizational structure of construction companies. The study involved face-to-face interviews with individuals working in prime contractors and construction projects and utilized the RII method to analyze the data and rank the factors affecting SCM implementation. The findings highlight the challenges faced by the construction industry, such as project duration, standardization of resources, conflicts, and lack of knowledge about SCM. The study emphasizes the need for improved SCM applications to enhance productivity, reduce costs, and increase competitive advantages in the construction sector.

*Zahra et.al (2020)* focuses on sustainable construction supply chain management, specifically addressing the challenges related to material provision and resource planning in the construction environment. It highlights the importance of considering uncertainty and green transportation in the decision-making process, which has not been extensively covered in previous literature. The research methodology involves a combination of qualitative and quantitative approaches, including the use of multi-criteria decision-making techniques and sustainable development triple bottom line. The study proposes a mathematical model to assist contractors in inventory control and supplier selection, taking into account green factors. The results indicate the significance of sustainable considerations in decision-making, with the identification of the optimal supplier and transportation vehicle based on green transportation objectives. Overall, the article provides valuable insights into sustainable construction supply chain management and offers practical solutions for addressing the complexities of material provision in construction projects.

*Abhishek et.al (2021)* addresses the research gap in understanding the adaptability of sustainable supply chain practices by Indian construction companies of different sizes and sectors of operations. The study employs a mixed approach of qualitative and quantitative methods, including a questionnaire survey and analytical tools like ANOVA and the Analytical Hierarchy Process (AHP). The findings highlight the positive correlation between the drivers, enablers, and barriers of green supply chain management practices and the willingness of firms to embrace sustainable practices. The study also provides insights into the background information of the construction companies, their adherence to green supply chain management practices, and the potential for future research in this area.

*Mohamed et.al (2021)* study and employs scientometric and systematic review methods to classify and analyze the included articles based on OSC types, SC stages, solution methods, and sustainability dimensions. The article also delves into citation analysis, co-occurrence network of keywords, and citation burst analysis to identify hot research topics and highlight research gaps. The findings emphasize the importance of addressing sustainability factors, collaborative planning, and logistics management in the context of OSC-SCM. Additionally, the article offers valuable insights for OSC-SC partners and researchers, highlighting research opportunities and fostering collaboration in enhancing the performance of supply chains in off-site construction.

*Xinyu et.al (2021)* explores the integration of supply chain management (SCM) in a project-based environment, emphasizing the need for careful planning and execution. It identifies key antecedents for successful SCM implementation, categorizing them into IT integration, organizational coordination, risk management, and supply chain resilience and complexity. The study utilizes a systemigram, a complex system visualization tool, to provide a holistic view of the conceptual integration of SCM with project management. The research aims to fill the gap in understanding how to implement SCM in a project and provides a high-level conceptual framework for SCM implementation in a project management context. It also offers practical implications and a resourceful list of references for project managers to design customized strategies tailored to specific industries.

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## CONCLUSION:

This literature study has provided a comprehensive exploration of supply chain management in the construction industry, covering various dimensions such as contract termination, claims processes, green SCM, and the integration of Industry 4.0 technologies. The development of reference models and the analysis of key performance indicators offer practical insights for enhancing efficiency and sustainability in construction supply chains. Expert interviews validate the robustness of the proposed models and frameworks. As the construction industry continues to undergo transformations, the study highlights the importance of staying abreast of emerging trends and leveraging innovative technologies to optimize supply chain processes. The identified research gaps and proposed future directions offer valuable guidance for scholars and practitioners seeking to advance SCM practices in the construction sector.

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