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Research Article

Minimizing delays in the Jordanian construction industry by Adopting SCM tools

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Abstract. Jordan's constructions sector is important and contributes significantly to the country's gross domestic product (GDP). However, the Jordanian public work and housing ministry and most participants in the sector including engineers and contractors claim that most projects are delayed, resulting in time and cost overruns and additional efforts. The main causes of ' delay include poor scheduling and planning, change orders, weather, late deliveries and incompetent technical personnel. To address these challenges, the implementation of Supply chain management tools (SCM) is essential for addressing these problems. This paper offers SCM as a strong technique to reduce delays in constructing projects in Jordan. The study focuses on two important aspects; first, identifying the main causes of delays and, second, correctly outlining the responsibilities of SCM in construction project. The paper also coincides with the duties and responsibilities of an SCM tools and the reasons for the delays.

1. introduction

Jordan continues to strive for growth, focusing on sectors that are of an important nature for growth. The Jordanian construction sector is one of the main sectors that play an important role in the Jordanian economy as a whole, and contribute to reducing unemployment[1]. Moreover, the construction sector is the basis and the main contributor to the Jordanian economy by providing the necessary needs in terms of providing jobs and leisure[2]. The rise in the construction of infrastructure projects in the past few years is due to road construction projects through massive investments through the government's economic plans [3]. However, the Ministry of Public Works and Housing (MPWH) and workers in the infrastructure sector in the Jordanian construction sector stated that most projects face problems of delay and overstay that lead to increased costs and additional efforts[4]. The researchers identified several main reasons for project delays, including change orders, location and weather conditions, delayed site delivery, unavailability of human resources, scarcity of qualified technical staff, and funding, material prices fluctuations, poor planning and design [5]. In order to meet these challenges, supply chain management (SCM) is implemented in the construction industry. The use of SCM in the construction sector is a recent phenomenon, particularly in implementation in Jordan[6]. Despite this, SCM started as a new Approach for the development of the construction sector, both in the construction sector and in the modern field of building construction[7]. Studies have proven that supply chain

management has the ability to improve processes and use tools to control delays, inventory, data flow, and increase collaboration on construction projects. On the other hand, the implementation of SCM enhances practices, continuous improvement, quality improvement and control activities and acts as a continuous catalyst for changing construction processes[8].

Many researchers have demonstrated the possibility of SCM to improve performance and information, reduce uncertainty, conflict, blame game, and complexities, among others [9-11]. However, no study has been undertaken in Jordan to explore the effectiveness of SCM to reduce delay problems in Jordan. The paper focuses on two parts: Firstly, defining the reasons that cause delays in projects, and the second part defining the roles and responsibilities of SCM accurately in the construction sector. Finally, matching the roles and responsibilities of the SCM specialist, causes of delays, and ways to address delays through the use of SCM tools. Thus, it will achieve a more comprehensive in the construction industry to address delays using supply chain management in the Jordanian construction sector.

2. Related research

2.1 construction projects success factors

Specialists in construction projects indicated that the success of the project affects different aspects that affect different aspects. However, there is no comprehensive rationale for these factors, but researchers agree that the scope of the project is significant[12]. Schultz established the first comprehensive characterization of critical success elements for project management[13].They differentiate between two "strategic and tactical" elements, which influence the project Results at different stages of the development cycle of the project. The "strategic" aspect includes, for example, factors such as project goals, management and planning, whereas the "tactical" category included elements such as client consultation, human resource selection, and employee training. Pinto increased the number of success criteria by considering the features of the various stages of the project life cycle[1]. The study found that the impact of project success differed depending on the stage of the project life cycle and the performance indicators used by the analysts [14].According to Kerzner (2001), project success is judged by completion, money, and quality. In comparison, some academics expanded these conclusions to incorporate additional criteria such as meeting client firm business goals and guaranteeing client satisfaction[15].

The first indicator of successful project management was the "iron triangle" itself "(time, cost, quality) [16].Finally, it was considered only one component of a total project success, all of which was a decisive part of the project, because these factors were seldom agreed in the literature[17].

2.2. Factors of Delays in Construction projects in Jordan

Delays are common in most Jordanian construction projects. Likewise, the Jordanian construction sector is also plagued with delay issues involving major public and private infrastructure projects [4]. Although many have examined these delay dilemmas, they have not been comprehensive including the number of delay factors involved in their study. Some example of those studies are - [18] – 28 factors; [19]– 28 factors; [20]– 37 factors; [21] – 19 factors; [22] – 55 factors; [23]– 45 factors; [24]– 20 factors; [25] – 55 factors.

There are several public and private infrastructure projects that have been experienced delays. Factors that cause delays in the Jordanian construction industry include frequent changes he has made Clients, climate, location, weather conditions, delivery delays, economic and financial conditions Problems, lack of technical know-how, poor designs, poor planning, and management, etc. [1,2,21,22,24,26-29]

Table 1. Major causes of delays in Jordan.

Researchers	Major causes of delay
[19, 26-29]	Poor design Negligence of the owner Change orders Site condition Weather condition
[18, 21, 27]	Late delivery Economic conditions Increase in quantities Mistakes during construction Slow decision-making by clients Construction methods
[19, 21, 28, 30-33]	Improper planning Shortage of materials Documents Lack of communication between project parties Preparation and approval of drawings Poor scheduling and planning of projects by contractors Frequent change orders by owners Shortage of manpower (skilled, semi-skilled, unskilled labor)
[25-27]	Incompetent technical staff Financial difficulties faced by contractors conditions of terrain Weather conditions. inadequate management and supervision by the contractor changes in design by customers cash flow problems experienced by the contractor and the adoption of minimum supply leads to low achievements

2.3. Supply chain management (SCM) tools in construction industry

SCM is a modern management philosophy in the construction sector, promoting the application of SCM practices for a procedural and technological transformation in Architecture, Engineering and Construction Sector[34]. Research has shown that SCM, its capacity in the construction industry to meet various problems. For instance. Can save costs and reduce turnover due to defects. Enables exchange and flow of

information, enhances productivity, eliminates design mistakes, and results in better project results[35]. Thus, enhancing procurement, boosting productivity, and increasing flexibility [36].in addition to decreasing stockpiles to the lowest possible level and more efficiently arranging supplier contact throughout the production line [37]. Reports on SCM point to the adoption of SCM in the construction sector as a suitable tool for increasing productivity, improving performance and more economical delivery of projects [38].

Maintain projects within the stipulated scope, timetable and costs which need competent and effective administration and engineering. Using SCM and understanding the tools and responsibilities of SCM is vital [39]. The use of the approach to supply chain management by many researchers motivates us to take a contemporary strategy and to avoid conventional construction methods[40]. Table 2 presents the tools, roles, and responsibilities of the SCM approach [41-44]. Understanding the tools and responsibilities that can be used to reduce project delays.

Table.2 Roles and responsibilities of SCM tools.

SCM tools	Roles and Responsibilities
Improving Risk Management Practices.	• Reduce uncertainty and enhance performance. • Plays a vital role in controlling risks. • controlling risks through the exchange of information
Improving Level of Collaboration and Teamwork.	• Assists other specialists. Generally, he works with those that physically construct. • Extracts information from the SCM tools for space planning, asset management, and maintenance schedule. • the building, helping the engineers to communicate with contractors or foremen • Solving problems by interconnecting supply chain management. • Increasing profits and improving product quality in construction projects. • Avails model files to general contractors.
Improve Flow of Information.	• Embeds information about the processes and resources required. • Sharing information and dealing with it well can achieve stronger integration in the supply chain with a cycle that leads to the best results for the project. • Develops the geometry in the BIM models, working in groups to create different parts of the model. • Identifies communication errors, improves communication and information

	• technologies and facilitates communication protocols
Better Project Team Selection.	• Oversees people in the implementation as well as maintenance of SCM processes. • Coordinates the team, production, and implementation of the Project. • Improving project teams creates the highest levels of productivity among employees. • Selecting teams to achieve sustainability in terms of long-term mentality. • transfers, access rights control, and information compilation from smaller models • of different members
Improving Supplier Management.	• Suppliers have role in reducing procurement costs. • Inspects and evaluates the objectives of the project and afterward designs a plan to meet the desires and demands of clients. • Performs other functions including coordinating entity model's integration. • Specifies detailing budgets for cost estimations.
Enhance Knowledge Management.	• Guides the decision-making of the team. • Concentrates on the production model, interacts with other project actors and the system
Promoting procurement management.	• Coordinates information from various construction stakeholders, which guarantees non-dilution of the responsibilities between the contractor and the design team. • improving performance • Risk sharing and early joint planning
Promoting Continuous Improvements.	• Promotes credibility and confidence in the project team including clients, subcontractors and internal team members. • Select the right individuals for every project activity. • Responsible for resources management (people, software, and hardware) involved in model development. • Designs a plan for small teams that after training perform works with SCM.

Enhance Relationship Management	• Manages and supports detailing teams for the implementation and establishment of SCM standards. • Verifies interference and keep the models accurate and updated. • Ensures the alteration of models when there is a request for changes. • Attends and participates in industrial conferences.

3.0. Dissuasion

It has been mentioned that delays have become an inevitable feature of project implementation. Even with proper project management and advanced technologies, construction projects can still be delayed[45]. The question that arises is "Can the Syrian Center for Statistics solve the delay problems?" To answer this problem, in Table 3, initial delays in Jordanian construction projects are matched with the roles of SCM tools in order to investigate the potential for SCM to reduce delays.

Table 3. Delay cause and the necessary strategies.

Delay Cause	Strategy to adopt by construction top management
Poor design	Recruiting SCM specialists to split the phase in intervals of technological infrastructure (e.g., 3D modeling software, Autodesk account, well-trained software manager) (design, drawing, verification).
Poor scheduling and Planning	In order to address this issue, the SCM tools specialist working in different models' groups, incorporates the processes and resources required, adds phases to the resources, creates build-up phase files for general contracting planning, extracts space planning, asset management and maintenance planning information from the SCM model, , typically, from medium to long-term based on a vision of accomplishment.
Lack of communication Between project parties	In this scenario, the SCM specialist will function as a communication cycle between the project partners by modeling the project and making it available to all parts, updating using an integrated communication web site so that any changes to the model are visible to all partners. The specialist's responsibilities include identifying communication problems, improving communication and information technologies, and developing facility communication protocols. He also organizes project teams and develops communication links between various offices.
Change orders	In this case, the SCM practitioner will act as a consultant. Establish a communication and information flow system so that all contractors in the business, whether they have direct or indirect involvement in the modifications, are aware of the changes and may provide feedback on their potential impact.

4.0. Conclusion

Implementing SCM can lead to effective project building. SCM application may boost productivity, improve business process flow, and decrease wastes, uncertainties, complexity, fragmentation, and disputes, resulting in high-quality construction projects. It also improves construction projects by lowering construction costs and enhancing information and communication among project stakeholders, resulting in delay reduction. SCM allows for the integration of disparate processes, improves sustainability, decreases bad quality, and works as a catalyst for altering the building process. According to the debate, SCM can alleviate key delay concerns such as poor design. In Jordan's construction sector, there is a lack of communication among project participants, as well as inadequate scheduling and planning, change orders in projects. SCM technique is projected to be utilized more widely in Jordanian construction project with training, client and government cooperation. This study paves the way for further realistic studies on using SCM as a powerful technique to address delay concerns in Jordan's construction sector.

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