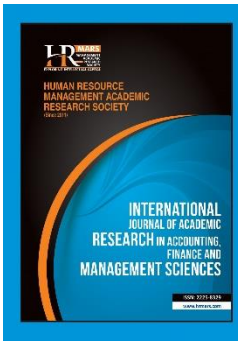

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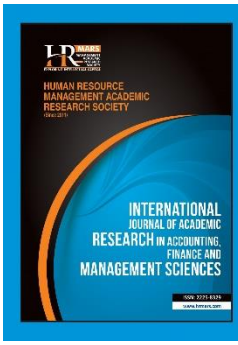
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The Use of Supply Chain Management to Reduce Delays in Jordan's Infrastructure Projects

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Abstract
The Jordanian construction industry plays an important role in economic production. However, the Jordanian construction industry suffers from delays, which results in time, cost, and quality, in addition to additional efforts. Researchers have identified the main factors of delay, including weather conditions, poor design, poor planning and scheduling, lack of experience, change orders, etc. To reduce the phenomenon of delay, there is a need to change the traditional construction approach to adopt modern construction methods. This research seeks using supply chain management in construction as a powerful tool to reduce construction delays problems. The research consists of two main parts; the first section identifies the main delay factors in Jordanian road construction projects, and the second section outlines a framework using useful SCM tools to reduce the traditional scenario to overcome the apparent delay in the road project in Jordan. Obtaining information using a qualitative method through semi-structured interviews, indicating the desired result to reduce the apparent delay in infrastructure projects in Jordan
Keywords: Construction Industry, Delay, Infrastructure, Jordan, Supply Chain Management.

Introduction

The Jordanian construction sector constitutes a large product of the GDP of the Jordanian economy, as in 2014 about 5.8% of the GDP in Jordan contributed. The Jordanian construction industry faces the problems of delaying the project and exceeding costs. Most construction projects suffer from the delay scenario repeatedly, including major public and private infrastructure projects. Moreover, most highway projects in Jordan are poor in terms of quality over time and are effective from Cost (Al-Hazim et al., 2017). On the other hand, major public and private construction projects. About 95% of the projects exceed original completion date and more than 50% of them experience additional time ranging from 10% to 30% of the initially set time (Bekr, 2018). The need for modification emerged in the approach of the construction process to satisfy the needs satisfactorily in a short time with the quality

required to improve efficiency, which highlights the need for a significant shift in practices to overcome the scenario because the delay not only affects the implementation of the project but also leads to more losses in terms of profit, delayed infrastructure, bad image of industry, etc. The researchers called for a change in current practices and a call to practice the current transformation as one of the factors that cause a delay in following traditional causes is ineffective (Riazi & Nawi, 2018; Senterre et al., 2018). As a result, to improve the organization's work and enhance sustainability through integration and control between individuals to create more value, reduce poor quality and a catalytic process to change the construction process. It was recommended that supply chain management be used to move forward and expand the scope of achievement in all organizations (Li & Taylor, 2014). In this research, supply chain management will be followed to reduce delays in infrastructure projects in Jordan. In the first section, the paper will focus on identifying the causes of delay in Jordanian projects, and in the second section, defining the roles and responsibilities of supply chain management and their application in construction projects. Application of auxiliary tools, supply chain management, and application to address project delays. Consequently, it will enable the construction industry to be more realistic and comprehensive by using supply chain management.

Past research has supported Supply Chain Management (SCM) as the route for improvement [see Riazi & Nawi, 2018; Love & Edwards, 2004]. According to Mehdi Riazi (2014), "*SCM prescribes organizational restructuring and extending achievement throughout organizations. It is a philosophy that proposes improvement in the organization's operation by including the elements of integration, coordination, communication, information and control systems to create more value out of every process*" (p. 41-42). Collaboration is the main key (Horvath, 2001) and uses joint efforts to achieve the utmost value throughout a project (Seng et al., 2018; Riazi et al., 2019). SCM which is defined as "*a modern managerial philosophy which stands firmly on the need for continuous integration of two or more project parties from initiation to handover and throughout those phases value shall be achieved via joint initiatives, pooled resources, pain/gain sharing, mutual trust and a long-term perspective on relationship towards the accomplishment of a fixed set of mutual objectives*" (Riazi & Nawi, 2018; p. 1672) has also been promoted to boost the construction industry performances which include timely delivery of projects (Riazi et al., 2020; Riazi & Nawi, 2018).

Jordanian Construction Industry Initiatives

Jordan is in the Middle East region, Jordan is characterized by its lack of natural resources, in addition to that, it is one of the countries with limited income. Jordan is heavily dependent on foreign aid and grants (Al-Kilani et al., 2012). Since the establishment of the Jordanian state and the declaration of its independence, Jordan has started implementing the first five-year plan for economic development in the year (1962-1967), as the construction sector has an important and effective aspect in social and economic development (Abbasi & Alnahhal, 2011; Profile-Morocco, 2010). Since the establishment of the Jordanian state and the declaration of its independence, Jordan has started implementing the first five-year plan for economic development in the year (1962-1967), as the construction sector has an important and effective aspect in social and economic development. As the results indicated that the plan was unsuccessful and had little impact. Since then, the old development plan was replaced, and then the 1987 Comprehensive Development Plan was largely overlooked. There have been many initiatives announced by the Jordanian government. At the beginning of 2006, the National Environmental Strategic Initiative (NES) was launched - the first of its kind

in the region. Nevertheless, the Jordanian construction sector still faces many factors and challenges towards sustainability (Abu-Dayyeh, 2004; Abu-Ghazaleh & Dalbouh, 2008). The Jordanian economic initiative that was launched in 2018 to 2022 to improve the scenario and reduce the dilemmas of the Jordanian construction sector. As the Jordanian construction sector is one of the most important sectors that the Jordanian government depends on through neighboring countries. This is mainly due to the multiplier effect it creates on other industries, and therefore there is a direct relationship between other sectors that work directly or indirectly with the construction and road construction sector including factories supplying building materials, insurance companies, project insurance, transport companies providing materials and many more Beauregard & Marpillero-Colomina, 2011). The construction sector faced many delays in many projects, including the Jordan Gate, and the desert road linking Jordan and Saudi Arabia. In contrast, infrastructure projects in Jordan face delays and cost overruns, although highways have an important role in the output by connecting them between neighboring countries, including Syria, Iraq, and Saudi Arabia. As the old approach followed does not meet the expected growth needs in a short period and quality. Therefore, trying to improve highway construction and improve efficiency. There was a need to change the construction method and use the supply chain management, an approach that has been proven to save construction costs, time, productivity, and quality.

Delays in Jordanian Construction Industry

Delays are an incessant scenario within the Jordanian construction industry. Likewise, the sector is also plagued with delay issues involving major public and private infrastructure projects (Btoush & Harun, 2017). Although many have examined these delay dilemmas,

Table 1

Major causes of delays in Jordan from Past Research

Authors	*Major causes of delay*
(Al-Momani, 2000; Al-Hazim et al., 2017; Owolabi et al., 2014; Samarghandi et al., 2016; Sweis, 2013)	Poor design, Negligence of the owner, Change orders, Site condition, Weather condition
(Odeh & Battaineh, 2002; Al-Hazim & Salem, 2015; Al-Hazim et al., 2017)	Late delivery, Economic conditions, Increase in quantities, Mistakes during construction, Slow decision-making by clients, Construction methods
(Sweis et al., 2008; Al-Hazim & Salem, 2015; Owolabi et al., 2014; Emam et al., 2015; Alnuaimi & Mohsin, 2013; Afshari et al., 2010; Kikwasi, 2012)	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)
(Bekr, 2018; Al-Momani, 2000; Al-Hazim et al., 2017)	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

They have not been comprehensive including the number of delay factors involved in their study. Some examples of those studies are by – Odeh & Battaineh (2002) – 28 factors; Sweis et al (2008) – 28 factors; Sweis (2013) – 37 factors; Al-Hazim & Salem (2015) – 19 factors; Samarah & Bekr (2016) – 55 factors; Assbeihat (2016) – 45 factors; Al-Hazim et al. (2017) – 20 factors; Bekr (2018) – 55 factors. Factors responsible for time overrun in the Jordanian construction industry has ranged from recurrent change orders by client to factors related to climate, location, weather conditions, extended delivery dates, economic and fiscal related matters as well as deficiencies in term of technical know-how, designs, planning, and also management (Al-Hazim et al., 2017; Bekr, 2018; Odeh & Battaineh, 2002; Al-Hazim & Salem, 2015; Assbeihat, 2016; Al-Momani, 2000; Al-Hazim et al., 2017; Owolabi et al., 2014).

The need for Supply Chain Management (SCM) in the Jordanian construction industry

Traditional practices are no longer viable to advance the success of the project (Alnuaimi & Mohsin, 2013). And highlighting the change in the traditional approach to using supply chain management as a proven method in many studies (Afshari, 2010). Whereas the approach adheres to cooperation as the "main driver" (Tipu & Fantazy, 2018), and takes a system perspective. In particular, the emphasis is placed on coordinating multiple entities that contribute to the completion of the project. The government has worked to improve performances via a variety of schemes such as privatization, partnership, Industrial Building

System (IBS), etc. Periodic plans which include bot long and short-term plans has also been made among the nation agenda but with limited outcome in solving delay issues of both the public and private sectors. Since then, there has been a need to adjust the approach to moving forward through supply chain management to create a competitive capacity and achieve sustainability (Tipu & Fantazy, 2018). As the construction sector became more sophisticated, the need to change approaches to a new and mature supply chain coupled with increased environmental and ethical concerns increased recognition of SCM as an engine and performance potential (Pagell & Wu, 2009; Johnson & Templar, 2011). Integration of supply chain management in the construction sector to facilitate information exchange and reduce communication gaps. Also, SCM is to establish a collaborative framework by establishing a collective network of suppliers and mentoring to facilitate work between project participants. As changes are needed in the construction industry, especially concerning current business. Research and development will provide a framework for best use and supply chain management practices in structural building practices. Through the proven benefits and successes through the implementation of SCM, development of the framework is expected to assist in better performance for the industry in Jordan and further modifications, optimization and upgrades could be made to suit other countries and projects of different nature and complexity. Improved industry performance can translate into better GDP trends and pose similarly positive multiplier effects on other industries directly dependent upon the performance of construction industry. In the end, improved performances of public sector projects would benefit the public.

Methodology of this Research

Essentially, the aim of this research is through supply chain management tools practices to reduce delays in road projects. In the research we will need to identify the main delay factors and group them into the underlying causes. Essentially, the aim of this research is through the practices of the supply chain management tools to reduce delays in road projects. In the research we will need to identify the main delay factors and aggregate them into the underlying causes. This research will focus on highway projects that were executed between 2009 and 2018 only under the supervision of the Ministry of Public Works and Housing (MPHO), the Jordanian construction contractors Association (JCCA), highway projects with a value of only 210,000.00 Jordanian dinars. In this study, companies participating in the implementation of infrastructure projects will be identified through the Ministry of Public Works and Housing (MPHO), and the Jordanian construction Contractors Association (JCCA). a combination of multiple methods begins with a survey about secondary data collection initially. Data is obtained from previous studies, and then many other methods used to obtain secondary data from them are reviewed, including reports, news, internet search engines, and the annual archives of the Ministry of Public Works and Housing. (MPHO), the Jordanian construction Contractors Association (JCCA). The next step is to collect primary data via semi-structured interviews. Use qualitative research methods in semi-structured interviews to understand the scenario. To create a search frame. A "purposeful sampling" approach will be used. The researcher will be able to achieve the goals simultaneously while controlling the level of difference between the interviewees. An invitation will be sent to companies and to identify experts with no less than 10 years of experience in the field of highway construction projects. to avoid unnecessary repetitive information. The “saturation point” will be announced when the additional interviews do not provide additional input to the search results. Analyzing data analytical will use program NVivo (10), which includes analyzing data

in the research into three basic methods. First, prepare and arrange the data for analysis; the second is by coding, reducing data to subjects. Third, create charts or graphs that show trends from the data to connect different topics and issues. Using content analysis as one of the methods of qualitative data analysis by identifying citations and coded programming processes, and finally, a planning approach will be used to document and achieve the objectives of the study. Ethical procedures and principles of confidentiality and anonymity will be adhered to. Each participant will be given a code to ensure the confidentiality of the participants regarding the confidential nature of his study. Also, the guarantees related to storing the data collected through the interviews were emphasized so that only the researcher could access the computer with a password, and finally the data will be destroyed after completing the research. Semi-structured interviews and evaluation will be compared with evidence gathered from different data sources. To confirm the validity of this study, a review and follow-up will be provided with the interviewees to verify the data during the analysis process.

Significance of Research

Improving the performance of the construction industry is of particular importance to the initiatives of the Jordanian government through many initiatives such as privatization, partnership, industrial building system and many others. Moreover, the long-term plans of the Jordanian government had yet to solve the dilemma of delay, as the construction industry had a desire to adapt and move away from traditional methods, and SCM was a potential savior (Beauregard & Marpillero-Colomina, 2011). The ability of SCM to reduce delays is well documented, as evidenced by the application of some tools (see Riazi et al., 2020). With past evidence of success, it is anticipated that SCM could potentially improve delays in Jordanian infrastructure projects.

Conclusion

Most infrastructure projects in Jordan are characterized by delays and cost overruns. The necessity to change the traditional approach to building, which faces difficulties in achieving the project objectives. The use of supply chain management will aid the success of construction projects. For example, file the success of SCM in raising both the productivity and quality of building projects. Today I made it so. The ideal option for a cooperation in the UK building sector. Numerous participants, clients, and contracting companies have profited as well, demonstrating their potential to significantly influence infrastructure projects in Jordan. The research will examine the SCM tools required to significantly minimize delays in road construction in Jordan in a way that addresses all difficulties of subgroups categorized into "pathogens" after understanding the limited research coverage of SCM disciplines. Specify delay Pathogens initially allow for the creation of a framework to solve delay issues from the fundamental causes, preventing difficulties in the future for unidentified reasons.The research's findings are intended to close a gap in empirical studies on SCM, and they will especially help the Jordanian public sector and the whole construction industry. It is anticipated that the suggested structure would serve as a helpful manual for projects of a similar nature in other nations.

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