Increase Oil and Gas Projects Resilience to Mitigate Materials Procurement High Risks[1]

Khalid Zaki Alawaji and Anwar Zumah

Abstract

As there are emergent risks on global markets that can jeopardize oil and gas projects completion, assigned project teams shall identify all related mitigation and avoidance plans for materials procurement risks during early stage of project life cycle. This paper maps out most common delay causes, for materials procurement phase, which occurred frequently and had negative impact on the execution of oil and gas projects, during 2020. In addition, short and long-term applicable response plans are developed for materials driven projects in order to mitigate related threats and avoid execution delays for future planned projects in the next 24 years. Those risks and response plans shall be reviewed regularly during all project's phases.

Key Words: *Risk Management, Project Management, Materials Procurement Risks*

Introduction

Since oil and gas projects are usually following plan driven method, which divides project into phases, all emergent risks on market conditions and technologies should be identified early in project cycle and assign appropriate and doable risk response.

Risk management is an essential process to deal with projects complexity and related tolerances at all phases of the project life cycle. (Yap, 2021) Iterative risks identification and review during all phases of oil and gas projects will definitely reduce uncertainty, possibility of risks occurrence during later phases and will contribute to the project success. (Alavi, 2020) Project execution team is required to plan their response plans for all identified risks that might encounter. (Yap, 2021)

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In this paper, the focus would be on the materials procurement phase, which is highly contributing to project success as delivering required materials inline with projects' schedules are crucial milestones to meet execution plans. Managing materials procurement risks, which consist of and not limited to supply and logistics risks, are highly contributed to project success. Supply risks are mainly related to raw materials procurement from manufacturers, while logistics risks are concentrated in delivering those raw, and fabricated materials to end users.

Those materials related threats could hinder projects completion if were not constantly reviewed and mitigated through project life cycle. Mitigation of those materials related risks will build and enhance project resilience. (Wilding, 2021) Since project execution team anticipates those materials related threats will occur more frequently, execution methodologies should cope up with those potential risks to be more adaptable and resilient to ensure new projects success over the next 24 years.

On the other hand, Energy Outlook report, which was issued by OPEC in 2020, projected that oil and gas demand over the next 24 years is increasing as shown in Figure 1, in which new investments are required to be made. In addition, Figure 2 illustrates refinery related new investments, which are projected to be made from the year 2020 to 2045 to meet future energy demand. (OPEC, 2020)

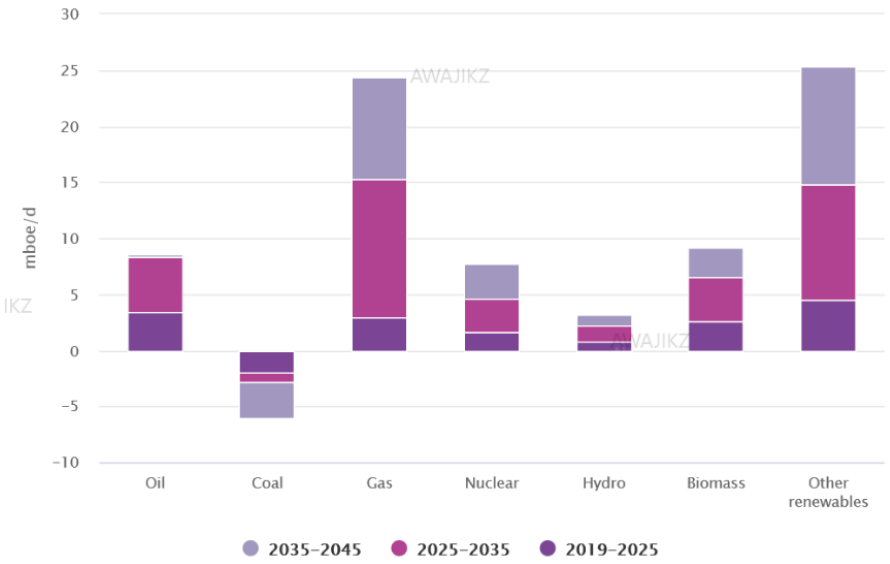

Figure 1: Figure shows projected growth in primary energy demand by fuel type from year 2019 to 2045. (OPEC, 2020)

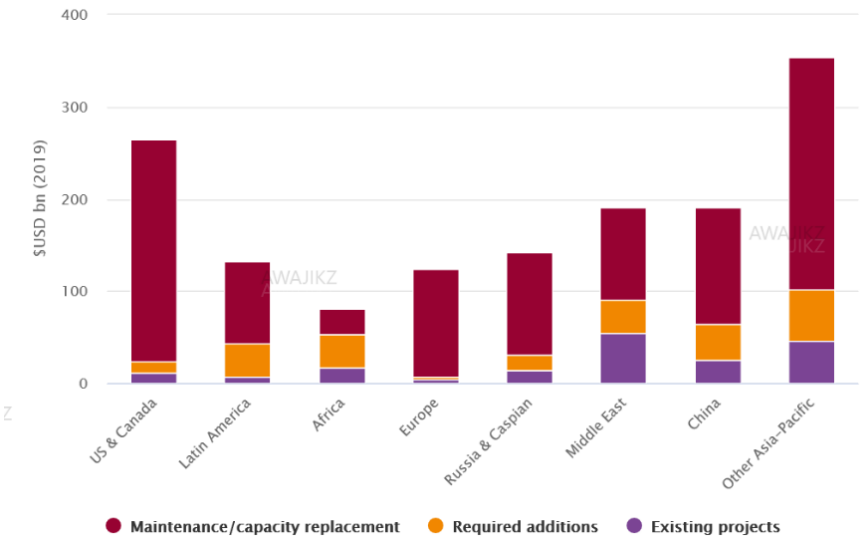

Figure 2: Figure shows existing and future required refinery investments from year 2019 to 2045. (OPEC, 2020)

Literature Review

Several studies were conducted to identify projects related delays and investigate their root causes. (Fashina,2021) During last years, those potential materials related risks with low possibilities of occurrence are becoming real threats for projects and could jeopardize projects completion.

Sambasivan research stated several projects delays are being encountered in construction industry to identify delay causes on projects completion. The study revealed that there were 28 delay causes for construction projects and then were ranked to identify the most frequent 10 delay causes. Reasons of those delays were due and not limited to improper planning, insufficient contractor experience, shortage in materials and labor supply. (Sambasivan, 2007) Also, another study by Fashina stated that there are 10 significant causes for project delays, in which 2 causes are related to materials reasons. (Fashina, 2021)

Another research studied projects risks that might occur simultaneously and could lead to cost and schedule overrun. The research stated that there are 13 materials procurement risk factors and attributes, which could lead to cost and schedule overrun. Study concluded that the

identified risk factors and attributes have an occurrence probability of 35% and will lead to schedule and cost impacts of around 30% of the original contingency reserve. (Mohamed Sayed Bassiony Ahmed Abd El-Karim, 2017)

One root cause that affects martials procurement phase and was discussed in several literatures is logistics sector challenge. In 2008-2009, global supply chain network was negatively impacted by 5 to 25% due to the low demand, which was a result of the 2008 financial crisis. This crisis created a high level of uncertainty that negatively impacted the logistics sector, which led buyers and suppliers to implement new measures to emphasize on business sustainability more than cost reduction. (Sheffi, 2015)

Similarly in year 2020, COVID-19 pandemic has severely disrupted supply chain networks around the world. (Mayer, 2021) Also, Rapaccini stated that COVID-19 pandemic has affected the economic output of the manufacturing sector globally as industrial production in the US had the steepest monthly decline since 1940s and related businesses were collapsed in Europe. (Rapaccini,2020) Countries were imposing restrictions on borders, which have severely disturbed the global logistics network and has led to reduce ships container capacity by 30%. (Xu, 2020) These global interruptions to the manufacturing sector and supply chain network have led to hinder projects progress as per execution plans.

Thus, considering the negative impact on projects due to materials related complications, future planned oil and gas projects should consider to review those materials related complications regularly and plan to eliminate or mitigate them in order to avoid unexpected projects outcomes. Project management industry needs to be resilient and agile to adopt such execution complication related to the materials procurement activities.

The purpose of this paper is to illustrate the materials delay causes with highest negative impact during 2020 and provide short and long-term responses to mitigate those negative risks and execution complications. Those responses will lead to avoid interruption to the energy sector related projects, and consequently sector will become more adaptable and resilient to unknown risks.

Methodology

The research methodology of this paper included detailed literature reviews, and interviews with specialists to identify materials delay causes as well as a questionnaire survey technique to gather research required data.

The survey was conducted to explore the likelihood of the identified causes of delays in materials procurement phase in addition to determine corresponding extents of severity. The survey was shared among different project execution agencies worldwide targeting project managers, project engineers, procurement managers, procurement specialists, engineering managers, engineering specialists, contracts managers, contract specialists, and projects control managers.

Delay causes that were identified based on the literature reviews and interviews are lockdown restrictions, shortage of materials in market, fluctuation in materials prices, logistics complications, change in materials specifications during construction, and damage of received materials.

The respondents were requested to choose a degree of frequency and severity for each identified delay cause from one (1) to four (4) as it follows:

- {Rarely (R) = 1, Sometimes (S) = 2, Often (O) = 3, Always (A)= 4}
- {Low (L) = 1, Moderate (M) = 2, High (H) = 3, Extreme (E) = 4}

The Frequency Index (F.I), Severity Index (S.I), and Importance Index (IMP.I) for each identified delay cause are calculated using Equation 1, Equation 2, and Equation 3, respectively.

$$\text{F.Ii} = \frac{\sum_{j=1}^{n} fij}{n} \quad (1)$$

$$\text{S.Ii} = \frac{\sum_{j=1}^{n} sij}{n} \quad (2)$$

$$\text{IMP.I i (\%)} = \frac{F.Ii * S.Ii}{100} \quad (3)$$

where (i) and (j) are the cause number and the respondent number, respectively. While (f) and (s) are the selected Frequency and Severity response, respectively. N is total number of respondents. The survey was conducted through email and linked-In website and were self-administrated.

The Frequency index (F.I) shows the average provided degree of likelihood for each of the identified delay causes. Similarly, the Severity index (S.I) shows the average provided degree of severity for each of the identified delay causes. In addition, the Importance index is used to rank the materials procurement delay causes based on their impact level by combining both frequency and severity indices. Methodology process flow chart is shown in Figure 3.

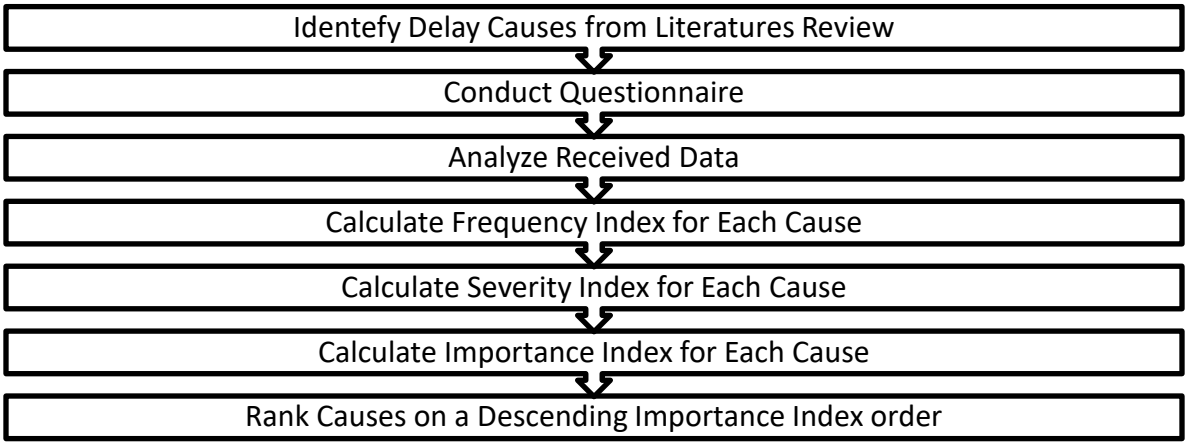

Figure 3: Process flow chart illustrates the followed methodology steps

Results and Discussion

Results show that the calculated frequency indices for both lockdown restrictions and logistics complications delay causes are the most occurred ones, which led to materials procurement delays during year 2020. Also, severity indices' result state that logistics complications delay cause had the highest negative impact on projects during 2020. Remaining calculated frequency and severity indices are shown in Figure 4.

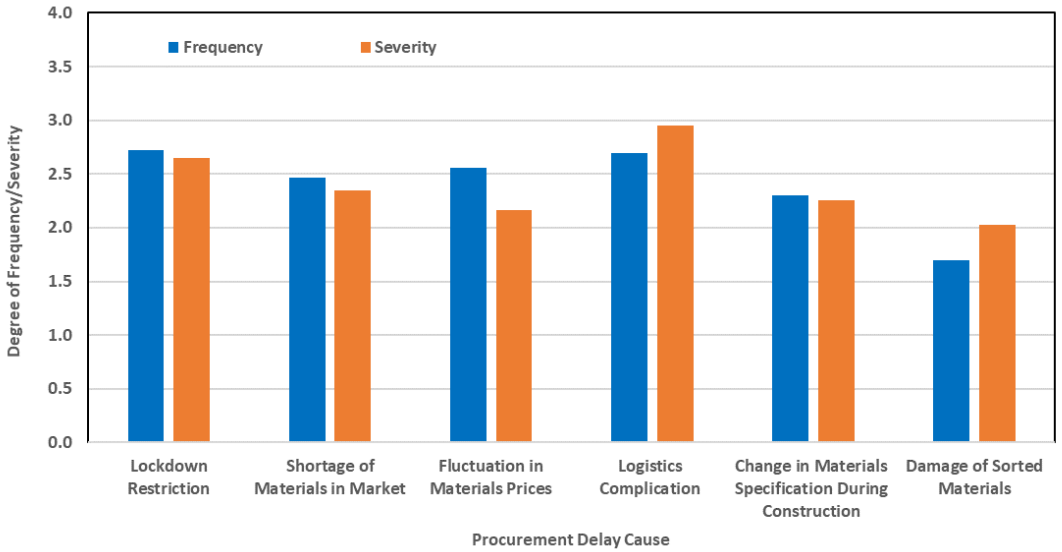

Figure 4: Figure shows the degree of frequency and severity for each of the identified materials procurement delay causes

Therefore, materials procurement delay causes were ranked by using Equation 3 and the results are shown in Figure 5.

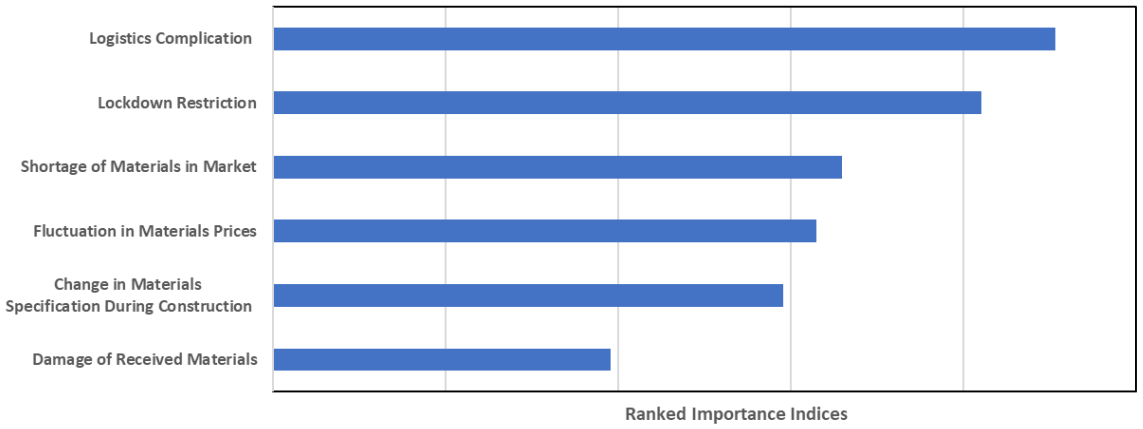

Figure 5: Figure shows the ranked delay causes based on their calculated importance Index

Short and long-term solutions to mitigate or avoid materials procurement threats could be implemented in all phases of projects as long as those threats were anticipated during early stage of project life cycle. Thus, projects should include in their risk register the materials procurement threats and their response plans including the low occurrence risks.

Adaptive Design

One of the temporary solutions to mitigate the impact of materials procurement threats is execution flexibility. Execution flexibility approach during design phase, is known as "adaptive design". This type of short-term solution, where an alternative design is developed considering the available and acceptable materials according to engineering standards will be implemented temporally to avoid jeopardizing project completion dates.
Adaptive design is known as a typical approach for IT projects, where project teams are adapting and modifying their design constantly based on customer feedback, whereas oil and gas projects are following typical waterfall approach. Ganis stated that flow or waterfall approach main principle is on completing each step of the project and then project will move gradually to the subsequent execution phase. (Ganis, 2010) Therefore, this adaptive design is considered as a temporary solution for such materials procurement threats. This approach would be helpful to mitigate such threats and complete urgent projects to meet required production demand.

Manufacturers Localization

One of the long-term solutions to mitigate any potential risk, that will impact oil and gas related projects and eventually production, is manufacturers localization. This will lead to improve the materials delivery process by reducing transportation lead time and avoiding materials procurement shortages around the world similar to what happened during 2020. In addition, adopting such initiative would help to avail such materials related components for accelerated requests.

Conclusion

This paper concluded that materials were delayed during 2020 mostly due to lockdown restrictions and logistics complications causes, which were imposed by countries. While, logistics complications had the highest negative impact on oil and gas projects schedule. Adaptive design

and manufacturers localization are the short and long-term mitigation and avoidance recommendation plans, respectively. Research was limited to year 2020 delay causes and responses could be further enhanced in future research to provide projects teams better insights in how to deal with materials procurement risks.

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Khalid Zaki Alawaji, MSc, PfMP, PgMP, RMP is a project management professional with more than 12 years of experience. He holds Bachelor and Master of Science degrees in Chemical Engineering from Oregon State University and University of Southern California, respectively. Khalid, currently, is working as a Project Management Supervisor and member of Gas Processing Standards Committee. Also, Khalid has obtained several credentials, including Program Management Professional and Portfolio Management Professional from Project Management Institute.

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