

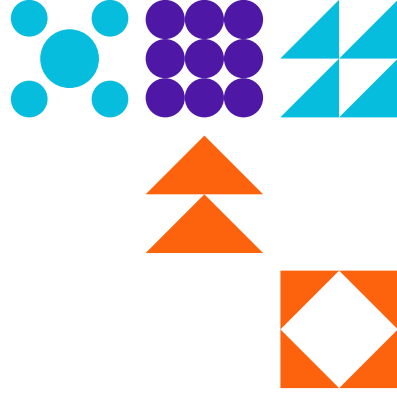


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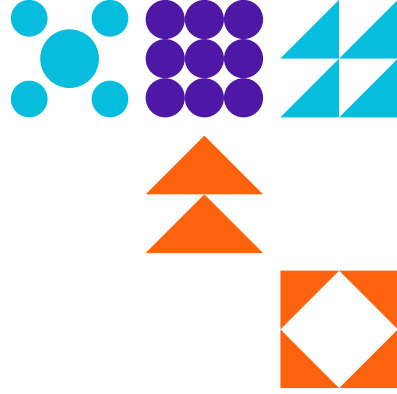
Supply Chain for O&G Projects (Challenges and Possible Mitigations)

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ABSTRACT

An observer to the current worldwide situation and the recent geopolitical, health, and economical events; could easily conclude that even the smallest events can result in an impact on the Supply Chain, occasionally Positive, but mostly to the negative side of the formula. It is known that there are two sides of a supply chain, the supply side from one end starting with the raw material sourcing, and the consumer from the other end. In the middle, there could be as little as few intermediary or it could be very complex supply depends on the nature of the supply. The remaining sections of the paper shall explain both sides of the Supply Chain along with an overview of the intermediary part, analyze some of the recent events and their impact on the Supply Chain, the impact of Supply Chain on Projects in the Energy Sector and conclude with a summary of recommended actions.



INTRODUCTION

WHAT IS SUPPLY CHAIN MANAGEMENT?

In simple words, Supply Chain is the network of entities, people, activities, information, processes and resources involved in the transformation of raw material into finished products and deliver them to the end user



Going through the Supply Chain Overview (Figure.1) which includes, but not limited to, Raw Material Producer, Supplier(s), Factory of variant types, Distributer(s), Retailer(s) and end with the final user/consumer. While this is typically the supply chain configuration for retail sector, it slightly defers when it comes to industrial project-based Supply Chain. The later would possibly eliminate some of the intermediary entities, for reasons which includes but not limited to, reduce the overall cost, reduce complexity of the supply and reduce the risk associated with the supply of the required material.



Referring to the above paragraph, we can realize that there are many types of Supply Chains and it could be as well used to source Products/Material.

WHY SUPPLY CHAIN?

Organizations around the globe have adopted Supply Chain Management to realize many benefits such as:

- **Cost reduction:** Streamlined processes, efficient inventory, and better supplier relationships resulting in expense/cost reduction.
- **Improve efficiency:** Fast production, delivery, and response to market changes.
- **Enhanced customer satisfaction:** Reliable product availability and timely delivery.
- **Increased Profitability:** Cost savings and operational efficiency directly enhance profits.
- **Gain Competitive advantage:** Agile supply chain enables quick reaction to market demand.

Above demonstrates some of the direct gained benefits from adopting Supply Chain Management compared to conventional procurement of material/service.

This paper shall focus on Industrial project-based Supply Chain Management mainly in the Energy Sector. The paper will explore as well some of the recent worldwide events and how they exposed projects to uncertainty and their direct and indirect impact on the supply chain. Finally, the paper will be concluded by recommending possible mitigation actions and techniques to help minimize the unfavored impact.



BACKGROUND

At the beginning, an overview of some of the events that the global market suffered during the past 5 years will be discussed.

COVID-19 PANDEMIC

Although COVID-19 pandemic restriction has been removed from most countries around the world and the trading market for raw material have slightly stabilized; raw material prices on the other hand did not return back to pre-pandemic state. From the name itself “Supply Chain” one will know that any issue even with one link of the Chain impacts the whole chain. Therefore, increase of raw material cost will eventually cascade and result in an increase of the whole downstream links. Taking Medical Face Mask as an example during pandemic early stage, the market experienced big shortage of this commodity which resulted in sky-rocketing the prices of that product. This introduces us to the Supply-Demand Concept of the Macroeconomics field, which is defined as follows; if Demand is higher than the Supply, prices usually surge-up and vis-versa. Additionally, lockdowns imposed by countries to mitigate the spread of COVID-19 around the world caused massive disruption to the Supply Chain which resulted in decreased level of productivity leading to high increase in cost and prolonged deliveries as a result of:

- Reduction of workforce and Factory Closures
- Minimum Distance requirements imposed by Governments and Corporations
- Curfews which restrict personnel movement
- Logistics restrictions disrupting the flow of goods and raw material

There are as well positive sides of the lockdowns which will not be covered in this paper.



OIL PRICE INSTABILITY

As demonstrated in Figure.2 below, the oil market during the past 5 years have been volatile and usually difficult to predict. Furthermore, oil prices are very sensitive to geopolitical events around the world as well it is subject to the supply and demand for this critical commodity. Oil prices per barrel have dropped in Q2021-2 (as a result of Covid-19 pandemic) to be sub-\$12 and exceeded \$120 per barrel toward Q2022-2 when the demand increased after the start of recovery from its impact. That is a change of 900% in one year. Although the oil prices nowadays are more stable at around \$80 per barrel; we can still see the prices of oil byproduct i.e. Diesel and Kerosene (Jet Fuel) as demonstrated in Figure 3 and 4, are still resisting to return to pre-pandemic prices and this is directly impacting the Supply Chain from many aspects, including but not limited to:

- 1) Energy including electricity required for production of raw material and final product.
- 2) Fuel required for Transportation and Logistics including both Sea, Land and Air Freights.

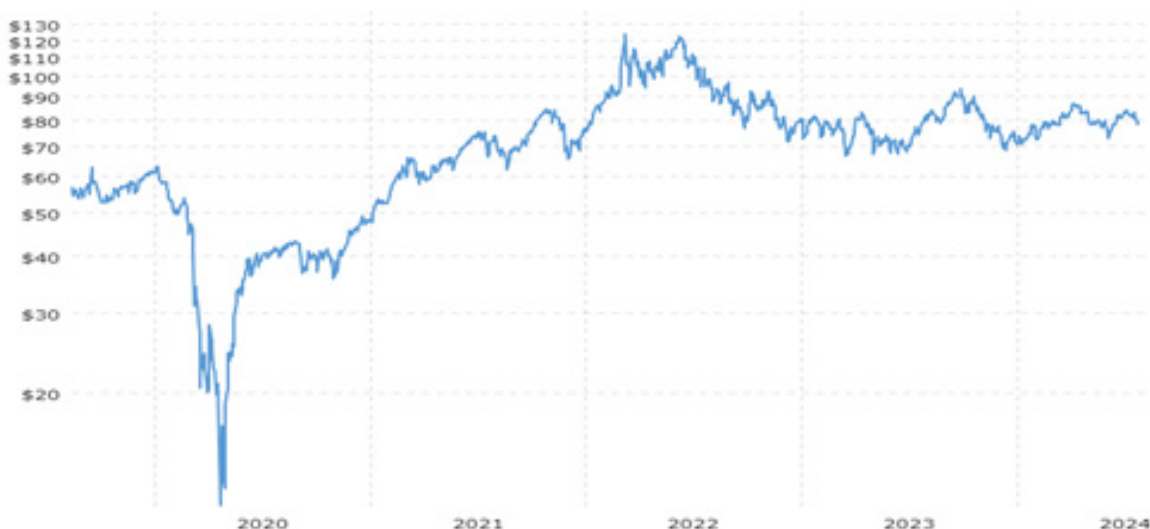


Figure.2 - Shows Oil Prices trends for the past 5 years (Source: Macrotrends©) (2)

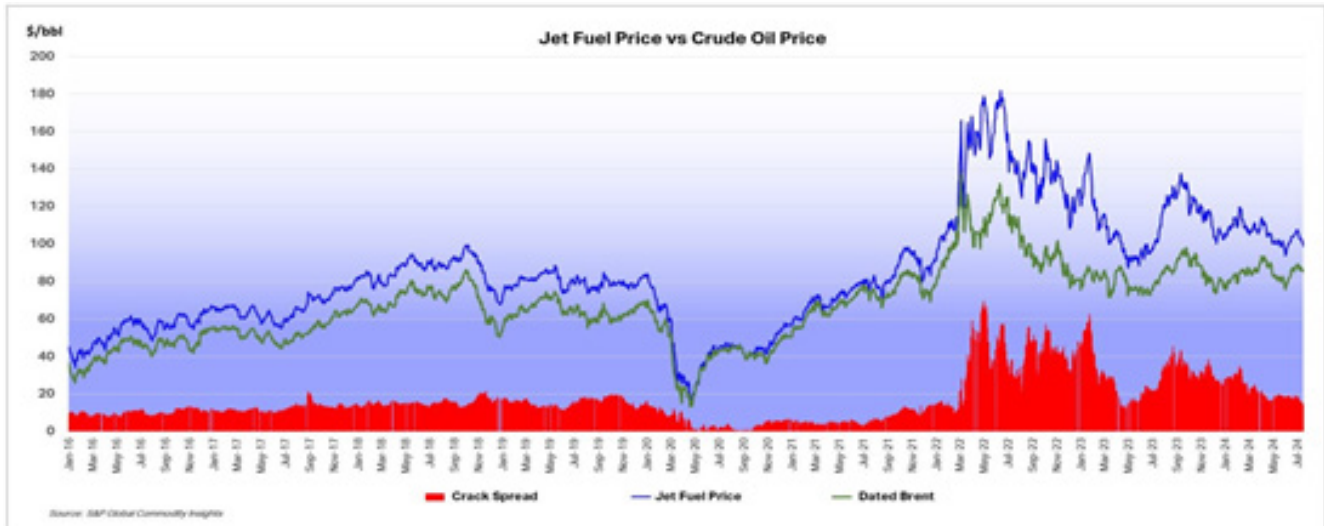


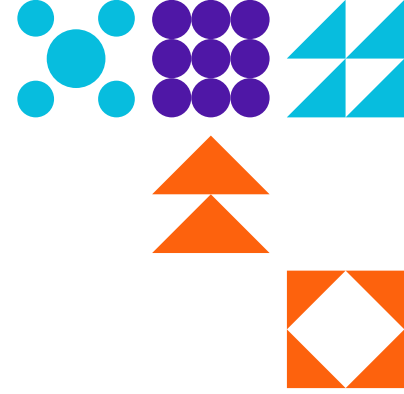
Figure.3 - Shows Jet Fuel price trends (\$ per barrel) for the past 10 years (Source: IATA©) (3)



Figure.4 - Shows Diesel price trends (\$ per Gallon) in the US for the past 5 years (Source: EIA and YCHART) (4) (5)

RUSSIAN-UKRAINE WAR IMPACT ON SUPPLY CHAIN

Since the start of the Russian invasion to Ukraine back in early 2022, the Supply chain industry has experienced surge of prices in many commodities produced by those two countries as well transportation prices. Wheat, oil, nickel and palladium are an example of the main commodities produced by these two countries in which their market have been disrupted and prices have climbed since then. Given the trade sanctions imposed on Russia by different countries as well the war causing restriction of movement of ships in the Black Sea leaving them stuck in Ukraine Ports and preventing reach of essential raw material to the customers (7).



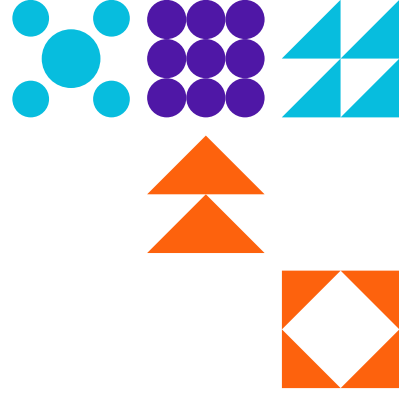
These events have led to market shortage of impacted commodities and inflation of prices. It is worth to mention that Ukraine and Russia are responsible for production of more than 28% of global wheat and 25% of the world's nitrogen fertilizers (8). Moreover, Ukraine metal production alone accounts for 10% of the nickel market and 70% of the world neon (7).

Taking the U.S. market as an example to explore the impact of such event, 30% of platinum group element, 13% of titanium and 11% of nickel are imported into the U.S. from Russia which are no longer available (8). This have resulted in shortage of these metals which are essential raw material for production of many important products like batteries.

This is simply demonstrating how a geopolitical tension in one side of the world could easily impact the whole global trade.

RED SEA CRISES

Sea Shipping carriers during the past couple of years have avoided certain routes due to geopolitical reasons threatening the safety of the assets, goods and onboard crews. The latest have been avoiding routes though the Suez Canal and Bab Al-Mandab Strait limiting access to Ports within that region and placing pressure on carriers to increase their prices due to the longer routes needed and elevated insurance prices. This resulted as well in drastic increase on demand on the remaining carriers that still offer this route leading to price inflation. Furthermore, this kind of geopolitical event results in staging of ships awaiting to offload their goods at alternative ports not impacted by the event.

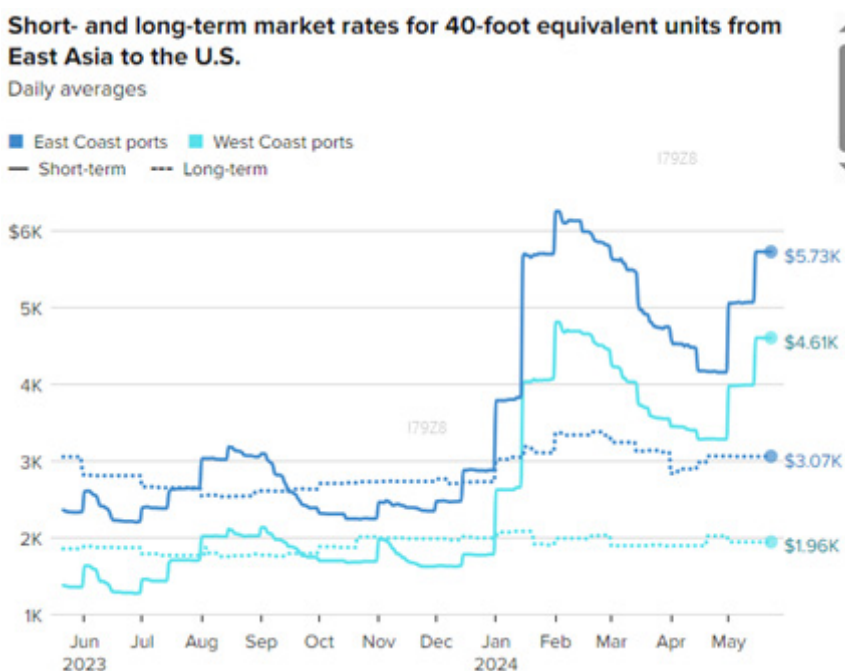


Taking Saudi Arabia as an example, the Kingdom experienced a huge decrease of carriers accepting to take the route through the Red Sea resulting in diversion of shipments from Jeddah Islamic Port to King Abdulaziz Port in Dammam located in the Eastern region. This imposed high flow exceeding the capacity of the Port leading to prolonged offloading and long-queue of awaiting ships.

WORLDWIDE SHORTAGE OF SHIPPING CONTAINERS AND FLUCTUATION OF PRICES

The worldwide shipping industry have experienced high fluctuation in prices of Shipping Containers. In specific, the Sea freight rates alone have more than doubled in value to exceed \$5K per 40-foot container when considering as an example the routes from East Asia to the US East Ports (Figure.5). This is mainly due to many reasons which includes worldwide shortage of shipping Containers and high demand on sea shipments specially during seasons like back to school and holidays.

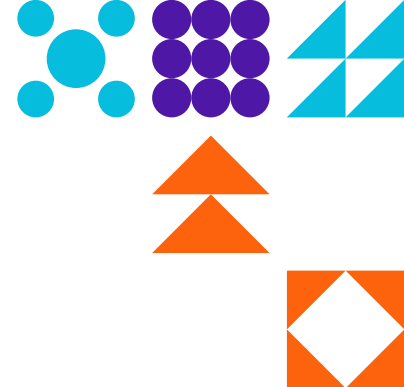
Shortage of Containers is another concern facing the industry given that carriers sometimes refuse to carry empty containers given the possibility to fully complete their loads with filled once which is more finically viable.





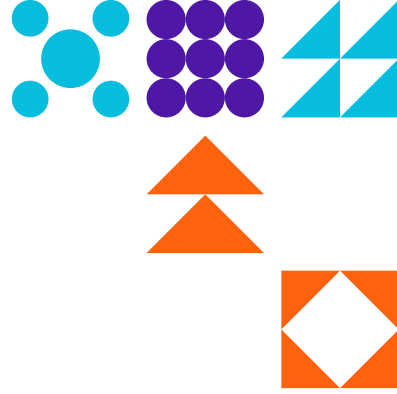
ANALYSIS OF THE IMPACT ON PROJECT IN ENERGY SECTOR

During the previous 5 years, Projects in Energy sector have been exposed to challenges due to the above-mentioned events and more, those challenges have never been seen in the last 3 decades in such sequence and close proximity of time from each other. Energy projects in their nature heavily depends on Supply Chain to source the material required to execute the projects. Typically, material accounts for 60 to 70% of the project cost (9) which gives a clear indication of the importance and direct linkage with supply chain. Material procurement is one of the main contributing factors that determines the failure or success of any project. Thus, it is worthwhile exploring some examples of these challenges and possible mitigations to reduce their impact and risk on the project, see Table-1 for more details.



1.Table

Challenges	Proposed Mitigation(s)
Inflation of Raw Material Price and Cost of workmanship	<p>Diversify Suppliers: Never rely on a single source to supply required material.</p> <ul style="list-style-type: none"> • Long-Term Contracts: To address short term price fluctuations, entities should consider long-term contracts with fixed costs. • Inventory Management: Proper management of inventory will provide buffer against price inflation. • Cost Pass-Through: Contract clauses that allow for cost pass-through to customers should be considered. This will help to reduce the risk associated with raw material price increase. • Alternative Material: Evaluate the use of alternative material that still meets the specification, but less volatile to price increase. • Supply Chain Visibility: Knowing what goes on in the Supply Chain Market will allow better control of cost and possibility to negotiate better deals. • Supplier Relationships: Building good relations with strategic suppliers increase the possibility to negotiate good deals and have reliable supply. • Improve efficiency: Obvious, yet people tend to forget about it; improving the design and reducing the waste help project better manage their cost. • Regular Reviews: Frequently conduct reviews to your supply chain strategy and adjust as needed.
Shortage of Raw Material	
Incremental increase of material shipping cost and its volatility	
Delays of material delivery and its consequences	
Long-lead Material	
Failure of Supplier due to Financial Reason	
Material deficiencies and Quality Issues	



RECOMMENDED ACTIONS

SHORT-TERM STRATEGIES:

- **Considering alternative routes for movement of goods:**

As early as possible if not at the planning phase, consider to have multiple routes options for your supplies especially Internationally procured items.

- **Build Scenario-based Prediction Model (Simulation)(10):**

Build a supply chain prediction simulation model involving several steps, including defining objectives, collecting data, developing the model, and validating it. Examples of the simulation methods are:

- **Discrete Event Simulation (DES):** a method of simulating the behavior and performance of a real-life process, facility or system.

- **System Dynamics (SD):** Focuses on the feedback loops and time delays within the supply chain.

- **Agent-Based Modeling (ABM):** This method simulates interactions between individual agents (e.g., suppliers, customers) and their environment.

- **Monte Carlo Simulation:** Uses random sampling to model uncertainty and variability in the supply chain.



EVALUATE MARINE SHIPMENT VS. AIR FREIGHT FROM COST AND SCHEDULE POV:

When it comes to O&G projects and depends of course on the project location, there will be for sure a big need to procure material internationally. Therefore, the following consideration should be taken for such critical activities:

- During project planning phase, start listing all material requirements which shall be kept alive until quantities are frozen.
- Planning, Engineering and Procurement teams needs to work closely during the whole process, as well as, when needed consultation of the Construction team for constructability and sequence of activity to be considered to define urgency of supply.
- Based on the material weight and size limitations, start the evaluation of Marine vs. Air shipments. During this step, project timeline needs to be carefully assessed and shall be studied carefully to ensure meeting project milestones.
- As demonstrated in the background section of this paper; the shipping industry is volatile to geopolitical and economical events. As such, during the execution of the project the team involved in the project Supply Chain needs to be vigilant to those situations and ready with alternative plans ready to be implemented in short period of time to support project meets its objectives.

DEVELOP A TASKFORCE DEDICATED TO FOLLOW GEOPOLITICAL AND ECONOMICAL INTERNATIONAL SITUATION:

Assign a taskforce to constantly follow the news and the supply chain industry as well as consider subscribing to reputable website that provide insights/updates about Supply Chain Policy and Economical Changes. As part of the responsibility of this the task force is to issue periodic internal Flyer to be distributed to concerned users.



CAREFUL REVIEW OF THE SUPPLIER CAPABILITIES AND WORKLOAD:

The Supply Chain Team along with the Project Management team needs to carefully assess the capabilities of the project suppliers and their current and future workload. This step is essential to ensure smooth supply which will support achieving project objectives.

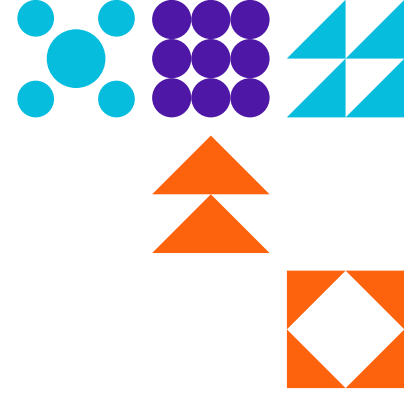
EVALUATE LOCALIZATION VS. GLOBALIZATION OF CORE BUSINESS COMMODITIES:

This is a long-term strategic decision by the organization which will offer, on the long run, stable and reliable supply chain for core business commodities. This as well support the local economy by introducing jobs and contribute to the GDP of the Country where the organization is located. This can be as well considered for Global supplies by having strategic suppliers by that achieve diversity, optimize cost and reduce

CAPITALIZE ON TECHNOLOGICAL ADVANCEMENT TO ENHANCE SUPPLY CHAIN OPERATION (11):

Utilization of new Supply Chain available technologies will add many benefits to the organization adopting it from areas like enhance efficiency, build-up data-driven organization and use information obtained to improve your operations as well discover areas of improvement. Many solutions are available nowadays, however some examples of the technologies to be utilized could be:

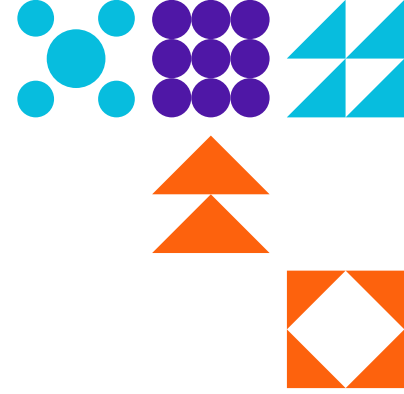
- IoT (Internet of Things) for tracking of goods movements throughout the Supply Chain links
- Big Data & Analytics to optimize cost, find patterns for capacity planning and enhance Customer Experience.
- Robotics which will allow reduction of human error and improve operational efficiency t warehouses as an example.



- Artificial Intelligence where the market currently offering many AI powered solutions for forecasting. Other solutions are available to overcome Supply-Demand challenges to help organization from shortage or overstocking of inventory. Furthermore, AI-based solutions that automate goods collection from source for accurate shipment tracking/fulfillment.

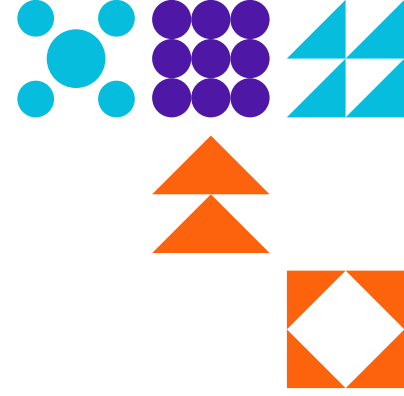
CONCLUSION

In conclusion, the imperative to build resilience within supply chains has never been more critical, especially in the face of the inherent risks of globalization. As global networks become increasingly complex and susceptible to disruption, businesses must adopt initiatives that not only stabilize current operations but also future-proof them against unforeseen challenges. By focusing on targeted actions, companies can effectively mitigate immediate risks while simultaneously preparing for long-term sustainability. Leveraging digital capabilities is a pivotal strategy in this endeavor, enabling organizations to optimize efficiency, enhance visibility, and respond rapidly to changing conditions. A balanced approach that addresses both near-term demands and long-term objectives will empower businesses to maintain robust, agile, and resilient supply chains in an ever-evolving global landscape.



ABOUT AUTHOR

Marwan Alarfaj is a Supervisor Project Engineer who has over 11 years of deep experience in managing Oil & Gas Mega projects. During the course of his career, Marwan have completed construction of major Pipeline Projects, a Grassroot Gas Plant in the kingdom of Saudi Arabia and participated in many projects starting from Engineering though Procurement and Construction. Marwan have graduated from King Fahd University of Petroleum and Minerals back in 2013 with honor Bachelor Degree in Mechanical Engineering. He is PMI member since 2014 and PMP holder since 2017.



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