EFFICIENCY TO RESILIENCE
BUILDING CAPABILITIES IN THE OIL AND GAS SUPPLY CHAIN FOR AN UNCERTAIN WORLD
JULY 2020
In a rapidly changing world, supply chains are faced with an ever-expanding set of global challenges that have increased the surface area and magnitude of supply chain risks. The ongoing COVID-19 crisis has only served to compound the impact of such supply chain vulnerabilities that many companies face. Downstream oil and gas supply chains, in particular, face unprecedented disruptions arising from structural complexities and a changing ecosystem.

Hence supply chain management today is faced with the burning need to reimagine itself to build resilience to be able to withstand the disruptive forces that are increasingly affecting operations. Beyond mitigating impacts from crises, companies can foster supply chain resilience as a key competitive advantage.

### Changing world - new risks and challenges

Downstream oil and gas supply chains in India are faced with increasing complexity and uncertainty, driven by four key trends:
- Significant volatility in commodity pricing and supply demand dynamics
- Unprecedented rise in climate change related impacts
- Structural shifts and disruptions in the logistics sector
- Likelihood of clean energy transition and changing customer expectations

### Guidelines for success

Companies can build resilient supply chains through a combination of three central pillars and three enablers supported by an overall strategic vision.
Strategic vision

Resilience as uncertainty advantage, in sync with the overall business strategy

Central pillars

- Diversification of geographic footprint of asset base
- Customised trade-off between resilience and efficiency based on customer needs
- Robust early warning systems and SOPs for response

Enablers

- Building resilience in business partners through investment in capabilities
- Leveraging advanced analytics capabilities for improved uncertainty prediction
- Fostering cross-functional collaboration backed by an agile organisation

Introduction

The COVID-19 outbreak has caused significant disruption to a gamut of industries, and oil and gas is no exception. Indian oil demand, collapsed by ~60% in April and May compared to last year due to the lockdown, exerting considerable downward pressure on refiners’ margins. Coupled with concerns around the tenability of the OPEC+ deal, price forecasts for FY20-21 remain highly uncertain with no clear picture of the extent of recession and the pace of demand recovery. The COVID-19 crisis has brought into sharp focus the increasingly uncertain business environment that oil and gas companies continually face. The question is: beyond the here and now, how can oil and gas companies better prepare to thrive in the ‘new normal’ from a supply chain standpoint? We believe, the answer lies in building risk-resilient supply chains while maintaining focus on cost-efficiency.

We can effectively define supply chain resilience as the ability to absorb and mitigate impact from exposure to risks and vulnerabilities and the adaptability to thrive in altered circumstances enabled by agile decision making and pro-active risk management. Managing for resilience requires more than just grafting new ideas or tools onto today’s approaches. It requires a fundamentally different mental model of supply chain management — one that embraces complexity, uncertainty, interdependence, systems thinking, and a multi-timescale perspective.

Many supply chain managers already undertake some form of risk management; but the degree of sophistication and professionalism varies widely. Mostly companies follow a reactive approach in responding to supply chain disruptions. On a regular basis, they monitor and implement strategies to minimize exposure to the most relevant, known risks, such as supplier disruptions or regulatory changes. However, resilience must also deal with unidentified risks: it must consider the various adaptations and transformations that supply chains need to make in order to absorb environmental stress and even turn it to advantage.

Supply chain resilience is the ability to absorb and mitigate impact from exposure to risks and vulnerabilities and the adaptability to thrive in altered circumstances
Changing world - Increasing uncertainty and new challenges

The Indian oil and gas downstream ecosystem is changing rapidly under the influence of global and domestic trends. The complexity and magnitude of uncertainty that supply chains are facing today are far higher than at any point in time previously. There are four key trends that need to be taken note of:

- **Significant volatility in commodity pricing and supply-demand dynamics**
  - West Texas Intermediate futures traded negative due to demand shock and excess supply – Oil prices are expected to remain at around $30-$40/bbl through 2020 and 2021 with global oil demand expected to drop by 8.1 mbpd as per the IEA in 2020. The demand is expected to recover by 5.7 mbpd in 2021.
  - Demand recovery patterns will vary across product segments – While gasoline demand is expected to recover fastest as the lockdown eases and commuters avoid public transportation, diesel will have a slower recovery as industrial activity and trucking demand will continue to remain depressed. This is borne out by petrol and diesel consumption in India in June 2020 returning to 85% and 82% respectively of last year’s levels in the same month. Aviation fuel demand will continue to suffer for two more years as global air travel, especially business travel will be the slowest to normalize.
  - Re-emergence of OPEC+ as a stabilizing force – The OPEC+ members’ decision to cut supply by over 10% in April and May and growing evidence that they are able to honour their commitments has played a major role in stabilizing oil prices in the medium term and may well prove to be the single largest factor in restoring the industry’s fortunes. Further, US backing of the deal could herald a new era of co-operation between the largest oil producers.
  - Liquidity concerns in oil producing countries – Countries heavily reliant on oil exports such as Algeria, Nigeria, Mexico and Venezuela among others are facing a severe balance of payments crisis. They are also facing severe liquidity issues and are resorting to emergency measures like currency devaluation and sharp increases in borrowing to manage fiscal pressure (Exhibit 1).

- **Storage implications** – Oversupply, coupled with a sharp decline in oil demand due to travel bans, led to an unprecedented build-up of storage until May 2020. Storage capacity was expected to run out by the end of June 2020 if further production cuts were not implemented. However, EIA now expects global oil inventories will begin declining in June due to sharper declines in global oil production and
Outliers due to government inability to meet budgeted spending commitments.

Relying on borrowing and reserves to withstand impact in short-to-medium term.

Exhibit 1: Fiscal pressure will be difficult for small OPEC producers to manage in 2020

Proportion of revenue from hydrocarbons (%)

Source: EIU; IMF; BCG Center for Energy Impact
Exhibit 2: Global oil inventories expected to decline from June after demand recovery

<table>
<thead>
<tr>
<th>Year</th>
<th>Change in inventories (Million barrels / day)</th>
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</thead>
<tbody>
<tr>
<td>2019</td>
<td>-0.3</td>
</tr>
<tr>
<td>2020</td>
<td>-3.0</td>
</tr>
<tr>
<td>2021</td>
<td>-3.1</td>
</tr>
<tr>
<td></td>
<td>-2.3</td>
</tr>
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Source: Short-term energy outlook, June 2020, EIA

higher than expected demand. EIA expects that global liquid fuel inventories will fall at an average rate of 2.5 million barrels per day from June 2020 through the end of 2021 (Exhibit 2).

- **Significant erosion of market cap for service companies** – Market capitalization in 2020 of the top three oilfield equipment and services companies — Schlumberger, Baker Hughes and Halliburton — declined by ~25% in June as compared to March. This could lead to consolidation and asset liquidation.

- **MSMEs in oil and gas sector at risk of shutting down** – A survey conducted in mid-May by the All India Manufacturers’ Organisation revealed that about 35% of MSME’s started winding up operations as they saw no chance of recovery in the wake of the COVID-19 outbreak. This could lead to increased dependence on imports for oil and gas companies as machinery and equipment manufacturers who provide key inputs become insolvent.

- **Collapse in upstream oil investment** – IEA estimates global upstream investment will fall to its lowest in 2020 since 2005. According to Bernstein, non-OPEC supply may peak in 2025 at around last year’s level. Seven major oil companies plan to cut capital spending by $ 40 bn in 2020 and $150 bn in 2021 (Exhibit 3). This could impact oil prices in the long term due to reduced ability to increase supply once the demand comes back.

In India as well, the top three oil marketing companies (Indian Oil, Bharat Petroleum and Hindustan Petroleum) are expected to cut cumulative capex by around 30% over FY21-FY22 compared to pre-COVID.
estimates, as per Fitch Ratings. ONGC too has announced a capex cut of 15% for FY21 due to the prevailing low crude prices scenario, as per a report published in Business Standard.

- **Shale firms in US are also significantly at risk** – With breakeven shale price > $40/bbl, the US shale oil industry is expected to see a wave of bankruptcies and restructurings. Already 17 smaller US oil and gas producers have filed for bankruptcy this year and the number could rise to 70+ by the end of 2020, as per Rystad.

**Unprecedented rise in climate change related impacts**

- Climate related disruptions have increased significantly in frequency and impact in the last five years (Exhibit 4).
- Financial impact on supply chains has also been rising steadily.
- India is particularly vulnerable with 35 mn people in low lying coastal areas estimated to be impacted by rising sea levels by 2050, according to research by Climate Central.

**Logistics sector undergoing transformational change**

**Move towards formalisation in a highly fragmented industry** due to introduction of GST -

- Around 90% of traditional industry segments such as warehousing and road transport are unorganized as per BOBCAPS research.
- The top 10 listed logistics players in the country cumulatively account for ~5% of the total industry share.
- Implementation of GST and e-way bill has tilted the balance towards organized players.

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**Exhibit 3: Investment cuts in oil supply could impact long term prices**

*All figures are in USD Bn*

**Upstream capex cutdown by 20-30% in coming years**

<table>
<thead>
<tr>
<th>Year</th>
<th>Pre covid</th>
<th>Post covid</th>
<th>Percentage Cut</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>573</td>
<td>397</td>
<td>-26%</td>
</tr>
<tr>
<td>2021</td>
<td>537</td>
<td>385</td>
<td>-28%</td>
</tr>
<tr>
<td>2022</td>
<td>596</td>
<td>440</td>
<td>-26%</td>
</tr>
<tr>
<td>2023</td>
<td>627</td>
<td>499</td>
<td>-20%</td>
</tr>
<tr>
<td>2024</td>
<td>662</td>
<td>546</td>
<td>-17%</td>
</tr>
</tbody>
</table>

**Oil majors have slashed capex by 22% from pre-COVID levels**

- **Saudi Aramco** -27%
- **Exxon-Mobil** -30%
- **Chevron** -30%
- **BP** -25%
- **Shell** -20%
- **Equinor** -19%
- **Total** -18%
- **ONGC** -15%
- **Indian NOC’s** -31%

*Source: Rystad Energy, OGJ*

*Note: Indian NOC’s refers to Indian Oil, Bharat Petroleum and Hindustan Petroleum*
Emergence of new-age, service oriented business models such as 3PL, express as compared to traditional execution focused asset-heavy models (plain vanilla transportation and warehousing):

- 3PL industry currently estimated at INR 45,000 – 48,000 Cr is expected to grow at 17-18% CAGR until FY22 driven by evolving supply chain practices and enabling regulations as per BOBCAPS research.
- India’s 3PL spend as a proportion of its total logistics spend at 4.5% is much below global standards indicating ample headroom for growth.
- Oil and gas companies’ traditional reliance on unorganized transporters is being challenged and opportunities are arising to leverage these new partnerships.

Increased competition, clean energy transition and changing customer expectations:

- Increased competition: The market share of private players has increased to ~10%. Reliance, Nayara and Shell are looking to increase their retail outlet network.
- Impact of climate change: Globally, oil demand could decline by 30% by 2040 under the 2° C scenario, which is the Paris climate accord’s acceptable temperature rise limit, as per IEA estimates.
- Changing customer expectations: Digitally mature retail customers’ demanding convenience and flexibility has led to the emergence of doorstep refueling startups.

These long term trends merit a relook at the supply chain priorities in order to be able to navigate successfully the challenges and uncertainties that lie ahead.

Source: Munich RE – NatCatSERVICE – Accessed 2020
The oil and gas industry is involved in a global supply chain that involves domestic and international transportation; ordering and inventory visibility and control; materials handling; import/export facilitation; and information technology. The unique structural challenges that make oil and gas supply chains fundamentally more susceptible to disruptions are:

- **Unparalleled exposure to natural elements:** Oil Marketing Companies’ tanker trucks operate in temperatures ranging from 50 degrees celsius in summer to minus 20 degrees celsius in winter. Naturally, it puts unparalleled strain on the logistics infrastructure.

- **Difficulty in end-to-end tracking due to vast area of operation:** Indian Oil operates a cross-country pipeline network of 14,670 kms and its 50,000 strong tanker fleet ensures delivery to over 50,000 customer touchpoints. Maintaining end-to-end visibility of its supply chain presents unique challenges given the sheer expanse of its network.

- **Hazardous nature of products transported:** The extent of environmental damage and impact on human lives and livelihoods from a pipeline leakage are far greater than the impact of disruption in other industries.

- **High cost of disruptions:** Oil and gas companies face extreme financial vulnerabilities from any pipeline leakages or disruptions. For example, the GAIL pipeline explosion in Andhra Pradesh in 2014 led to a 5% reduction in ONGC’s annual gas output compared to the previous year and approximately 500 Cr in EBITDA losses. Twenty two people lost their lives in the fire following the explosion.

- **Limited ease of adjustment due to fixed nature of assets:** The capital intensive nature of assets in the oil and gas industry increases the challenge in implementing resilience improvement measures. For example, compared to the apparel industry that can easily shift its supplier base from say, Europe to South East Asia, sourcing contracts, port locations, terminals, pipelines and even contracts with transporters for an oil and gas player are long-term in nature with low maneuverability. This further restricts the scope of response strategies to any disruption.

Hence, oil and gas companies with winning aspirations need to reform their supply chain priorities to focus on building resilience without losing focus on efficiency.
Oil and gas supply chains today face unprecedented disruptions arising from immediate shocks and long term structural shifts. In this context, organizations need a reformed approach to balance the competing priorities of building resilience while maintaining cost-efficiency. The benefits of this could be substantial for oil and gas companies:

**Higher financial returns during periods of crisis** - Resilience combined with cost leadership, will become a key competitive advantage in uncertain times. According to research by the BCG Henderson Institute, companies that prepared early and with a long-term perspective (resilients) significantly outperformed their peers during the 2008 global financial crisis (Exhibit 5). With refiners’ margins under pressure during periods of crisis, the companies most likely to emerge in reasonable shape will be the ones that are able to reduce their operating expenses and introduce new technologies to cut costs. Hence companies need to look at resilience building as an uncertainty advantage rather than an impediment to efficiency.

**First mover advantage to new business opportunities** – Having a resilience building mindset can open up new business opportunities in asset-backed oil trading and new go-to-market models such as doorstep refueling. The COVID-19 oil price shock is a clear illustration of how Indian downstream oil companies could have amplified their gains from the sharp decline in crude prices had they invested in acquiring strong trading capabilities and in building up storage. In an average year it is estimated that the added value of trading on refining can be over $1 bn when aggregated across India’s major refineries, and in extreme years, this value can easily double. Supply chain agility is also a prerequisite for participating in emerging delivery models such as doorstep refueling that will become increasingly relevant for traditional players to ensure customer centricity in operations.

**Exhibit 5: Resilient companies performed better during the ’07-09 downturn**

*Performance during 2007-09 downturn by strategic orientation, using NLP*

<table>
<thead>
<tr>
<th></th>
<th>Resilients&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Non-resilients&lt;sup&gt;2&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average TSR outperformance&lt;sup&gt;1&lt;/sup&gt;</td>
<td>1.4%</td>
<td>-0.9%</td>
</tr>
<tr>
<td>Average revenue growth</td>
<td>4.2%</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

1. Annualized TSR compared to average of large companies in same sector during 2007-09 period
2. Resilience orientation score determined by BHI proprietary NLP analysis of mgmt. discussion in companies’ 10-K SEC filings. Resilience or non-resilience orientation based on whether average score during the downturn period is above or below average across all large companies. Note: Statistically significant relationship between long-term orientation and TSR and growth (p<0.01) holds when controlling for other factors such as sector and additional strategic orientation scores. | Source: S&P Capital IQ; SEC 10-K filings; BCG Henderson Institute analysis
How to build a more resilient supply chain

In light of the increasing business complexity and growing overall uncertainty, establishing a systematic supply chain risk management approach becomes more and more relevant. Based on our experience, we suggest a comprehensive framework (Exhibit 6), for achieving resilience in supply chains that can be tailored to a company’s need, based on their individual starting position.

1. **Elevate resilience as a supply chain strategic priority**

Companies need to recognize supply chain risk management i.e. systematic risk assessment and mitigation methodology, as a core competency of the overall supply chain management philosophy. Alignment of the supply chain priorities – cost efficiency; resilience; access; and service levels – with the business focus areas is critical.

**Practical applications**

**CISCO – Embedding end-to-end resilience in supply chain design**

Cisco’s sophisticated risk management practices are designed to proactively embed end-to-end resiliency in the supply chain to improve overall time-to-recovery during a disruption (Exhibit 7). The supply chain risk management team’s four key processes extend across the entire organizational and capability structure:

- **Product resiliency** – Scorecards are developed to identify and “de-risk” single sourced and other risk components to drive resiliency upstream in the product development process. This helps identify risk trade-offs in the early design and development phases of Cisco’s products. Resiliency scores have become mandatory criteria in product launch gating process.

**Exhibit 6: Framework for creating supply chain resilience with efficiency**

- **Primary Levers**
  - **Diversify geographic footprint of SC asset base**
    - Assess asset’s criticality to revenue and design redundancies/backup options for high-risk suppliers, mfg. sites, WH’s
  - **Customized trade-off basis customer needs**
    - Identify competitive priorities basis product category and match those with supply chain capabilities
  - **Robust early warning systems & SOP for response**
    - Develop communication channels with partners for faster threat detection with well defined escalation matrix
  - **Invest in building resilience in business partners**
    - Invest in upgrading supplier’s risk management & early detection capabilities to serve as key competitive advantage during crisis
  - **Embed risk & demand analytics capabilities for better prediction of uncertainty**
    - Move from visibility and monitoring to scenario modelling and decision support
  - **Foster cross functional collaboration backed by agile organization**
    - Collaboration between sales, mfg, ops, logistics & SME’s backed by senior mgmt buy-in

**Enablers**

- **Strategic vision**
  - Resilience as uncertainty advantage Core to company’s strategy

Source: BCG analysis
Exhibit 7: CISCO has embedded end-to-end resiliency into supply chain

Risk management process spanning entire value chain

<table>
<thead>
<tr>
<th>Innovation</th>
<th>Plan</th>
<th>Source</th>
<th>Quality</th>
<th>Make</th>
<th>Delivery</th>
<th>Customer &amp; Field support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfect operations</td>
<td>Global planning &amp; fulfillment</td>
<td>Global support management</td>
<td>Technology &amp; Quality</td>
<td>Manufacturing operations</td>
<td>Logistics</td>
<td>Customer operations</td>
</tr>
</tbody>
</table>

Product Resilency

Incident Management

Business Continuity Planning

Unique resilience metric for transparent monitoring

<table>
<thead>
<tr>
<th>Very Resilient</th>
<th>Index categories</th>
<th>Key metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Component Resiliency</td>
<td>30% Single sourced, Component supplier TTR(^1), End of life parts</td>
</tr>
<tr>
<td>9</td>
<td>Supplier Resiliency</td>
<td>20% Supplier Financial Health, Supplier BCP compliance, Non PSL and new suppliers</td>
</tr>
<tr>
<td>8</td>
<td>Manufacturing Resiliency</td>
<td>30% Dual manufacturing sites, Qualified alternate sites, Manufacturing TTR(^1)</td>
</tr>
<tr>
<td>7</td>
<td>Test Resiliency</td>
<td>20% Test equipment TTR(^1)</td>
</tr>
</tbody>
</table>

Source: Supply Chain Risk Management at Cisco: Embedding End-to-End Resiliency into the Supply Chain - Submission for ISM 2012 Award for Excellence in Supply Management Authors – John O’Connor, James B. Steele, Kristina Scott CISCO

1. TTR - Time-to-recover
Supply chain resiliency – Aims to assess and improve resiliency across Cisco’s supply base, manufacturing and test equipment partners. A unique resiliency index score is calculated for the top 100 products by revenue and reported semiannually to senior management and works to identify and mitigate any circumstances that could limit these products from recovering in X weeks from a major disruption.

Business continuity planning - A semiannual process, enabled by a unique web-based tool to engage all critical supply chain partners in providing Cisco with over 36 resiliency data points such as emergency contact information, availability of alternate power supplies and estimated time-to-recover. This creates resiliency visibility into more than 1000+ supply chain nodes in over 50 countries.

Supply chain incident management - A process for monitoring worldwide events on a 24/7 basis, identifying and escalating any incident of concern, assessing impact and organizing a cross-functional response team to mitigate the risk to resolution. The crisis management dashboard and a robust set of crisis playbooks enable response to any event within a two hour timeframe.

Indian Oil – Robust business continuity planning for seamless customer service

Business continuity planning (BCP) is an essential part of Indian Oil’s annual strategic planning exercise. Due to the robustness of its BCP, the company could respond much faster and resolutely during the COVID lockdown period. In the midst of the nationwide lockdown, Indian Oil worked with critical stakeholders including crude suppliers, shipping companies, port authorities, OEMs, transporters, dealers, state and central administration to ensure operational continuity. This ensures that the company can serve customers even under extremely uncertain environments be it natural calamities or operational hazards-making it the preferred fuel supplier to Indian Defence forces.
2. Diversify the geographic footprint of the supply chain asset base

The focus on lean, global networks to achieve efficiency has led to companies sourcing a disproportionately large share of raw materials/components from a single supplier. This in turn leads to high risk of disruption if the supplier is impacted due to natural disasters or economic vulnerabilities. In order to build resilience, companies need to have multiple suppliers with built-in capacity buffering to hedge against such eventualities.

**Practical applications**

**PepsiCo – Supply chain design with contingencies**

The PepsiCo coconut water supply chain starts with growers in Philippines and Indonesia; uses copackers in Asia and in the United States imports goods through ports in California and New York; provides first line storage in warehouses near the ports; and then redistributes the goods to other distribution centers across North America based on demand. Typhoons and tsunamis are a common occurrence in the coconut growing region. To build resilience against natural calamities, PepsiCo uses three copackers in South East Asia located geographically apart so that the chances of all three getting impacted at the same time are minimized. There are additional copackers in the US as well to enable the final packaging of the product closer to the market. This higher cost alternative is to be used only in the case of a supply disruption.

**Toyota – Building redundancies for risk mitigation**

Toyota too has developed alternate production facilities for its suppliers, increased dual sourcing for key components and was able to recover from the Japan earthquake of 2016 in two weeks as compared to six weeks in 2011.

**Implications for oil and gas companies in India**

Companies should evaluate the risk exposure that they face due to close interlinkages with global supply chains. For example, imports of crude, LPG and high-value machinery and equipment are common. Even domestically, we should take a closer look at the extent of risk exposure that each supply point faces and pursue diversification for effective mitigation. Companies need to identify potential areas of risk concentration due to:

- A high proportion of imports coming from geographically contiguous countries prone to climate disruptions or geo-political unrest
- Supply points (refineries / storage terminals) that face risks that are similar in nature to those faced by coastal locations, being prone to floods and cyclones

Companies should also optimize their sourcing mix between long term contracts and the spot markets to balance flexibility and cost efficiency.

To build resilience in secondary logistics, it is critical to

- Optimize the balance between transport modes (rail, road and coastal)
- Deploy a mix of transporters in terms of financial strength, fleet sizes and capacities
Coconut farms destroyed by Typhoon Haiyan in Philippines
3. Customised trade-off between resilience and efficiency based on customer needs

Supply chain managers need to follow a systematic approach to match the competitive priorities of particular product categories with their supply chain capabilities. The trade-off between investing in resilience versus taking the risk of being hit when unprepared needs to be quantified. This will depend upon the likelihood of occurrence, the magnitude of impact and the ability to mitigate the disruption. Determining whether cost or response time is more essential for the product is important.

**Practical applications**

**CISCO – Matching product priorities with supply chain capabilities**

Customers of Cisco’s optical services routers, value short lead times and quick responses to service calls, based on product customization and differentiation, more than low cost. This calls for a responsive supply chain to minimize stockouts and maintain high service levels. To improve the resilience of its optical router supply chain, Cisco converted its global “lean supply chain” to a system in which the products are mainly configured to order from partially assembled components, thereby enabling flexibility.

On the other hand, price competitiveness was critical for Cisco’s simple routers. The demand for those products was more stable and did not require customization. More standardization meant that the supply chain could be designed to maximize cost efficiency, based on economies of scale, with products sourced from the lowest cost factories. This suggested that, for simple routers, Cisco needed a tightly coupled system and a streamlined supply chain.

Cisco traded higher efficiency for higher vulnerability in its simple router supply chain whereas it prioritized resilience and flexibility in the supply chain for specialized routers in line with market demands.

**Implications for oil and gas companies in India**

Similarly, O&G companies should create a systematic process to maintain the balance between resilience and efficiency in supply chains, based on the interplay of product segment and market demand characteristics. For example, the demand for MS/HSD in micro market A could be stable due to a very high market share. In micro market B, there might be high demand variation due to competitive forces at play. Hence, the supply chain catering to A could focus more on cost efficiency whereas that servicing B should have greater focus on resilience.

O&G companies should explicitly evaluate the risk exposures and vulnerabilities that different product segments face from a disruption. For instance, the risk of disruption from a breakdown in a particular storage terminal is relatively lower for aviation fuel having lower volumes, higher safety stock levels and alternate ways to service the demand from nearby terminals. Whereas, a high number of MS/HSD retail outlets whose single source of supply is the disrupted terminal will face a major shortage.

Careful consideration of such tradeoffs will lead to more informed decision making. By applying the risk management lens, O&G companies can limit risks from disruption while optimizing the storage terminal footprint. Consider a scenario where Terminal A is linked to two refineries through pipelines besides having road, rail and sea connectivity courtesy its coastal location whereas an inland storage facility B is linked to one refinery with no backup storage facility in the near vicinity. For Terminal B, the focus should be more on building resiliency through buffer storage capacity and more frequent replenishment as compared to Terminal A.

In summary, O&G companies need to carry out a segment-wise evaluation of the likelihood of disruption, the magnitude of the exposure and the ability to withstand the disruption and accordingly decide the supply chain priorities.
4. Robust early warning systems and SOPs for response

Perhaps the most critical aspect of building resilience is to have robust early warning systems to proactively detect disruptions. Real-time visibility of supply chain nodes creates the ability to produce immediate insights that can reduce reaction times from days or weeks to just hours or minutes in case of a disruption.

**PepsiCo – Early stress detection in suppliers**

PepsiCo worked with suppliers to improve communications and data quality around possible disruptions. Copackers in their coconut water supply chain report weekly on how many cases of each SKU they have produced, whether they have enough raw material to continue scheduled production, and provide reason codes associated with any failures to produce what they had committed. Routine checkpoints are established and on-site contacts identified to ensure there is regular communication between the supply chain organization and the supplier base. This requires active collaboration with partners and fostering an atmosphere of trust through investing in partner’s capabilities.

**Wilbur Curtis– AI based real-time risk monitoring**

Similarly, Wilbur Curtis, the world’s leading supplier of commercial beverage systems, partnered with RiskMethods, a provider of supply chain risk management software to automate its approach of managing risk. Through AI based web monitoring of supplier financials, order volumes and values and impending natural calamities, Wilbur Curtis was able to keep track of all risk related information and receive notifications on impending risks based on the level of urgency. It allowed for drilling down into the second and third tiers of the supply chain to better anticipate emergent risks even before they hit the tier 1 suppliers. Courtesy the alerts that the software threw up, they were able to speed up delivery of a shipment from a supplier in Taiwan and got the items out of the country before a major typhoon crippled the area where the supplier was located.

**Implications for oil and gas companies in India**

O&G companies can deploy various AI enabled intelligent monitoring systems across the value chain

- Intelligent sensor based pipeline monitoring system for leakage prediction
- Drone-based inspection of assets — columns, vessels and tanks — in depots, leveraging UAV, GIS and IPS technology for automated fault detection
5. Invest in building resilience in business partners

Given the complexity of supply chains today with suppliers spread across geographies, companies need to recognize the importance of building resilience in their suppliers and transporters as well as a single disruption to their operations could upset business continuity.

Practical applications

Zimmer Biomet – Collaborating with suppliers through a continual risk management program

Zimmer Biomet, the world’s second largest orthopedic company, recognized this and instituted a continual formal Supplier Risk Management program. The categories that Zimmer Biomet focus on in their program are single and sole-source supplier risk, business continuity risk and financial risk. They focus on third-party suppliers worldwide that produce critical products in all business segments, and they rank their priorities based on risk to revenue.

The process begins with a questionnaire to determine how the supplier is currently handling risk management. If a plan is already in place, Zimmer Biomet will advise on ways to evolve or reinforce it. If no plan is in place, they work with the supplier to put best practices into place and formalize their program, either directly or by referring them to additional resources. Each month, they meet with high-risk suppliers to make sure that project plans are implemented and resource needs are met.

In the two years since launch, they have been able to reduce the number of high-risk projects by 50% and expect to have 90% reduction by the year end.

ON Semiconductor – Mitigating supplier disruptions through detailed risk mapping

ON Semiconductor works with 16,000 suppliers for its manufacturing operations located in nine countries. The top suppliers in terms of revenue contribution with no backup plan and no dual sources are identified. They employ accountants from insurance company FM Global that work with these suppliers, go through their entire business model in detail and identify the key source of risks and their current level of preparedness. They go down two-to-five levels below the primary supplier to identify potential threats and work with them to mitigate that exposure. Says, Bret Ahnell from FM Global,

“If you don’t know anything, you are putting a lot of eggs in one basket and putting yourself at a great deal of risk. That’s not where you want to be.”

They also help suppliers secure funding from their insurer, to minimize the costs associated with making changes.

Implications for oil and gas companies in India

O&G companies should adopt a holistic approach in partnering with supply chain partners (dealers, transporters, suppliers) through

- Partner financial health monitoring – Regular review of partner financials, order volumes and values to determine the relative importance of the stability of the partner’s operations and for critical partners, extend support in times of crisis
- Monthly/quarterly risk management review and linkage with incentive structure – Map all partners on the 2X2 matrix of criticality and vulnerability to identify critical high-risk groups. Work with dealers and transporters to identify their key sources of risk and their level of preparedness. Help them to improve their risk resilience by instituting a risk management program, sharing best practices and extending financial support if needed. For example, top transporters in terms of volumes should be assigned a risk resiliency score based on the maintenance quality of their fleet, experience of drivers, safety features of the tanker truck etc. If the transporter’s score is below the threshold, the company should advise and support the partner with measures to improve upon the same. Rigorous reviews should be conducted with transporters to ensure that risk mitigation measures have been implemented. The incentive payout to the partners should also incorporate an element of risk resilience.
6. Embed robust risk analytics capabilities for better uncertainty prediction

Most companies have invested in ERP tools and IT systems to collect operational and performance data from multiple sources. However, merely using the data for building dashboards for visualization and awareness is not enough. To build resilience in supply chains through better and faster decisions in the times of crisis, companies need to develop advanced analytics capabilities that can generate actionable insights from the data through scenario characterization and impact assessment. This will enable not just rapid response in times of crisis, but also enable supply chain managers to proactively identify points in the supply chain where disruptions are expected to occur. Additionally, companies can also use the insights to become more customer-centric in their approach by identifying changes in demand pattern and new customer requirements.

**Practical applications**

**Hewlett Packard – Leveraging analytics for supply chain awareness and response**

HP’s predictive risk modeling platform demonstrates the power of advanced analytics capabilities for achieving resilience across its global supply chain comprising 110 manufacturing sites and 145 distribution centers (Exhibit 8). Their
business continuity planning platform is a centralized node for

- **Risk visualization** – For visualizing global risks in a single interface by consuming threat awareness feeds (weather patterns, change in trade terms) with severity status highlighted based on anticipated impact

- **Threat alert generation** – Auto notifications generated with details of the contact person e.g. the site manager if the threshold trigger for escalation is breached

- **Risk impact modeling** – Quantification of impact on lead-times and inventory buffers due to disruptions through a simulation engine. For example, evaluation of impact on inventory and lead time due to lithium batteries being banned as cargo on passenger planes

- **Response optimization** – Rapid prioritization among multiple response options based upon objectives and constraints through predictive modelling

This has resulted in a 96% reduction in their threat characterization times from >1 day to 1 hour leading to consistency in customer service levels. OTIF variance of only 14% has been maintained through multiple disruptions such as port strikes, earthquakes, flooding, etc.

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### Implications for oil and gas companies in India

O&G companies can share information with dealers about the exact transit status of deliveries. Likewise, dealers can share information with suppliers about their inventory levels. As demand rebounds post the COVID-19 crisis, companies can model the differential demand growth trajectories across RO's based on the extent of lockdown restrictions uplifted, the base demand etc.
7. Foster cross functional collaboration backed by agile organization

Supply chain resilience needs a risk-awareness culture of transparency, empowerment and cross-functional coordination with strong senior management backing in order to flourish. Building resilience is not only a matter of awareness, but of setting an intent across the organization, clearly communicating to the entire workforce, and taking tangible action to address the immediate and long-term risks.

**Practical applications**

**Walmart – Co-ordinated crisis response through collaboration**

Walmart established their global emergency operations center (EOC) to function as the centralized node for crisis response. It brings together experts from diverse disciplines such as operations, transportation, merchandising, logistics along with meteorologists, for developing a coordinated mitigation strategy against disruptions. During a disaster, they work closely with the local stores and field divisions to ensure emergency demand replenishment and transportation. From tracking demand patterns through social media to working with power companies to proactively deploy generators in areas of sustained power failure, the EOC is a prime example of how cross-functional collaboration can foster resilience and agility during a crisis. Says Mark Cooper, Senior Director of Global Emergency Management at Walmart.

**Cisco – Fostering a risk management mindset across the organisation**

A critical success factor behind Cisco’s supply chain risk management program has been senior management support and buy-in. Cisco’s product resiliency index scores are published across the organization and reported semiannually by general managers to BU heads. That senior level interest has led to business-unit-to-business-unit comparisons of risk vulnerability, which has led to internal competition, which, in turn, is driving down risk quotients across all business units.

Cisco provided product designers with clear and objective information about new designs and suggested remediation steps to derisk the design instead of giving them a blanket mandate. This led to high acceptance and helped ensure that designers think about resiliency as a product attribute rather than as the concern of operations executives. Cisco’s product development teams and commodity management teams worked together to develop resiliency plans such as specifying alternate components in a bill of materials or creating buffer stocks of key components in order to mitigate risk. This culture of openness has helped create an ownership environment, where warning signs of internal and external risks are openly voiced and employees feel responsible for the outcomes of actions and decisions when a risk event occurs, and work harmoniously towards a rapid resolution.

**Implications for oil and gas companies in India**

Given the hazardous nature of products transported and the high costs associated with disruptions, O&G companies should set up a central emergency response disaster management office comprising meteorologists, fire experts, and operations, logistics and marketing representatives to respond swiftly to any crisis with clearly defined SOPs, roles and responsibilities and delegation of authority. There should be a clearly defined action plan with well defined timelines to respond effectively to the disruption be it a natural disaster or operational turmoils such as a pipeline leakage, fire in a terminal or economic stress such as large section of transporters facing financial distress.

As the world continues to grapple with the challenges caused by COVID-19, we could start to see discontinuous shifts and a “next normal” beyond the recovery for supply chains. Rather than wait, oil and gas companies should recalibrate their supply chain priorities and embed resiliency as one of the key tenets. Unpredictability stemming from economic, political and climatic shifts is unlikely to decrease anytime soon. Efficiency alone cannot cope with this reality. Oil and gas companies with winning aspirations should take a proactive approach and invest in supply chain resiliency and continuity today so that they are better prepared to manage inevitable future disruptions.
AWS - Commitment to serve customer needs in harsh weather over inhospitable terrain

As an annual exercise, Indian Oil carries out advanced winter stocking (AWS) during the months of May-October to ensure supplies to the remote trans-Himalayan territories of Ladakh, Sikkim and Kinnaur. This activity involves clockwork coordination among personnel and processes at Indian Oil’s refineries, storage terminals and depots, and transporters and customers, including the Army. The components in the supply chain that enable Indian Oil to achieve the unique feat of transporting 140 TKL of petroleum products and 33k tonnes of LPG over two of the world’s highest passes include:

- Special tankage of 400 KL winter grade HSD having pour point less than minus 30 degrees celsius is created at the Leh depot to cater to Army demand during winter
- Days available from a location is considered from the date of start of loading from that location till target date of completion
- Day-wise monitoring of dispatches from each location for comparing with the prorated days available

BS-IV to BS-VI transition – Seamlessly powering India’s cleaner fuel revolution

Nothing demonstrates the agility and resilience of Indian Oil’s supply chain better than the smooth pan India roll out of BS-VI-grade auto fuels in a record time of three years. This project required upgradation of the 11 refineries, revamp of the entire downstream infrastructure of 119 terminals, 14000KM of pipelines, creating SOP, training people and instituting a robust monitoring system for project execution. The strategies that Indian Oil used to navigate the multiple challenges and roadblocks that came in the way demonstrate the practical application of various elements of the supply chain resilience model, namely...
Robust monitoring systems and SOP for response – A detailed tank by tank conversion plan was prepared with centralized monitoring. Vendor failure risk was mitigated through a robust selection process and by working with multiple vendors.

Partnership mindset in dealing with vendors and suppliers – Coordinating with international equipment suppliers to ensure timely deliveries and working with domestic vendors to surmount contracting challenges arising from GST implementation.

Agile decision making – Power of attorney was given to the project management consultant to take decisions up to a certain financial amount. This shortened the decision-making process and resulted in faster execution of the work.

Project management excellence – The lighthouse model of piloting, learning and scaling up was followed. The NCR pilot model was replicated pan India. This allowed sufficient time for learning and validation to minimize failures.

COVID-19 pandemic – Keeping the wheels of the nation running during crisis

Ability to ensure the smooth and uninterrupted supply of POL and LPG for households and emergency services during the lockdown demonstrates that Indian Oil has imbibed supply chain resilience as a key strategic priority. The primary contributing factors behind Indian Oil’s ability to overcome the many challenges faced during COVID are:

- Dedicated fuel transporters and gritty crew members with unmatched work ethic
- Outreach and coordination with central and local government officials for timely transport permits
- Strict enforcement of safety measures among truck crew and support staff including distribution of personal protective equipment
- GPS-enabled vehicle tracking system enabling real-time optimization of transport routes

To manage the unprecedented buildup of inventory during the COVID-19 crisis, Indian Oil converted all their time chartered vessels to floating storage units, turned around the under-maintenance storage units, and used hospitality storage besides exporting surplus products. Such agile and decentralized decision making allowed Indian Oil to continue running their refineries even during the lockdown.
Indian Oil Corporation Limited (Indian Oil) is India’s flagship National Oil Company. It is a diversified energy major with presence across the entire hydrocarbon value chain from refining, pipeline transportation & marketing, to exploration & production of crude oil & gas, petrochemicals, gas marketing, alternative energy sources and globalisation of downstream operations.

Indian Oil is the market leader in Indian Petroleum sector with 44% market share. On an average the company serves 23 million customers on a daily basis through 50000+ customer touch points. Indian Oil group has consolidated revenues of $ 77.5 Billion and as per Fortune 500 rankings the company ranks 117th globally and 2nd in India.

The company has global footprints in countries like Sri Lanka, Bangladesh, Mauritius, the UAE, Sweden, Singapore, Canada, Russia, USA and The Netherlands.

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