

A Strategic Response to Disruption in the Crude Oil Industry: Insights from Contemporary Literature

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Abstract

The current spike in crude oil prices due to the Russia Ukraine war notwithstanding, the international crude oil industry value chain is witnessing a fundamental strategic shift in recent times. A variety of factors is causing this shift, including the automobile industry's inching towards a slow but gradual Electric Vehicle future coupled with extraordinary consumer behavior exhibited by millennial and post-millennial consumers- where apart from being carbon-footprint sensitive, they move from ownership of assets (including cars) to sharing economy. In addition to that the uncertainties thrown by COVID-19 impact the crude demand-supply dynamics and put pressure on crude oil prices, thus posing significant challenges for the industry. A comprehensive review of current literature has been undertaken to identify a framework that suggests a strategic response to tackling disruption in the global crude oil industry.

Patterns emerging from some refining hubs indicate some initial response to the challenges faced by the international crude oil industry, especially in the light of lowering demand from conventional consumers. The refineries value chain of the oil industry is gearing up to redesign its product mix to tackle this. Crude oil industry players are slowly but gradually making investments in the renewable energy industry. Moreover, the crude oil exploration and production industry is also to reap the benefits of leveraging Information and Communications Technology (ICT) for business optimization to ensure a systematic sustainable future for them.

Keywords: Crude Oil Value Chain; Electric Vehicles; Carbon Intensity; Downstream; Renewable; ICT; Strategic Framework.

Introduction

Starting from E&P and progressing through storage & transportation, refining, and further distribution of petroleum products to end consumers, the international oil industry value chain is witnessing a fundamental strategic shift in recent times.

Incidentally, it is not just the oil industry that is witnessing changes. As

per research (Patel et al., 2017), the entire world energy system is undergoing transformation. Rising demand in emerging markets, new energy sources, and the likely growth of electric vehicles (EVs) are just some of the elements disrupting the status quo. It is difficult to determine how the reverberations will affect the extraordinarily complex network of sectors and stakeholders. The study has identified the game changers for companies and policymakers, as well as their implications. New energy sources, mobility, and industry fragmentation are set to disrupt the system.

Some of the major factors that are causing this shift include the automobile industry's inching towards a slow but gradual Electric Vehicle future (Economic Times, 2019) coupled with extraordinary consumer behavior exhibited by millennial and post-millennial consumers—where apart from being carbon-footprint sensitive (Davis, 2015), they move from ownership of assets (including cars) to sharing economy.

As per a report by World Economic Forum {WEF (1), 2019}, “the present transition in the global energy system has been prompted by concerns over climate change, falling costs of renewables, and the speedy market penetration of electric vehicles (EVs)”. This transition if not appropriately tackled, has serious implications for the global oil industry.

Some recent reports (Cleantechnica, 2019; Bloomberg (1), 2019) have postulated that Electric Vehicle prices shall have parity with ICE cars soon. Conventional car manufacturers are stepping up investments in creating EV manufacturing facilities. The report also talks about changing consumer attitudes towards EVs and EV manufacturers are tackling some consumer apprehensions about EV function. Besides from imminent price parity, EV manufacturers are also making strides in developing compact batteries with more densely packed energy. Experts feel that by 2030, costs for motors, inverters, and power electronics could be 25 to 30 percent lower than they are today (Bullard, 2019). Moreover, EV technology is gradually finding a place in marine transport applications also. OPEC— though conservatively—also in their 2019 Oil Industry Outlook, acknowledges the steady growth of EVs in global vehicle fleet share. (OPEC, 2019)

It is also noteworthy that world crude oil consumption (in million barrels per day) has been growing at a less than 3% for the past 15 years (Statista, 2020). Moreover, it is slated to remain so and even may go below that. Urban pollution, climate change, and subsequent tighter rules on emissions may bring about the prospect of 'Peak Demand' (The Economist, 2019). While climate change, urban mobility, and emission issues are important, any adverse impact on the Oil industry, having USD 16 trillion of capital and 10 million employees, has serious consequences for energy markets and geopolitics. With the prospect of oil suppliers' and buyers' equations being rewritten, energy markets may see serious upheavals and the resultant geopolitics may witness turbulence. As per The Economist (2019), 26 countries rely on oil income for 5% or more of their GDP. That means many countries whose marginal cost of production is high (and also crude oil quality is low) may see the possibility of terrible economic consequences. Even US Shale oil needs an oil price of USD 40-50 per barrel to break even.

In addition to that the uncertainties thrown by COVID-19 impact the crude oil demand-supply dynamics and put pressure on crude oil prices (the current spike in crude oil prices due to the Russia Ukraine war is an aberration), thus posing significant challenges for the industry (Filipe et al, 2020; Verma, 2020; Blackmon, 2020; Taylor, 2020; Kar & Bansal, 2020; Collins, 2020; Jefferson, 2020).

In view of the abovementioned challenges faced by the crude oil industry, an attempt has been made to explore the current literature in order to identify the strategic response of the international crude oil industry to these challenges.

Identifying the Oil industry's strategic response: Exploring contemporary literature

After the 80s and 90s, which have been classified as lost decades (Katakey, 2015) for the international crude oil industry due to depressed international crude oil prices and slow growth in demand, the crude oil industry had started looking up at the beginning of the 2000s. However again in 2008, the U.S.-led global economic slowdown affected the investments and returns in the global crude oil industry, which took about 2-3 years to recover. The start of the

second decade of the 2000s seemed to be a little promising for the industry when oil prices had crossed 100 U.S.D. per barrel. However the euphoria did not last long as at the beginning of 2014, the crude oil industry witnessed a sharp drop in prices and also subsequent minuscule/negative growth in demand. The trend continues even after 6-7 years of the start of the low-price era for the international crude oil industry (The current spike in crude oil process due to the ongoing Russia-Ukraine war is an aberration). And it has been during these times that the oil industry has been having a serious relook at its strategies to have a sustainable future for their industry.

Thus it would be germane to review the current literature (Duursma, 2014) of about the past 5-6 years to understand the methodological response to the challenges faced by the crude oil industry. That would help in identifying a suitable strategic framework (Hourani, 2017; Guillermo et al, 2020; Isoherranen, 2012) that articulates the response. Following section deals with this current literature review.

Abington & Gilblom (2019) report that “Shareholder pressure, evolving new technologies and rapidly changing consumer preferences have forced oil and gas companies to re-evaluate their long-term strategies and explore new business streams” and oil companies have been diversifying into renewable businesses. The oil industry is perhaps one of the most important allies of the renewable energy industry as they cannot afford to remain behind the technology curve where the energy system evolution is putting renewables in a prominent position. Sensing this all major oil companies are making significant strides-maybe slow in the beginning but steady- in this space. (Chatsko 2018). This is indeed a significant departure from the scenario, a few years ago, where oil majors were superficial in their approach to having renewable energy in their overall energy (predominantly hydrocarbon) portfolio (Csomós, György 2014).

Europe's major oil companies including Shell, BP, and Total, apart from investing in renewables are also venturing into the production, distribution, and sale of electricity to industrial, residential, and transport markets, in direct competition with traditional multinational utilities. This diversification, though small for now, signifies the

transition of oil and gas companies into full-spectrum energy suppliers. Investment in renewables is also a means to reduce their carbon footprint and earn green credentials. Apart from global concern over the impact of climate change and heightening public concern to reduce carbon footprint, economics also plays its part in the oil industry's diversification into renewables and electricity markets. The growth in demand for coal, oil, and gas is dipping in Europe and the United States. Additionally, investors are becoming conscious of the climate and environmental risks in their portfolios. Hedge fund managers ranging from the New York Pension Fund, the World Bank, and Norway's trillion sovereign wealth funds, have indicated phased divestments in fossil fuels. (Newman, 2019).

Golden (2019) believes that given their cash flow abilities to invest in R&D and scalability, they being tactical and owing distribution networks, the oil companies are poised to be apt renewable energy allies. In addition, Chatsko (2018) has also documented the oil companies' attempts toward the transition to clean energy.

It is important to put this transition (though partial) to renewable energy in the perspective of timelines. As per an estimate (OIES, 2019) 2018 onwards, wind and solar are adding around 270TWH (Terra watt-hour) per annum of new energy each year for \$300bn per annum of investment for Oil & Gas companies; the same as Upstream Oil which adds +2,000TWH per annum. And this transition is a multi-decade journey (OIES, 2019). At the macroeconomic level, the speed and trajectory of energy transitions would vary depending on the specific geographies and economic sectors (BCG, 2019). Fattouh et al (2019) argue that, due to the high uncertainty, oil companies need to develop strategies-which are flexible and evolving- that are likely to be successful under a wide set of possible future market conditions. Moreover, for oil-exporting economies, there is no trade-off involved in renewable deployment as such investments (in renewables) can unshackle oil and gas for export markets, improving the economics of domestic renewables projects. In the long run, however, the main challenge for many oil countries (and companies) is economic and income diversification as this represents the ultimate safeguard against the energy transition. Luhavalja

& Tsao (2019) and Bouso & Twidale, (2019) discuss an 'important transition' in the global energy industry, with an increasing appetite for electricity, natural gas, and renewables as alternatives to help decarbonize the world's fuel mix. All major conventional fossil fuel energy players are significantly investing in low or no-carbon energy and new technologies to augment their traditional oil businesses. As consumer preferences shift and evolving technologies open more revenue streams, oil companies are diversifying where they get their energy from. The quickening pace of the transition to low-carbon energy among the world's largest fossil fuel producers reflects this (Bloomberg (2), 2019). Pyper (2019) documents the strides made by global hydrocarbon fuels giant Shell in the area of not only renewable energy but also diversification in electricity generation as measures towards de-risking their oil & gas business along with contributing towards the mandate of clean energy. Ziady (2020) quoting a global energy think tank, the International Energy Agency (IEA) argues that no energy company will be immune to the wave of clean energy transitions. Oil companies are facing mounting pressure from investors, governments, and activists to consider renewable energy as an important part of their overall portfolio (Ken, 2019; Yarygina, 2019; Blasi & Toril, 2019)

Certain patterns emerging from some refining hubs are a pointer toward an initial response to the challenges faced by the international crude oil industry, especially in the light of the lowering of demand from conventional consumers. Refineries are gearing up to redesign the product mix to tackle this (Pathak, 2017; Duane et al, 2019). This could be viewed as an attempt to ensure a systematic sustainable future for the international oil companies. As per a McKinsey study, demand growth for refinery products is shifting towards Asia and non-fuel end uses, such as petrochemicals (Billing & Fitzgibbon, 2019). Other expert opinions also support this proposition (OPEC, 2019; KPMG, 2019; Equinor, 2019). Thus despite the fall in demand for crude oil for fuel usage, refining capacity is projected to be added up (though at a lower rate) due to change in refinery product mix (Billing & Fitzgibbon, 2019). As many parts of the world adopt new

petrochemicals-derived synthetic material applications for not only replacing costlier (and exhaustible metals/wood) but also discovering novel usages, despite a fall in European markets, Asian and North American markets' growth keep overall refining capacity utilization respectable (Billing & Fitzgibbon, 2019). This is a pointer toward the crude oil industry's slow but gradual reduced dependence on liquid fuel-driven demand for refinery products. Changes are in the offing in Asia's second-largest refinery hub, India too. India's 2nd largest refinery products manufacturer, Reliance Industries has drawn up a perspective plan to produce only jet fuel and petrochemicals at its mega Jamnagar refinery complex as it gears up to implement an oil-to-chemical strategy that will eliminate most fuels it produces in favor of high-value products. By this, the company is preparing its Jamnagar, India complex, the world's largest refinery at a single location, to be future-ready as fuel demand undergoes change with the advent of electric vehicles. (Economic Times, 2019). Thus while fuel consumption patterns may undergo change, the oil industry may be able to withstand this by tweaking the downstream refinery value chains to focus on non-fuel refinery products and also aligning refinery capacity planning with the needs of geographies.

In an era of sliding crude oil prices and shifting consumer preferences, harnessing new technologies by global oil sector players can boost efficiency. Leveraging recent technological advancements, oil executives should consider digital technologies with the potential to transform operations and create additional profits from the existing capacity (Tan, 2019; WEF (2), 2017; Choudhry et al, 2016). Research (Choudhry et al, 2016) finds that the effective use of digital technologies in the oil sector could reduce capital expenditures by up to 20 percent; it could cut operating costs in the upstream by 3 to 5 percent and by about half that in downstream and that may result in up to \$1 billion in cost savings or production increases. The three major categories of applications of digital technologies in the oil sector are Operations Management (including using advanced analytics for predictive maintenance and yield optimization), Reservoir Management (using 4-D seismic imaging for increasing reservoir limits and significantly

reducing capital expenditures), and digital-enabled marketing and distribution (using digital technologies to gain better insights in consumer behavior and using geospatial analytics, for example, for increasing the efficiency of their supply & distribution networks through location planning and route optimization).

Brinkman et al, 2016 had in the recent past opined on five technologies viz. mobile, the Internet of Things (IoT), machine learning (ML), robotics, and blockchain technologies that over the next decade will change a great deal about how the oil industry works. Mobile will speed oilfield transactions, increase efficiency, and improve safety by removing people from hazardous locations; the Internet of Things (IoT) has the potential to reduce the cost of repairs; Machine Learning shall deliver ever more optimal solutions to field challenges; robotics is poised to change the work systems drastically, and blockchain will make contracting speedier and smoother than ever before.

However, experts feel that adopting these technologies will be a challenge for many in the oil industry, requiring a mindset change. Engineers as they tend to work on certain immediate issues, risk caught in the myopic view trap, as do companies trying to maximize their return on investment. But investments in these transformative technologies now will mean less to fix in the future, and more time to innovate, operate and develop resources as fully as possible—which is what the oil industry requires today. These technologies will be key to operating more effectively, and safely, at lower costs. Given what is known about the availability of supply and known reserves of non-conventional that can be brought online quickly at each price level, the next ten years likely will be an era of industry restructuring and cost optimization. But that cannot be done at the expense of safety. These five technologies are critical enablers of safety also. Together they can significantly increase the overall efficiency of routine processes by eliminating steps and reducing downtime between tasks. Moreover, they will improve safety, for instance by saving the field tech the need to drive to fetch supplies.

Over the next few years, it will be important for oil companies to track them and their applications, and to

participate in their development and adoption. Some applications may rise gradually in the industry; others may rapidly reach a tipping point where processes shift overnight to the new way of working. The move from employees to freelance contractors for fieldwork (the 'sharing economy' analogy) could occur quickly under certain conditions; for example, continued cost pressure, a viable “marketplace” app, and rapid adoption in a region. However these technologies evolve, and at what pace, it will be better for the industry to run ahead of the curve than behind it. Ward (2016) has discussed making better use of existing technology can deliver serious returns by increasing production, streamlining the supply chain, or reducing engineering time by advanced analytics/machine learning and simplifying process automation. All this, in his opinion, has the potential to bring about savings to the tune of USD 1 billion.

Vega-gorgojo et al(2016) discuss the impact of big data in the exploration and production of oil & gas in the Norwegian Continental Shelf Overall explaining how the industry is currently transitioning from mere data collection practices to more proactive uses of data, especially in the operations area. The study also discusses operational and financial impacts associated with the use of big data comprising data generation and data analytics business models, commercial partnerships around data, and the embracement of open data not only by the industry but also by the Norwegian regulator. Gezdur and Bhattacharjya (2017) mention that the increase in data richness from the digitization of supply chain processes could help oil & gas companies manage risks, and increase collaboration and profitability. Studies as reported by Tan, (2019), WEF(2) (2017), Marie-Hélène Ben et al(2019), and Wakama (2017) find that digitization remains a key focus for oil companies and that lot of oil firms believe digital transformation can drive process efficiencies resulting into significant cost advantages.

The oil industry's investment initiatives in the digitization of oilfields with integrated data communication across wellheads, pipelines, and mechanical systems have the potential to enhance the value of oil assets to the extent of 25%. (Finance-monthly, 2019). Businesswire (2018)

reports that oil and gas companies across the globe are using (information) technology to improve their decision-making process. By doing this, they are not only able to tap new resources and increase recovery rates but also lessen the environmental impacts. The oil industry, thus by aligning with the developments in emerging Information & Communication Technologies can derive significant advantages in almost all major functions of the value chain. Senior management must be proactive and supportive of the efforts of the ICT team and must treat the outgo as an investment rather than an expense.

Discussion

The macro-level developments while presenting huge challenges, also offer significant opportunities to the Oil industry. As derived from the current literature review above, these include a gradual change in the portfolio of

conventional oil companies, including renewables, a review of their downstream businesses by understanding future refinery product mix, and at the same time making the best use of modern tools of Information & Communications Technology. In very few instances oil industry has also been considering diversifying into Hydrogen Fuels (The Conversation, 2017; Energy Post, 2020).

The framework of Strategic Response to Tackling Disruption in the Crude Oil Industry

Three major strategic responses were derived from the contemporary literature review and used as inputs to suggest the framework that also explains the rationale behind these options along with the imperatives from the crude oil industry. The framework is as follows:

Table1: Framework of Strategic Response to Tackling Disruption in the Crude Oil Industry

Options for Crude Oil Industry	Rationale	Imperatives	Time Frame
1. Gradual Transition towards Renewables	Part of Energy System Clean Energy Public Acceptance Sustainable Scalable Goodwill Relatively NIMBY* effect Free Long-range window as renewables are going to stay	Stitching up M&As Agility Investments in R&D Preparedness for relatively modest ROI Organizational capabilities to deal with the new Energy System Shareholders' buy-in Integration/Synergies with existing Hydrocarbon Business	Medium to Long term
2. Reviewing Downstream Refinery Business	Tweaking existing Hydrocarbon value chain In alignment with the existing business model Identifying new refinery product mix good for the long run Opportunities for scale and scope economies Respectable gross refining margins	R&D investments Tackling NIMBY* effect Significant investments in refinery infrastructure and technology Innovations in water resources conservation Collaborating with the Materials Science industry.	Short to Medium Term

Options for Crude Oil Industry	Rationale	Imperatives	Time Frame
<p>3. Leveraging Information & Communications Technology</p>	<p>Leveraging opportunities for business efficiency and optimization Effective Reservoir Life Cycle Management Significant cost savings Positive Health, Safety, Security & Environment (HSSE) externalities Leveraging scale and scope economies</p>	<p>Outgo in creating ICT infrastructure and skill-set to be viewed as an investment and not an expenditure Effective collaboration with the ICT industry Ensuring senior management buy-in ICT to be viewed beyond usual technological interventions Industry-wise knowledge sharing for best results</p> <p><i>*NIMBY: 'Not in my backyard'-Public resistance to polluting industries in their neighborhoods.</i></p>	<p>Short to Medium Term</p>

Strategic frameworks provide a structured understanding of the formulation and implementation of strategy in organizations (Hourani, 2017; Guillermo et al, 2020; Isoherranen, 2012). The global crude oil industry is grappling with unprecedented macro-environmental challenges and hence stakeholders of the industry need an articulated approach to deal with various facets that are relevant for long-term survival and growth of the industry. Strategic frameworks deal with all these facets and also provide a direction where various elements of the particular framework can be further quantified to enhance the robustness of the frameworks. Nevertheless, even theoretical strategic frameworks derived from systematic approaches such as current (or extant, as the case may be literature reviews are a good starting point towards gaining insights (and also providing inputs) into the strategic management processes of organizations, including the international crude oil industry.

Given the mounting political, social, and economic pressures to fast-track on sustainable energy transition, falling crude oil prices, and changing consumer attitudes, oil companies, whose business models and technologies may be (currently) incompatible with this transition, are the ones posed with major challenges. However, they shall have to overcome these challenges as their future depends on seeking medium to long-term solutions. The paper

analyzes how the oil (and gas) sector is gearing up to tackle these by also identifying some of the opportunities and risks they face. First of all, there is a crucial issue that oil companies need to consider when strategizing for the energy transition: whether the transition is possible within not only the existing socio-technical regime but also current business frameworks, or it will require a major change that requires new practices, regulations, values, perceptions, and business models, as well as new technologies. (OIES, 2019; BCG, 2019). The oil and gas sector's approach to this will determine its preparedness to tackle the challenges of the desired energy transition. As discussed in the derived framework (Table 1) these changes go way beyond new investment opportunities; they require a fundamental reconsideration of energy and other stakeholders in sustainable energy and digitalized world. Second, it has been derived that oil companies will have to fundamentally alter their refinery business model. And this change has implications not only in terms of changed business model, product mix, and revenue streams but also how society in general views the (seemingly polluting) refining business. Thirdly, the oil companies should log on to technologies where they see real opportunities and they are in a good position to exploit them for reasons owing to efficiency and subsequently hedging against declining or stable oil prices. Effective collaboration with Information &

Communications Technology industry and industry-wide knowledge sharing would be crucial to exploiting the benefits of digital technology.

Finally, as the global oil & gas industry gears up with the responses available (as opportunities) to tackle the disruption (threats) caused by macroeconomic factors beyond its control, it is important to understand how the industry can overcome its weaknesses and leverage on its strengths to create a good strategic fit.

1. One of the weaknesses of the oil industry is its perception as an industry that pollutes. Hence any attempt to decarbonize its portfolio by adding renewables certainly helps the industry overcome this weakness.
2. Recasting downstream (refinery business) leverages the oil industry's one greatest strength- the capability to commit substantial capital expenditures and effective project management. Any such recasting of refinery business will certainly be aided by this strength and this value chain transformation shall be much easier.
3. Similarly since technology has been one of the inherent strengths of the oil industry, any move to harness the benefits of digitalization from Information & Communications Technologies for its effective and efficient operations shall be again a natural advantage for the industry. Also since committing adequate capital expenditures has been one of the strengths of the industry, thus adequate outlays for a digital transformation shall also be facilitated by this strength.

Conclusion: Evolving Oil industry ecosystem

The global energy system is changing and this change is being driven by the need to move towards a sustainable energy world. There is significant pressure from all stakeholders of the global ecosystem on the world's decision-makers to take serious steps against carbon emissions and transit towards a clean energy ecosystem. Consistent technological advances have resulted in noteworthy development of new energy sources, with solar and wind energy having an important place in the world energy basket. The steep drop in battery prices is resulting in electric vehicles achieving price parity with internal

combustion engine-based vehicles, and gradually moving towards an electric transportation system. Further, as cleaner technologies achieve cost competitiveness, this transition, unlike in the past, may involve displacing a larger portion of fossil fuel demand for the transport sector with cleaner energy sources. The tangible impact of these changes on oil and gas companies will depend on the rate at which these evolutions occur. In a business as usual (BAU) scenario, as world energy demand continues to increase, hydrocarbon fuels will continue to play a significant role in the world energy mix until at least the next three decades. However, if a rapid change (owing to factors discussed above) is witnessed, despite hydrocarbon fuels' significant presence in the global energy mix, it is very likely to observe a substantial replacement of hydrocarbon fuels' demand by renewables from key sectors, particularly transport. However, in all scenarios, the expectations from the oil and gas sector to take significant steps to reduce carbon emissions (in all parts of their value chain) remain. It is thus critical for the sector to proactively invest in technology, digitalization, and clean energy advancements in order to ensure that they can not only move their portfolios towards net-zero emissions but also achieve efficiency in their operations.

At the same time along with this transition, the companies also need to revamp their portfolios- for example, a serious relook at refinery operations- to ensure operations' profitability. Incidentally, given its long history of existence and capabilities built over a period of time, the hydrocarbon sector has both the financial power and the scale-scope of its activities to successfully spearhead any significant future energy transition. As the world crude oil industry witnessed upheavals, the players have to chart a course of action for its sustenance and growth. Identified strategies should have a long-term perspective and need to be in sync with the basic characteristics of the crude oil industry at least in the immediate future. Only then the leveraging of existing capabilities shall take place without the crude oil industry having the need to go for a different trajectory or entirely divergent business models. However, along with the oil industry's sights on the renewable sector, their leveraging of ICT for optimum advantages, and reworking the midstream

value chain, the crude oil industry also needs to be ever ready to chart an offbeat course whenever the need arises. That's because consumer behavior is fickle and technological disruptions inevitable.

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