

**COST INVOLVED IN EXPLORATION, PROCESSING
AND TRANSPORTATION OF OIL AND GAS**

BY

ZISHAN MALLICK

SAP ID: 500057209

Guided By

**ZAFAR KHAN, FINANCE MANAGER,
NASIM AHSAN CONSTRUCTION PVT. LTD.**

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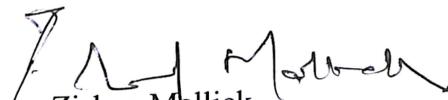
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Zishan Mallick,

8/1 Rai Charan Paul Lane, Kolkata 700046

Mobile: 8820529825

Email: zishan1239@gmail



NASIM AHSAN CONSTRUCTION PVT. LTD.

APPENDIX – III

Declaration by the Guide

This is to certify that the Mr Zishan Mallick, a student of MBA Oil & Gas Management Program, SAP ID 500057209 of UPES has successfully completed this dissertation report on “Cost involved in exploration, processing and transportation of oil and gas” under my supervision. Further, I certify that the work is based on the investigation made, data collected and analyzed by him and it has not been submitted in any other University or Institution for award of any degree. In my opinion it is fully adequate, in scope and utility, as a dissertation towards partial fulfillment for the award of degree of MBA.



Name & Designation: Zafar Khan, (Finance Manager)
Address: Ward No 03 Bathauli Post Tilrath Dist Begusarai Bihar 851122
Telephone:
Mobile: +91 8677850597
E-mail: zafarkhan2093@gmail.com

Table of Contents

List of Tables and Illustrations	i
List of Figures	ix
Executive Summary / Abstract	x
Chapter 1: Introduction	1
1.1 Overview	1
1.2 Background	1
1.3 Purpose of the Study	1
1.4 Research Hypotheses	3
Chapter 2: Literature Review	4
2.1 Review Area Broad	4
2.2 Review Area Narrow	9
2.3 Factors critical to success of study	9
2.4 Summary	12
Chapter 3: Research Design, Methodology and Plan	13
3.1 Data Sources	13
3.2 Research Design	14
3.3 Survey Questions	14
3.4 Interview Procedures	15
3.5 Data Analysis Procedures	15
Chapter 4: Findings and Analysis	17
Chapter 5: Interpretation of Results	19
Chapter 6: Conclusions and Scope for Future Work	21
Bibliography	23
Appendix: Interviewer Script	24

Crude Oil Consumption by Country- December 2019

Rank	Country	Consumption (Thousand Barrels per Day)	
1	United States	18,961.00	
2	China	10,480.00	
3	Japan	4,557.00	
4	India	3,660.00	
5	Russian Federation	3,493.00	
6	Brazil	3,003.00	
7	Saudi Arabia	2,961.00	
8	Germany	2,435.00	
9	Canada	2,374.00	
10	Korea, Republic Of	2,328.00	

Source: United States Energy Information Administration

The 5 largest Indian oil and gas companies by revenue in 2018

Rank	Name	Industry	Revenue (in ₹ Crore)	Revenue growth	Profits (in ₹ Crore)	Headquarters
1	Indian Oil	Oil and gas	424,321	13.2%	22,189	New Delhi
2	Reliance	Oil and gas	410,295	28.2%	36,075	Mumbai
3	Oil and	Oil and gas	333,143	11.0%	22,106	New Delhi
4	Bharat	Oil and gas	238,638	13.7%	9,009	Mumbai
5	Hindustan	Oil and gas	221,693	13.4%	7,218	Mumbai

Source: Fortune Indian 500

Tables showing cost involved in exploration, processing, and transportation.
(Source- Ministry Of Corporate Affairs)

PROFORMA
Statement showing the details of Survey Cost

Name of the Company	
Name of Geological Area Surveyed	
Period	

Cost Information:

Sno.	Particulars	Brought Forward	Current year	Total Amount Rs.
1.	Materials			
	a) Explosives and Detonators			
	b) Others (to be specified)			
2.	Direct Employees Cost			
3.	Contractual Services			
	(a) Shot Hole Drilling			
	(b) Contractual Payments			
	(c) Others (to be specified)			
4.	Other Direct Expenses			
	(a) Data Processing cost			
	(b) Data Interpretation Cost			
	(c) Transport Expenses			
	(d) Insurance			
	(e) Land Expenses			
5	Repairs and Maintenance			
6.	Depreciation			
	(a) Acquisition			
	(b) Processing			
	(c) Interpretation			
	(d) Transfer In or Transfer Out			
	(e) Others (to be specified)			
7.	Royalty or Technical Know-How or Lease Rent			
8.	Administration Overheads			
9.	Others (to be specified)			
10.	Expenditure Transfer In or Transfer Out			
11.	Total Survey Cost			

II Status:

Sno.	Particulars	Total (Rs.)
1.	Cost of Survey transferred to Producing Properties.	
2.	Cost of Survey directly charged off to Cost of Production	
3.	Cost of Survey carried forward	
4.	Others (to be specified)	
Total Survey Cost		

PROFORMA
Statement showing Cost of Exploratory Drilling or Development Drilling

Name of the Company	
Area under Exploration or development: Offshore	
Name of the Block	
Period	

I Quantitative Information:

Sno.	Particulars	Unit	Current	Previous Year
1.	Status of Wells (a) Under Drilling (b) Under Testing (c) Dry (d) Hydrocarbon Bearing (e) Service Wells			

II Cost Information:

Sno.	Particulars	Amount (Rs.)		
		Brought Forward.	Current year	Total Amount Rs.
1.	<u>Preparatory Cost</u> (a) Land (b) Approach Road (c) Civil Work (d) Others (To be specified) Total Preparatory Cost			
2.	<u>Drilling – cost of Rig or Drill Ship Operation</u> (a) Material Cost (i) Indigenous (ii) Imported (iii) Self Manufactured/Produced (b) Direct Employees Cost (c) Repairs and Maintenance (d) Other Drilling Overheads Total			

PROFORMA

Statement showing Cost of intermediate-activities like Lifting, Conveying, Treating and Transportation of Crude Oil or Natural Gas

Name of the Company	
Period	

Quantitative Information:

Sno.	Particulars	Unit	Current Year	Previous Year
1.	Gross Production			
2.	Used for Mining Operation			
3.	Transit Loss			
4.	Unavoidable loss or flaring			
5.	Bottom Sediment and Water			
6.	Net Production			
7.	Net Production in appropriate oil			
8.	Transferred to Refinery or Extraction plant			
9.	Sales			
10.	Trunk Pipeline capacity			

A. Cost of Transportation of Crude Oil / Natural Gas

Sno.	Particulars	Amount		Cost per Unit	
		Current	Previous	Current	Previous Year
1.	Consumables (a) Pour Point Depressant (PPD) or Flow Improver (b) Others (specify)				
2.	Crude Oil Conditioning Plant				
3.	Utilities (specify)				
4.	Direct Employee Cost				
5.	Direct Expenses				
6.	Consumable Stores and Spares				
7.	Repairs & Maintenance				
8.	Logistic Services or Transport Allocation a) Marine Tankers b) Pipelines c) Road d) Rail				
9.	Depreciation				
10.	Other Overheads (a) Service Overheads (b) Administration Overheads (c) Others (to be specified)				
11.	Others to be specified				
12.	TOTAL COST OF TRANSPORTATION				
13.	Less: Amount received separately customers, if any.				
14.	Net Cost				

PROFORMA
Statement showing the Cost of Production of Crude Oil / Natural Gas

Name of the Company	
Name and address of the Producing Unit	
Period	

1. Quantitative Information:

Sno.	Particulars	Unit	Current Year	Previous Year
1	Opening Stock			
	1a. Opening Stock in Tanks & Pipelines			
	1b. Opening Stock in Installations			
2.	Gross Production including Condensate			
3.	Less: Used for Mining Operation (Internal use)			
4.	Less: Transit Loss			
5.	Less: Bottom Sediment and Water			
6.	Less: Condensate quantity (Offshore)			
7.	Net Production (2-3-4-5-6)			
8.	Transferred to Refinery or Extraction Plant			
9.	Sales			
	9a. Crude Oil / Natural Gas			
	9b. Naphtha spiked with crude oil			
	9c. Condensate spiked with crude oil			
10	Closing Stock (1+7-8-9)			
	10a. Closing Stock in Tanks & Pipelines			
	10b. Closing Stock in Installations			
11.	Trunk Pipeline capacity for Transportation to			
12a.	Quantity throughput by Pipeline			
12b.	Through Tankers			

2. Cost Information:

Sno.	Particulars	Amount		Cost per Unit	
		Current Year Rs.	Previous Year Rs.	Current Year	Previous Year Rs.
1.	Finding Cost				
2.	Lifting Cost				
3.	Cost of Conveying and Treatment				
4.	Cost of Exploratory or Development Drilling – Charged off				
5.	Cost of Transportation				
6.	Cost of Survey charged off, if any				
7.	Provision for Impairment				
8.	Provision for Abandonment				

9.	Overhead: (a) Project (b) Regional (c) Headquarter				
10.	Royalty on production, if any				
11.	Statutory levies on production, if				
12.	Other Expenses (to be specified)				
13.	Total Cost of Production				

B Transferred to:

Sno.	Products	Basis of apportionment of cost	Actual quantity	Equivalent quantity	Value (Rs.)
	Transfer of Crude Oil / Natural Gas to: Refinery or Extraction plant, Sales Related Party Transfer				
	Total				

PROFORMA
Statement showing Cost of Refining

Name of the Company	
Name and address of the Fuel Refining Unit	
Name of Product	
Period	

a. Quantitative Information

Sno.	Particulars	Unit	Current Year	Previous Year
1.	Installed Capacity	MMTPA*		
2.	Crude or Gas Refined	MMT		
3.	Capacity Utilization	%		
4.	Fuel and Loss (quantity)	MT		
5.	Fuel Loss (%)	%		
6.	Production of Joint Products:			
	1. Product 1			
	2. Product 2			
	3. Product 3 (etc.)			
	Total			

*MMTPA: - Million Metric Tonne Per Annum

II Cost Information:

Sno.	Particulars	Quantity	Rate	Amount	Cost per Unit	
					Current Year Rs.	Previous Year Rs.
			Rs.	Rs.		
1.	Material					
	(a) Cost of captive crude oil or gas from (Specify Oil Fields separately)					
	(b) Transportation Cost, if any.					
	(c) Others (specify)					
	(d) Total					
2.	Crude oil or gas Purchased					
	(i) Indigenous					
	(ii) Imported					
3.	Process material/Chemicals					
4.	Utilities (specify details)					
5.	Direct Employee Cost					
6.	Direct Expenses (Specify)					
7.	Consumable Stores & Spares					
8.	Repairs and Maintenance					
9.	Quality Control Expenses					
10.	Research and Development					
11.	Technical Know-how/Royalty					
12.	Depreciation/Amortization					
13.	Other Production Overheads					
14.	Add/(Less) Stock Adjustments					
15.	Total					
16.	Less Credit for Wastage or By-products					
17.	Total Cost					

DOWNSTREAM SECTOR

- COST INVOLVED:**
1. DIRECT COST
 2. INDIRECT COST
 3. EPC COST
 4. OPERATING COST
 5. PRODUCTION COST
 6. TIME DEPENDENT COST
 7. FIXED CHARGES
 8. ASSET OVERHEAD COST
 9. GENERAL EXPENSE

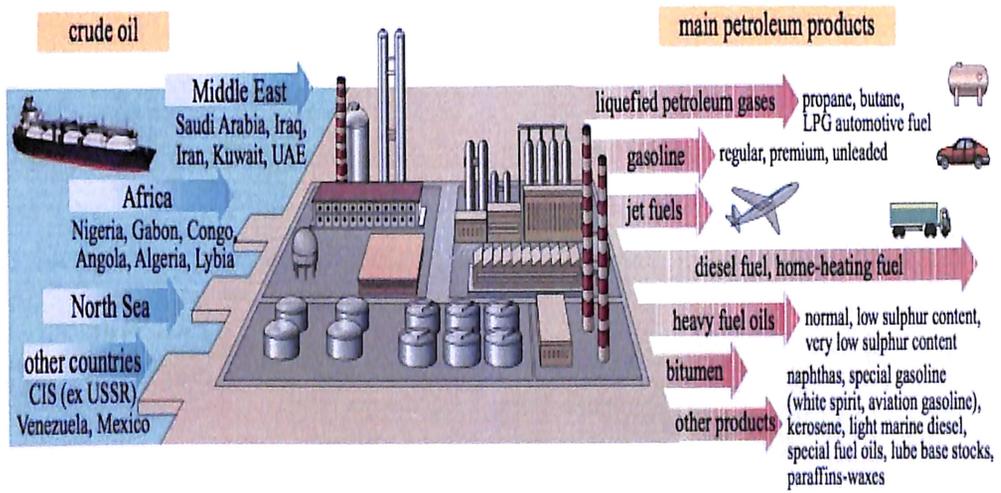
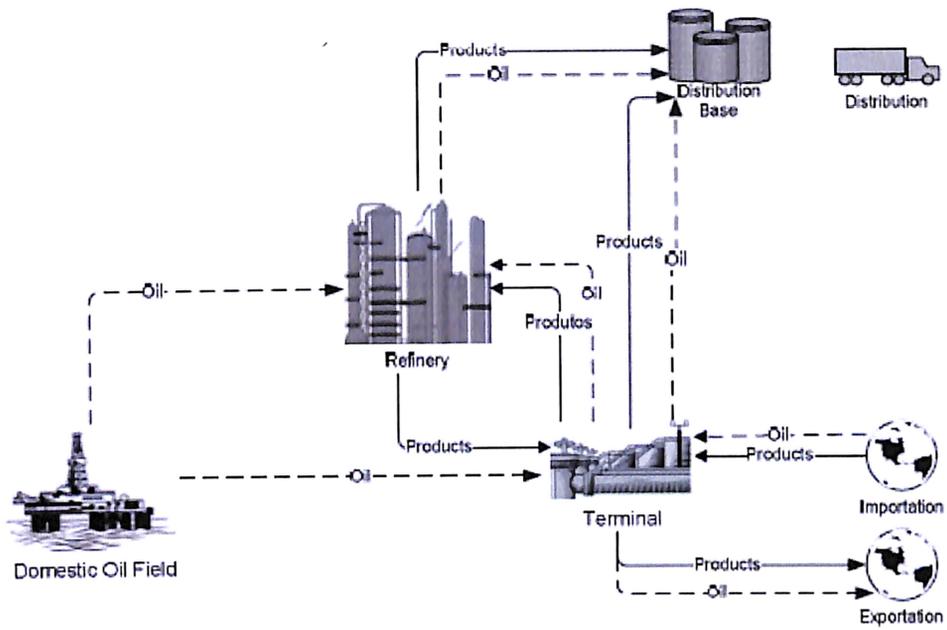


- COST OPTIMIZATION TECHNIQUES:**
1. VERTICAL INTEGRATION
 2. COLLABORATION
 3. INFORMATION TECHNOLOGY
 4. SUPPLY/DEMAND FORECASTING
 5. REFINERY PLANNING
 6. DISTRIBUTION & LOGISTICS
 7. PROCUREMENT
 8. MARKETING
 9. TECHNOLOGY ADVANCEMENT



**COST MINIMIZATION
&
PROFIT
MAXIMIZATION**

List of Figures



Typical oil and gas sector (Ribas et al., 2011)

Executive Summary

Oil and gas industry is backbone of a country economy, this applies to both oil exporting and oil importing nation. But lot of complexities and inflexibilities are effecting this industry on day to day basis, these included political instability, government policy, corruption, lack of research and failure by oil and gas companies to properly identify and optimize the cost involved in exploration, processing and transportation of oil and gas.

Working onto oil transportation business, experiences shows that there are lot of challenges being faced by the oil majors and their vertically integrated companies particularly in offshore field, which includes tough environment, piracy, long lead time, pilferages, involvement of various third parties, difficulties in doing business with the nation facing trade sanctions and losing revenue.

This dissertation mainly highlights the cost involvement in this trade and ways to optimize these costs. Here I believe that better government policy with improved research in upstream sector and better-cost management in downstream sector will surely help in profit maximization and customer satisfaction.

Chapter 1: Introduction

1.1 Overview

This dissertation deals with the Cost involved in exploration, processing and transportation of oil and gas. The chapter contains a brief discussion about the background of the topic used for the study, the problem statement and purpose of the dissertation.

1.2 Background

There is no doubt that the oil and gas industry in today's world economy and in our daily lives plays a significant role. The oil and gas is the primary source of energy for many industries, in fact any major industry anywhere directly or indirectly connected with oil or gas.

The US is known to be the biggest oil consumer and China has become the second one, India at number three. Moreover China and India as well as other fast developing countries robust economy and growth will continue the increasing trend in oil and gas demand/consumption. These countries heavily depended on imported oil or gas to keep moving its economic growth. The biggest producers and exporters in the industry are from the Middle East territory, especially Saudi Arabia and Russia.

Other alternative energy sources also know as clean source of energy such as renewable wind, water and solar energy are still not equal competitors of oil and gas. Although oil and gas reserves are limited, they will be available and exploitable for several decades and will keep on playing the important role and will remain and provide the base for the global economy in the near future.

1.3 Purpose of the study

One of the major challenges that this industry is facing in this competitive market is exploring, refining and transporting oil and gas at a lower cost. To sustain their supply of crude oil or gas, Industry is not only looking after extending the life of mature sites but are also compelled to seek new sources of oil or gas which is highly complex and costly. Other uncertainties or challenges facing by these industries are hostile environments, the high cost and difficulty in extraction, Massive capital investments, emergence of alternative energy sources, national and international regulations, complex transportation and supply chain, stringent environmental standards and unforeseen events such as political or economic

changes. Demand growth, ease of trading and technological advancement built a strong competition among the petroleum corporations.

Unforeseen and political events, for instance political changes such as the recent sanction to Iran, Russia and Venezuela have an impact on the price of the oil. Fluctuated oil and gas prices affect the accurate demand forecasting which could lead to distortion in the supply. The oil and gas industry is also known for having very complex involvement of cost compared to other industries.

The whole oil supply chain is divided into upstream and downstream segments based on activities before and after the refining stage. The distance from the oil exploration point to the final consumers could often be thousands of kilometers. In addition, petroleum products have to go through a complex, capital-intensive refinery process as well. The long lead-time also indicates the involvement of various means of transport such as chartering ships, cross-country pipelines rail and road, which involves high transportation cost.

Oil and gas industry faces several inflexible characteristics such as long lead-time or rigid take or pay procurement and the limited primary distribution capacity. Due to the competition, complexity and inflexibility, oil companies strive for vertical integration, which gives a potential advantage by having a greater control over the cost management.

It can be seen that cost management and optimization has an important role to play not only to gain competitive advantage but it helps to solve many constraints and challenges facing by this industry.

This dissertation seeks to add values by presenting cost involvement and optimization techniques in order to achieve cost savings in the long run.

Executing this task is also challenging because many sources of cost involvement in exploration, processing and transporting of oil and gas and its optimization are not thoroughly analyzed and less literature and research articles can be found about the topic of cost involved and optimization techniques. Therefore, analyzing this cost involved could contribute to further research. Moreover, providing a logical framework for optimization also could be useful for any oil and gas company, for their current and potential future employees too.

The main objective of this dissertation is to propose cost optimization techniques in oil and gas industry by analyzing and studying the various costs involved in exploration, processing and transportation of oil and gas.

1.4 Research Hypothesis

Through research methodology including primary and secondary data collection and approaching the research through qualitative approach, this dissertation will try to present the cost involved in exploration, processing and transportation of oil and gas.

This dissertation will investigate the costs involved in in the oil and gas industry and find options for cost optimization in order to maximize profit and achieve competitive advantage by analyzing data collected from research methodology and reviewing literatures.

This dissertation will help in solving the main research question addressed by this dissertation “What options does the oil and gas industry have for optimizing the cost involved under high levels of uncertainty?”

Chapter 2: Literature Review

In this chapter the cost involved in exploration, processing and transportation of oil and gas in theoretical concepts and research is reviewed. This determines key areas for cost optimization of the oil and gas upstream and downstream sector which forms a basis for the study and for linking the theory to the practice.

2.1 Review Area Broad

Crude oil and natural gas are the raw materials of the petroleum industry. Hussain et al. (2006) describe the production process. “The production of crude oil can be found either deep underground or in offshore areas. These are used for the production of petrochemicals and oil derivatives. After crude oil is accessed, it goes through a distillation process and different fractions of it are produced. Fuel gas, liquefied petroleum gas, kerosene and naphtha are examples of the main fractions of the crude oil, which are transferred to the refineries as a feedstock, that is followed by the cracking process and new products can be extracted for the petrochemical industry such as olefins and aromatics. Later petrochemical plants can produce more specified products such as plastics, soaps, detergents and healthcare products, synthetic fibers, furniture, rubbers and paints”.

Direct Costs

Direct costs are those associated with main equipment such as columns, separators, rotator drives, etc. that are essential for processing plants, as well as utilities. Other direct cost includes cost pipes, valves and fittings, electric cables, cladding, instrumentation, etc. Other direct costs consist of the construction costs for onshore and offshore platforms, as well as on-site construction costs.

Indirect Costs

Indirect costs include the cost of transporting equipment, materials, as well as various structures and stationary and mobile offshore equipment. General expenses, audits, and certification are other examples.

EPC Costs

EPC Costs or engineering, procurement and construction costs consist of contracting and construction costs of production facilities. EPC costs often vary and can be broken down into basic engineering, surveys, management, project management and insurance costs.

Operating Costs

Operating costs are the total expenditures involved in operating a production facility.

The operating costs can be classified according to their function, (personnel, services and supplies) or according to purpose (i.e., production, maintenance, security, and others). A further breakdown of these costs is listed in the following classification of operating costs summary:

- Personnel costs, accommodation, subsistence, transport.
- Consumables (fuels, energy lubricants, chemicals, office supplies, technical equipment, such as piping, drill strings, joints, catalysts, cladding, molecular sieves, laboratory supplies, individual items of security equipment, spare parts, household supplies and food).
- Telecommunications costs, miscellaneous hire charges, service and maintenance.

The costs involved in this industry are very complex compared to other industries. The crude oil has to make a long journey from the point of production to the refineries. Long distance results in a long lead-time of several weeks to months and in numerous players in between these sectors. The production is concentrated in certain areas, which means very few nations are oil or gas producing nation but the product itself is demanded all over the world and majority by developed and developing nation. The refinery process is most complex and capital-intensive part of the chain. The refined products are distributed either by road, water, rail or pipeline. (Hussain et al., 2006).

Cost involvement in oil and gas industry can be further described as:

Direct production costs or variable production cost

Direct production costs are associated with the level of production and includes feedstock / raw materials, operating labour, operating supervision, power / utilities / services, operating supplies, maintenance and repairs, laboratory charges, royalties / patents / licenses, catalysts / chemicals / solvents.

Time dependent costs

There are operating costs that are triggered by a timing assumption rather than being driven directly by the level of throughput or production and includes major shutdowns for

maintenance and repair, catalyst change-out / replacement, operating supplies / spares replacement, equipment inspection / overhaul, routine maintenance (e.g. painting).

Fixed Charges

Fixed charges are incurred regardless of the level of production and include depreciation, local taxes (property), asset insurance, rent, financing (interest), lump sum royalties, etc.

Asset overhead costs

These are expenses incurred to allow the asset to function as an efficient unit and includes HSE and protection, medical, general plant overhead, payroll overhead, recreation, restaurant, salvage, control laboratories, plant superintendence, storage facilities.

General expenses

General expenses relate to the operations of the company. There are three main categories of general expenses: administrative, sales and marketing, and research and development and includes administrative expenses, executive salaries, clerical wages, central engineering and technical, legal costs, office maintenance, communications, sales and marketing, sales office, personnel expenses, shipping, research and development.

The main goal of oil and gas industry are the same like in any other industries, is to identify all the cost involved right from exploration to processing to transportation and optimize the same. The oil and gas industry is essentially divided into two major sectors: Upstream and Downstream sector.

Upstream

Upstream basically starts with the acquisition of crude oil and natural gas and involve the related operation such as exploration and production.

1. Exploration: This stage involves seismic and geological operations.
2. Production: This concerns about exploitation of the crude oil from the reservoir by drilling.

Costs incurred in oil and gas-producing upstream activities can be classify into:

Acquisition Costs

These costs are incurred by the companies to acquire rights to explore, drill and produce undiscovered natural resource such as oil and gas. These costs include lease bonuses, options

to purchase or lease properties, brokers' fees, recording fees, legal costs and other costs incurred in obtaining mineral rights.

Exploration Costs

As soon as the company has the right to use the property, exploration costs are needed to find oil and gas. Exploration involves identifying areas that might warrant examination, and examining areas that may contain oil and gas reserves. These costs included costs of geological or geophysical studies, the costs of the machines that used in exploring oils and the cost of exploring drilling.

Development Costs

These costs are incurred in preparing proved reserves for production. Development involves drilling and equipping development wells and service wells. Also, the cost of acquiring, constructing and installing production facilities for extracting, treating, gathering, and storing oil and gas.

Onshore Development cost

In this facilities, the wells are grouped together and consists of a network of connecting carbon steel tubes which sends the oil and gas to a production and processing facility where it is treated through chemical and heating processes. The oil and gas is then separated from water and sediments and placed in storage after which the resources can be pumped through pipelines to loading terminals where the resources are ready to be transported by oil tankers or transport vehicles.

Offshore Development cost

In offshore development drilling wells are involved where production and extraction process consist of fixed platforms or floating vessels. Offshore rigs contain processing equipment and facilities onboard and the resources extracted are transported by pipeline or stored so it can be loaded on tankers. In gas production and development, production and condensation plants are required in which a liquefaction plant provides treatment, refrigeration and liquefaction followed by the storage and loading of liquefied gas.

Production Costs

These costs are incurred to operate and maintain wells and related equipment and facilities. It includes costs of lifting the oil and gas to the surface and in gathering, treating and storing the

oil and gas. Production costs include depreciation of equipment and operating costs or support equipment and facilities and other costs of operating and maintaining wells and related equipment and facilities.

Downstream

Upstream sector consist of exploration and production and downstream sector consist of procurement, refining, distributing and marketing. Cost involved in downstream sector is already discussed earlier and mostly includes direct cost, indirect cost and operating costs.

Inflexible cost

Oil and gas industry is quite volatile and involves inflexibility. First of all the purchase of the product has to be determined few months prior to the actual sale. Secondly the primary distribution occurs with fixed pipeline capacity or with fixed shipping capacity. Finally, since the depots' capacity for the secondary distribution is limited, it has to be booked on a take-or-pay basis. Take-or-pay agreement in oil business means that one party agrees to purchase from other party a minimum amount of oil for certain period of time or to pay the same amount even if the oil is not needed. (Jenkins & Wright, 1998; Ribas et al., 2011)

The increasing level of competition and high quality requirements increase the complexity of the cost involvement, which also has a negative effect on the flexibility. Other highlighted reasons for the inflexibility are long lead-time, manufacturing capacity and limited means of transportation.

Vertically Integrated Cost

Fundamentally the oil and gas industry is a vertically integrated chain coupled with a push system approach, the pushed chain couples with low cost. Low cost is the primary goal of this industry. Demand-pull appears only at the scheduling activities for the delivery of the product to the customers. So positioning the decoupling point in the downstream segment and securing transportation can reduce the bullwhip effect. Using reliable transportation mode and placing inventory closer to the final users enhances the customer satisfaction because faster lead time and faster product availability can be achieved (Hall, 2002). On the other hand inventory is costly, however, exceeding production is not a preferable option of the oil companies because a possible production shut down is costly or it could result in massive discounting on price therefore they rather store it (Hall, 2002). Vertically integrated nature bears a potential advantage within the oil industry by having great control all over the chain.

2.2 Review Area Narrow

Identifying the cost involvement, the next step is for cost optimization and is focusing on the management and examining of the network within the upstream and downstream sector for gaining a better cost saving and providing a better customer service. To achieve cost advantage, good capacity utilization, and effective inventory management and better strategic planning is required.

Proper supply/demand forecast, desired quantity production, desired derivatives production, regular supply of the natural gas or crude oil, reduced lead time, lower production and distribution cost are one of the main steps in cost optimization.

2.3 Factors critical to success of study

Integration

Integration must stand as a firm base; it has to happen between the different departments horizontally and coordinates the strategy, the planning, the scheduling and the operational execution vertically.

Cost optimization is very much related to the efficient management. Hussain et al. (2006) mention that manufacturing efficiency alone does not provide competitive advantage.

An integrated process needs to be implemented all the way from procurement of crude oil or natural gas to the delivery of the final product. Due to the size of the oil and gas network, many individual suppliers are involved. Integrating them into the major company is very challenging because either they have different optimization tools and software which is hard to integrate into the major company or they are just simply cautious to share information. (Hussain et al., 2006).

As oil and gas is very large business and involved complexity in the business, a large amount of data is involved in each function on a daily basis. Information from different sectors need to be processed and assessed. Therefore, integration and advanced IT solutions with technology are very much required in order to have better control and management in the oil and gas industry.

Information Technology

Cost optimization is strongly linked to the IT and it is built around it. Beynon-Davies (2009) mention that Information is power in terms of competitiveness and that all businesses are dependent on it. Information sharing is a necessity to facilitate communication and to link

many functions in this sector such as procurement, production planning, transportation and inventory management. This includes increasing information flow and finding the best information technology to improve planning and controlling the cost which will lead to cost minimization and higher levels of customer service.

Gainsborough (2006) emphasizes on the need for developing, integrating and implementing appropriate software tools with the focus on a standardized refinery planning and scheduling process in order to optimize the cost. IT software tools based on mathematical programming are the appropriate tools to handle the numerous uncertainties surrounding the oil and gas industry and to configure refinery activity or to manage a cost efficient system. Overall IT software tools represent option for optimization in order to lower the possibility of errors in the forecast under the uncertainty using appropriate Enterprise Resources Planning (ERP) software contributes to the integration of suppliers and customers (Jasuja et al., 2009).

Collaboration

Increased collaboration appears in many levels within oil and gas industry through integration. Therefore collaboration happens horizontally and vertically along with integration. Cooperation has to happen at all management level involving cross-functional coordination. Close relationship is necessary to execute core activities in a cooperative way.

The global nature of this industry forces oil companies to deal with many different cultures. As many oil companies are owned by their national states, to collaborate with governments or with their petroleum authorities is common which can enhance good relationship and trust between buyers and suppliers. Through collaboration and trust, better coordination can be achieved to reduce disruption and by this profit can be maximized. Competing oil companies form alliances mainly for delivery reasons to decrease transportation and inventory cost as well as to improve the customer service level. This form of collaboration is called shipment swapping. (Hussain et al., 2006).

Demand Forecasting

Accurate demand forecasting is indispensable for the optimization (Gainsborough, 2006) and it covers procurement, refining and distribution, which form the basis to optimize the downstream supply chain. Although marketing is the last stage in the oil downstream supply chain by selling the oil derivatives, it also has responsibility for provide forecasting information. Demand numbers usually come from historical data, forward trade data, macroeconomic indicators, Point of Sales (POS) system, marketing input and metrological

input. Accuracy plays key role because a little error could cause very expensive damage on the total cost. (Balasubramanian, 2002).

Procurement

Refineries optimized performance is based on the demand data but it also has an impact on the procurement of petroleum industry. As the choice of suppliers of crude oil are relatively limited due to dominance of oil cartels in the market, plus because of the frequent oil price fluctuation, creating long time agreement with some oil producing nation could stable secure supplies and the sudden price fluctuation (Jasuja et al., 2009). Procurement has to strive to minimize the material supply considering refinery throughput and inventory management. Since the oil or gas mostly comes from remote location and involves many means of transport thus choosing reliable transportation mode is important for reducing lead time and stock level which requires better Logistic management.

Refinery Planning and Inventory Management

The refinery is a particularly costly and complex activity in the oil supply chain thus its process is a crucial point in the oil industry (Balasubramanian 2002). First of all operating and maintaining it is very expensive that is why for instance during low demand it stops operating. Insufficient throughput is also costly thus it requires accurate and regularly monitored data information. Moreover, the operation has to be configured based on which kind of final product and how much needs to be produced. (Hussain at al., 2006). Seasonal changes also have an impact on the refinery shut downs or slow downs, therefore, it also affects the inventory and distribution planning. Refinery LP model and tracking system, namely SAP plays a key role in the optimization for planning these activities. (Balasubramanian, 2002).

Jasuja et al. (2009) mention that an early supply arrival can result in piling the stock up which is expensive. Lack of visibility, incorrect demand information and over production are causes for increasing stock level. Using reliable transportation and persistent information exchange can reduce inventory cost. Moreover, the governments have the power to set the strategic safety stock limit lower. On the other hand Hall oil industry does not strive to keep its inventory to absolute minimum low. Over production in the upstream stage can cause a discount on the price but oil companies rather pay more to stock pile the oil than loosing high profit. Although a higher level of inventory is more expensive, it fulfills customer needs faster Hall, 2002).

Distribution and Logistics

Distribution of the final products also relies on the accurate demand forecast. Logistic management is involved both in up and downstream supply chain. Focusing on the means of transportation, especially on coastal shipping and road transport could be a good area for optimization and reduce cost, it is mostly because these are highly flexible elements. As lead time is long and many variations of means of transport is possible, with an excellent IT software such as the fleet scheduling package and the supply chain management model, cost optimization can be achieved. They are cost effective, increase flexibility, which contributes to higher customer satisfaction, and they also improve planning and controlling the production. (Jenkins & Wright 1998). Most of the crude oil or natural gas are transported through sea, this costly process involves chartering a tanker through broker and transporting the cargo to the receiver.

2.4 Summary

This dissertation deals with cost involved in exploration, processing and transportation of oil and gas and ways to optimize these cost. Literature review includes deep and a broader understanding of cost involvement and ways to optimize these costs.

Literature review further mentions various types of cost involvement; the characteristics of oil and gas industry, regarding its complexity, flexibility and vertical integration were briefed.

The oil and gas industry is divided into two major sectors: upstream and downstream sector, where the refinery stage stands decoupling them. In this dissertation, the analysis mainly concentrated on the downstream sector since it is considered as the source of flexibility.

Optimization means creating opportunity for value adding and getting competitive advantage. It is also the primary opportunity for oil and gas industry to considerably minimize their cost and develop their performance.

Another aspect discussed in the literature review is the roles of downstream functions such as demand forecasting, procurement, inventory management, distribution and marketing.

Chapter 3: Research Design, Methodology and Plan

This chapter will briefly describing the meaning of research methodology and include the types of research approaches.

This chapter primarily concerns with the qualitative research approach namely brain storming with the experts, Interviews, secondary sources study, questionnaire, expert opinion and personal opinion and same approach is used for completing this dissertation. Purpose is to find answers to questions through the application of systematic and scientific methods. This needs formulating a hypothesis, collection of data on relevant variables, analyzing and interpreting the results and reaching conclusions either in the form of a solution or certain generalizations.

3.1 Data Sources

One of the most significant steps in writing a good report is the collection of data or information. Because a good report depends on the quality of the data collected, the report will be good if the data collected is good.

The following sections will give a detail description on types of data and methods of data collection and will further address the data and method used for conducting this dissertation.

There are two types of data:

(1) **Primary data:** These data are directly collected and gathered for the first time for ongoing research project. Primary data is that collected through firsthand experience. Primary data can be gathered by applying either of the two basic research methods, qualitative (e.g. extracts from the conversations of subjects) or quantitative (or statistical form, e.g. charts, graphs, diagrams and tables)

(2) **Secondary data:** Data that has been formerly gathered by other researchers during their course of study. These data already exists. Secondary data is simpler and has lower cost to develop and to use than primary data. Before evaluating this data, its source, reliability and consistence has been properly verified.

For this research both primary data through interviews and questionnaire and secondary data from different sources, such as books and articles as a supportive data is used for framing the context of this study and provides a guidance in making analysis with the findings systematically and properly.

3.2 Research Design

A research design encompasses the methodology and procedure employed to conduct scientific research.

Research methodology is defined as 'a way of finding a solution for research problems or it can be described as a science that deals with how research is carried out scientifically' (Kothari). Research methodology is important for researchers in order for them to do research in a way that highlights and gives essential training in collecting material and arranging and putting it together for carrying out research. There are two basic approaches to research: qualitative research and quantitative research.

'Qualitative research is the collection, analysis and interpretation of data that cannot be meaningfully quantified, that is, summarized in the form of number' (Diggins & Wiid, 2009). Qualitative research basically depends on the gathering of qualitative data. In qualitative research the research questions are carried out in a flexible manner and the researcher meet the people concerning to the working field and the techniques thereafter used are interviews, questionnaire.

Qualitative research methods offer the required and complementary viewpoint on human behavior. The techniques used in qualitative research include focus groups, in depth interviews and predictive techniques.

For this dissertation it was decided that qualitative research is the best applicable method for the study and the reason for it is due to the nature of the research that is based on gathering, and analyzing of qualitative data. Investigating and interpreting individual ideas and analyzing the findings in context to the research questions make this study.

3.3 Survey Question

Good research is objective in the sense that it must answer the research questions. This necessitates the formulation of a proper hypothesis; otherwise there may be lack of congruence between the research questions and the hypothesis. The research question should be a fact - oriented, information - gathering question.

The researcher's task is to formulate the question related to field of study. A Research question is the hypothesis of choice that best states the objective of the research study.

Interviews will be used as means of survey questions in this report. Part of Interviewer Script is attached with this dissertation for reference.

3.4 Interviews Procedures

'While the interview process uncovers reaction, learning, and impact data, it is primarily used for collecting application data' (Phillips and Stawarski). Interviews could take a long time and needs the preparation of the interviewer to guarantee the consistency of the process. There are three types of interviews: structured interviews, unstructured interviews and semi structured interviews. Lussier and Kimball explains that the 'structured interviews use a list of preplanned questions to ask all individuals or candidates that are to be interviewed where unstructured interviews are interviews that don't use questions that are planned in advance. Semi structured interviews are interviews where interviewers ask questions from a preplanned list of questions but also ask unplanned questions as well. Semi structured interviews contains a number of questions to be explored by each of the candidates to be interviewed. One of the major strengths of using semi-structured interview is that there is a positive rapport between the interviewer and interviewee.'

For this dissertation semi structured interviews were used and applied because interviews were made with different people working in the same company or involved in a project with the company and different candidates interviewed have different posts. Questions of each interview were relevant with the job description of the candidates to be interviewed to get relevant information to make a better dissertation.

3.5 Data Analysis procedures

Data collected using primary and secondary sources of data through semi-structured interviews will be analyzed.

Data analysis includes classifying and interpreting the information collected through interviews.

There is lot of ways of collecting and analyzing qualitative data and among these, the most commonly used: Interviews, focus groups and observations. Kothari states that for selecting the appropriate method for data collection, a researcher should keep in mind the following key factors:

“(1) Nature, scope and object of enquiry: This is the most important factor that influences or affects making a choice on the particular method to be implemented. This factor also plays an important role in making the decisions on what type of data to be used, primary data or secondary data.

(2) Availability of funds: Availability of funds plays a big role for selecting the appropriate

data collection method. When there is limitation of funds the researcher has to select a cheaper method for collection of data.

(3) Time factor: It is important for a researcher to keep in mind the availability of sufficient time before making a decision on what type of method is to be used for the data collection.

(4) Precision required: Being precise is another key factor to be taken into account by researchers when selecting the method of collection of data.”

This research, which is based on qualitative research approach, interviews is mainly used as the relevant data collection method. While collecting the data for this study the means of communication used with the concerned person of the firm chosen for the research was face to face interview and through Internet also.

Chapter 4: Findings and Analysis

The findings follow the main elements of literature review. Interviewees also demonstrate their answers with several real or theoretical examples for better understandings.

Downstream Management

Here different functions such as procurement, refinery, logistics and marketing carried out. The different functions are sharing information and cooperating with each other through proper management.

Barauni refinery has a total capacity of 6.10 MMTPA. The crude oil to refinery comes via Paradip- Haldia- Barauni pipeline (PHBPL). The 1447 km long pipeline from Paradip in Odisha to Barauni in Bihar has 328 km long Paradip- Haldia and 498 km long Haldia- Barauni sections. This pipeline consist of offshore pipeline connecting from Single point mooring at Paradip, where large crude tankers unloads and a dock pipeline from Haldia crude oil jetties

The interviewee continues, after the procurement and supply of the crude oil, it is refined and the refineries produce the type of product in a demanded quantity. Then, products are marketed to wholesaler or to retailers, which can be owned by own brand retailers at various locations within the city or at Petrol pump. In the case of diesel, industry players such as transportation, logistics and agriculture companies are big user. Petrol is usually related to the automobile industry and sold at various petrol pump within the states.

The respondent confirms that the ultimate goal of cost optimization is the profit maximization. It is also come to point that customer satisfaction is mainly focused more in the retail market. Optimization is inevitable because of full of constraints from procurement to marketing and unforeseen constrains such as a broken pipe or theft.

All interviewees state that it is facing several challenges and constraints coming from the complex and inflexible nature of the industry. Long term planning concerns more about strategic decisions such as opening a new plant. Short term decision deals with such issues as the yearly maintenance. The short time planning is more accurate. Therefore, better decision can be made.

Demand Forecasting

Marketing division carries out demand forecasting task but it can be different in another oil companies. Demand for oil has been fluctuating all the time. Demand planning triggers the whole downstream supply chain and marketing department makes it. Refinery process is obviously a special part and also a very complex process and included various cost, from where many different types of oil derivatives can be produced. The optimization of involved cost can be better managed by planning and schedule production as well maintaining inventory. Unseen events such as refinery breakdown or short inventory to be always considered in planning.

Distribution and Logistics

The interviewee reminds that supplying and deliver oil and its product is costly and difficult. After the refinery stage, finished goods are transferred to the retailers mainly via road or in some cases by rail. The finished good from the depot is either picked up by the whole seller or delivered on trucks.

Jenkins and Wright (1998) find “logistics as an area to reduce cost and achieve customer satisfaction since oil supply chain has a long lead time and many means of transport can be involved”. In this case, the attention is given to the logistics department regarding better and timely transportation.

After the analysis it was found that various cost involved are well elaborated and taken into account however attention is required towards the various uncertainties and inflexibilities particularly due to political instability of a oil producing country and various trade sanctions.

Due to oil and gas industry’s increasing volatility, they have to follow the zero based mindset which basically means they have to re-imagine their budgets and spending based on what things “should cost,” not what they have cost in the past. Starting with a clean slate in multiple areas can help oil and gas operators achieve better visibility into the organization, prioritize spending, and sum up capital that can be reinvested in activities that drive growth and profitability.

Chapter 5: Interpretation of Results

It can be seen that the cost optimization is at the center of the oil industry in order to maximize profit and achieve competitive advantage.

From analysis it was also found that customer satisfaction does not play a very key role in oil and gas upstream sector. Customer satisfaction is part of marketing in downstream sector of this industry.

Oil and gas industry can target big profit in downstream sector by providing quality refined products and customer satisfaction. With better management of inventory, logistics and refinery, cost optimization techniques can be obtained resulting in profit maximization.

Upstream sector is involved with lot of complexity and high cost, any investment decision by oil company should take into account government policy, uncertainties involved and capital required. A company loss in her upstream business should never affect her downstream business and both should be managed entirely separate.

I am mentioning some of my views below and interpreting the analysis for results, which in my opinion, may further improve oil and gas industry and will help in cost optimization.

1. Proper supply/demand forecast by using latest IT technology and better marketing will maintain the supply- demand curve, thus stable demand/supply chain will be maintained and volatility in commodity price of crude oil and natural gas can be well control.
2. Government policy is of vital importance. Oil and natural gas prices directly affect the country economy. Improper regulation of petroleum price will affect the inflation level in the country. Taxation and regulation of petroleum prices should be balanced in such a way that neither consumer nor oil majors are at loss.
3. It has been reported that India spent USD 111.9 billion on oil imports in 2018-19. Oil and gas companies in collaboration with Government should promote exploring petroleum reserves within the country. India's policy Hydrogen Exploration and Licensing Policy has not caught the attention of foreign oil majors recently but new report suggest that oil giant ExxonMobil is in preliminary agreement with ONGC to study geological data for exploration. Oil major should be provided with the option to pursue international arbitration in case of any dispute and assurance that company will be justly compensated if the state takes over its business or assets.

4. Oil and gas companies should give more importance to Research and development field. Money and time spent on this department will surely help in reaping benefits in future.
5. As oil and gas cannot be subsidized completely, but switching to other alternate or cleaner way of energy may reduce our dependents on non-renewable sources of energy. Oil and gas industry should promote and utilize solar, battery or wind energy for their miscellaneous day-to-day industrial use in better ways.
6. Regular supply and reduce lead time or transportation time of natural gas or crude oil by improving road and rail network, proper maintaining and expanding country and cross country pipelines from shipping terminals to refineries and to consumer or retailers directly will surely help in reduction of cost. Improvement in coastal shipping and coming up with more coastal ports may reduce the transportation cost. LPG pipeline distribution system directly to consumer should be promoted more diligently.
7. In my opinion cost optimization and saving can be done more preciously in downstream sector. Therefore oil and gas industry should keep their refinery and processing system up to date with latest advance technology. Their cracking unit should be capable of processing sour crude which is generally cheaper than sweet crude. Marketing department should be up to date with desired quantity and desired derivatives in demand. All the cost involved in processing and transportation of gas and oil to be well accounted for.
8. Corruption and bad government policy is nightmare for this industry. For example Venezuela, Iran, Syria are all known as crude rich country. But due their foreign policy and political instability, they are into various trade sanctions. Reliance India is now into tough situation in continuing oil trade with Venezuela. Oil or gas industry should be well versed with the political scenarios of oil producing countries by monitoring government policies, unemployment ratio and mass agitation against government. Short contracts, alternate trading partners may help oil and gas companies in trading with these politically unstable countries.
9. Oil and gas industry should follow Vertical integration techniques for maximizing profit e.g. An oil Major should attempt to acquire or buy shipping company or owns her own oil rigs.

British petroleum, Chevron, ExxonMobil, these companies are active entirely from exploration, processing and transportation of oil and gas. They have their own petrol pump or gasoline station. Reliance India limited is also following the same footstep of vertically integrating its business.

Chapter 6: Conclusion and Scope for Future Work

The literature review shows the cost involved in oil and gas industry. Complexity and inflexibility of the oil and gas industry raises numerous constraints and challenges such as long lead time, involvement of many modes of transportation, rigid procurement and fixed shipping capacity. Uncertainties are also due to the impact of economic and political situation on the oil industry, combination of supply surpluses, low prices, the struggling and unproven business case for large-scale shale drilling, and the looming threat of peak demand.

For oil and gas companies, “business as usual” is no longer a winning strategy. Amid the supply and demand disruptions that are rocking the industry, competitive agility becomes a critical asset. Some leading players are already becoming leaner and more adaptive with new operating models, processes and digital technologies. They are also embracing an entirely new approach to spending—one that optimizes costs with zero-based budgeting and aligns spending to a strategy for growth and profitability. Others would be wise to follow their lead.

In an environment characterized by low prices and a constant state of market volatility, oil and gas companies will find that their current cost levels will no longer sustain the margins to which they have grown accustomed. They will also find that their traditional approaches to managing their operations and costs will hold them back from achieving the agility they now need. It’s time for them to pivot their focus to cost optimization, process transformation, and digital advancement.

Costs involved in oil and gas industry to be monitored on priority basis, a separate department within the company to be actively monitoring these data using advanced IT system, in this way various activities such as exploration, exploitation, processing transportation can be controlled manageably. Oil and gas industry should look at the opportunities of diversifying their business.

In the processing section, geographical location of refineries play a key role, generally refineries should be located at coastal area for convenient means of transportation through sea. This will avoid further transportation of raw materials through road or rail.

Improvement in survey technologies will play significant role in reducing the cost due to unsuccessful exploration activities.

It can be concluded that better planning, marketing, cost management and IT advancement will provide better control on various cost involved in various process and lead to cost optimization.

Oil and gas is a vast industry and included various segments within upstream and downstream sectors. Apart from petroleum and gas products, petrochemicals are also involved. Therefore there is always a scope for future work and research on further evaluating the cost involved in exploration, processing and transportation of oil and gas and to optimize these costs.

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Appendix: Interviewer Script

Interview 1

Interviewee: Zafar Khan, Finance Manager

Questions

- How your company- Nasim Ahsan Construction Pvt.Ltd. is working in collaboration with IOC Barauni?
- How contribution of third parties contractor helps in growth of oil majors such as IOC?
- As a financial planner, how various cost involved in oil industries are calculated and tabulated?
- What are the costs involved in refinery process and ways to optimize them?
- How does the downstream sector look like? (Departments and their functions?)
- How does the new technologies advancement help your company to find out various miscellaneous and day-to-day costs and how to manage the cost better for profit maximization?
- How future trends are understood in your company and role of new technologies and advanced analytics in addressing the challenges faced by oil industry?
- IT triggers integration and enhances information sharing. This also contributes to a better communication, collaboration and measuring performance. How IT software helps in better planning and production?
- How collaboration works within your company with different departments?
- How your company is achieving better-cost efficiency and customer satisfaction?
- How demand forecast is done and how does the marketing and production department work in collaboration?
- How does your company make sure to gather accurate demand information? (How accurate are they normally?) Does the demand change quickly and frequently?
- In procurement, how does your company decide where, how much and when to produce?
- What mode of transport used in various systems right from bringing crude to transport refined products.
- What are the Key Performance Indicators and benchmarking used by your company?