

Fundamental Cost Analysis In Petroleum Upstream Industry – Part A

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Abstract

Cost control and management is not appropriate only for manufacturing and commercial industry; cost management is applied in upstream industry such as Petroleum exploration, development and production cost. Many Petroleum Companies don't pay more attention to cost control and especially during exploration phase except if Companies face financial dilemma, declining production or if they see they cannot meet their planned schedule of Capital program that lead them to not meet their obligation, commitments and required return, therefore, they start considering cost reduction or control. This paper provide management accountant, cost controller, financial controller, financial manager, internal auditor and cost recovery auditor with brief of cost control, how cost is analyzed and managed and performance is measured in Petroleum upstream industry.

Keywords: Cost Management and analysis for petroleum exploration, Optimizing production, exploration and development programs, Project Cost Management and Analysis for Petroleum Upstream Industry, Procurement Cost Management, Drilling Cost Management, Production Cost Management, G&A Cost reduction.

It was noticed that few major oil companies hired management accountant and cost control accountant who are assigned to the correct tasks and duties that include measuring management, department and overall company's performance, support management and provide with required financial and non-financial information that can help management to take a decision, participate in putting plan and strategy for the company.

Before discussing about the cost management and performance evaluation in oil and gas E&P companies, we like to draw our reader's attention that this paper does not criticizing the drilling practices of oil and gas companies but it provides fundamental concepts for the possibility of managing costs in such industry.

Accountant and internal auditor needs to understand what is the type of costs per function in oil and gas industry, to assign KPI of cost management to each functional department. The costs that are assigned to each functional department shall be direct costs that are effected by cost drivers rather than decision-making such as barrels produced of petroleum, hours spend by staff, meters or days drilled, KM2 seismic run, processed or interpreted, meter square or cubic meter of space occupied.

1) Oligopolistic Market

Oligopoly is created when there are few number of large firms in the industry that explore and produce somewhat similar commodities of oil and gas and there are many buyers because

entering the market is not easily because it is too costly for exploring and producing oil and gas, the major part of such cost are fixed or sunk cost that increase the break-even output. The profit is maximized when the marginal cost equals marginal revenue. In summary, we assess the petroleum upstream producers market as oligopolistic market due to the following characteristics:

- 1- Small number of large firms
- 2- Somewhat similar commodities that could be differentiated by its nature that is referred to the quality of oil and gas produced.
- 3- Natural barriers to entry that high set-up cost and exploration costs.
- 4- Elasticity of oil supply is relatively inelastic [Tom Konrad, Jan 26, 2012. *The End of Elastic Oil. Forbes*] & [John C.B Cooper. March 2003. *Price Elasticity of demand for crude oil: estimates for 23 countries. Organization of Petroleum Exporting Countries*]

Oligopolistic Company could take advantage of economics of scale that reduce production costs by reducing average fixed costs and take advantage of high price that is determined by setter who has price power. The disadvantage of oligopolistic company can allocate the resources and produce inefficiently.

But many less experienced small or medium Oil and Gas Companies pay less attention to cost reduction in exploring and producing oil and gas because many of such companies thought that all costs incurred for exploration, development and production will be cost recovery, the finding and operating costs of one barrel or mscf does not reflect major part of oil and gas price. In other word, whatever it has been spend for finding and producing oil, the large recoverable reserves could payout the costs in very short time and

such costs will be spread among the recovered reserves which lead to reduce the average costs to the level which make it immaterial. However, low finding cost and operating costs could lead to have more feasible well and attract companies to produce oil for such well.

2) Cost Analysis and Estimation

All costs have not same behavior, there are costs are proportion to changes in volume range of production, other costs such as Labor hours and machine hours of production facility equipments. And there are costs that are not changed in responding to changes in volume range of production. Understanding Cost behavior enable Oil and Gas Companies to the following:

- a) Identify the breakeven and Cost-volume-profit analysis
- b) Evaluate organizational or departmental performance.
- c) To make routine decisions
- d) To make non-routine decisions

Before identifying the direct or indirect costs. Management accountant should identify critical costs in petroleum upstream Companies. Then break the costs into elements and costs drivers to enable the management accountant to identify and group the controllable costs from non-controllable costs and the responsibility centers.

2.1) Critical Costs Identification.

Petroleum Company in Upstream Industry shall maintain detailed and accurate records if they are serious in cost control-orientation to enable Company to track the costs and to find ways for cost management improvements.

When Drilling Department or Exploration Manger finalized Project Management Plan and Work Breakdown Structure (WBS) they specify

which materials and services they need to buy and what are the specifications of those materials and services. Also, Operation Department need to determine how much materials and what are the services they need to buy based on their Materials and Services Requirement Plan and based on their experimental judgments and historical data.

Responsibility centers, Program Manager or investment center manager should conduct with management accountant or cost controller to understand the critical costs and cost behaviors and identify the controllable costs.

All Oil and Gas Exploration and Production Companies financially categorize the costs into five major category as follow:

2.1.1) Pre-acquisition and Acquisition Cost

Management accountant should help program manager or investment center manager to get and analyze the acquisition costs to enable the program manager to get in very good negotiation with government or third party to acquire license at lower costs. The Pre-acquisition and acquisition costs include cost of purchasing seismic data, cost of G&G analysis for this data, cost of license bonuses and signature bonuses, broker's fees and legal costs for acquiring the licenses.

Before taking decisions for acquiring the licenses and signing the related contracts with host government. Management accountant should prepare Contract cash flow projection and understanding the effect of the Contract terms to the cash flow projection and providing recommendation to program or exploration manager to have good negotiation with host government. The contract terms that could impact on the Production Sharing Contracts cash flow projection are as follow:

- a) Royalties

- b) Profit Oil Split
- c) Work commitments
- d) Non-recoverable Costs
 - 1. Annual Bonuses
 - 2. Signature Bonuses
 - 3. Acquisition Costs, If any.
- e) Cost Recovery ceiling

Also, management accountant should consider other variable inputs for PSC cash flow projection such as

- a) Petroleum Price
- b) Required Rate of Return
- c) Estimated Finding (Exploration, development and facility) Costs
- d) Preliminary chance of success
- e) Preliminary potential Petroleum reserves
- f) Corporate Income Tax
- g) Estimated Operating Costs

If there is no attractive potential reserves or the preliminary chance of success is very low due to new discovery area, the Company can get into good negotiation with host government and obtaining Production Sharing Contract with good terms but if the expected rate of return of the cash flow projection does not encourage company to acquire the license

2.1.2) Exploration Cost

Exploration costs are costs incurred after acquiring the license and before decision is made for developing the license. Such costs include the following:

- Geological and Geophysical studies that covers
 - Seismic Acquisition cost
 - Seismic processing/reprocessing
 - Seismic interpretation
 - Velocity modeling
 - Other G&G study
- Cost of holding the undeveloped licenses
- Cost of drilling and testing exploratory wells

Cost Management or Cost Controller should estimate the exploration costs that be used in Cash flow projection and viability analysis of discovering petroleum. Program manager or exploration manager should understand that the higher Capital Costs that represents exploration and development costs, the higher minimum target size of reserves will be, and the lower expected monetary value and higher opportunity loss may occur. Cost Controller or Management Accountant should analyze the service contracts that are related to seismic acquisition, processing, drilling contracts and others and investigating for higher costs and find the best alternative way to manage the costs without reducing the quality of service, materials or the performance of subcontractor's in HSES.

Management Accountant or Exploration Manager need to know when to use 2D, 3D or 4D seismic, the quality of providing seismic acquisition and management accountant should consider the costs of high quality seismic in comparison of cost of drilling dry well. Also, exploration manager may not expect that petroleum will not be discovered in geological formation that its thickness will be less than 3 meters, therefore, exploration manager may contract with Seismic Company to use less frequency of seismic waves that include the less than 3 meter formation into prior or consecutive thicker formation which going to be neglected in the seismic processing and the costs will be reduced, but exploration manager might be wrong, and Company may carry higher costs for drilling wrong well or for not having accurate seismic mapping. Any decision for having some specification in contracts should be reviewed by cost controller to check the cost and benefit of such quality or specifications.

Even the cost of exploratory or development wells, such costs are combined into drilling contract, cementing, logging and fluid contracts. Cost Controller or contract specialists,

management accountant and exploration manager should not looking for only the lower cost of tender, they must consider the technical performance of such subcontractors. The lower performance the higher costs could be incurred in late time.

2.1.3) Development and Facility Cost

Development costs are costs incurred after taking the decision for developing the license or reservoir that include:

- Cost of drilling and testing development well
- Cost of completing and equipping production well
- Cost of facilitating in producing oil or gas such as building facility equipments of separator, treator, storage, waste disposal system.
- Cost of improved recovery equipments.

2.1.4) Operating Cost

The third important activities that are performed for producing oil or gas which include:

- Labor costs engaged in operation of well and related facility equipments
- Cost of repairs and maintenance of producing equipments
- Cost of materials and fuel consumed and cost of services that are used in operations of wells and facility equipments.

2.1.5) Site restoration Cost

It is costs of plugging and abandoning wells and dismantling all the surface equipments in accordance with production sharing agreement or local regulations.

3) Elements of Costs

Whatever the type of costs or the functional activities that cause costs, the costs are contains three elements which are:

- Materials
- Labor
- Other expense

And each of the above elements are either directly and completely assigned to specific units or charged to prime costs or indirectly elements that cannot be assigned to the specific unit or charged to prime costs the most appropriate example of indirect costs are overhead such as drilling overhead, exploration overhead, administrative overhead.

Exploration, development and production costs can be divided into materials and services, labor and overhead. Each of this costs can provide an opportunity for controlling and managing the costs.

3.1) Materials/Assets or services Cost

Procurement Department and Drilling Manager shall ensure that they are obtaining the best prices with very good quality of materials and assets, check with variety of suppliers to find the best prices and materials via tenders and based Procurement Management Plan.

3.1.a) Materials

Procurement Manager, Operation Manager, Drilling Manager, or Exploration Manager may intend to buy in large volume of drilling materials or operation materials to obtain purchasing discount, saving transportation cost, meet variations of drilling needs, but they may neglect the following risks and the costs associated of buying high volume and building up stock.

- Obsolescence and selling the materials less than actual costs at late time
- High storage Cost
- Opportunity costs of keeping high value of surplus inventory. However, if such money invested in bank with free-risk interest, it can generate income to the Company by 4% or more annually depends on the interest rates prevailed at that time.

Building materials and supplies Inventory in oil and gas upstream industry is subject to the type of costing.

When Company enter in production phase, it applies costing process system for production process, therefore, they follow Materials Requirement Plan, but they apply job-order costing system for exploration and development drilling that allow to use Just-In Time Inventory. However, drilling wells in specific geological formation may vary from place to another, and availability of suppliers may vary from country to another, Many of Petroleum Companies intend to buy their drilling materials or assets (Casing and wellheads) based on their estimated requirements of proposed wells to be drilled plus 10% - 20% as contingency.

Many PSAs require to pass title of drilling materials or assets to the host government at the termination of PSAs, which lead Company to bear the loss of disposed assets. To mitigate such loss, Petroleum Companies are supposed to have very clear and practical drilling schedules in foreign Companies and high experienced technical and drilling staff to have the best estimate of actual needs of drilling materials/assets that will be bought.

In Petroleum upstream Companies, the followings are the major materials costs that could be controlled and managed properly.

- Tangible Drilling cost such as
 - o Casing
 - o Tubing
 - o Wellhead
- Operating materials such as
 - o Treating chemicals
 - o Small tools & supplies
- Furniture's and equipments
- Facilities Assets such as
 - o Pumper
 - o Generators

- Gathering compression
- Flowlines
- Treater, Separator

3.1.b) Services

After preparing the WBS, Drilling Department and Procurement Department will outline the requirements for services in Contract Statement of work (SOW) after identifying the type of contract and the risks, Company and Contractor will bear them. Most of the Petroleum service contracts is fixed price contracts with economic price adjustments.

Drilling and Procurement Departments defines the technical, functional, and performance specification and the exact works that are needed from Contractor in enough detail to mitigate the disputes between the Company and Contractor.

SOW and contract must clearly define the parameters for acceptable performance and timeline for each section of work based on the nature of the work.

Drilling Department, Procurement Departments or Exploration Management may be trapped themselves unknowingly by increasing the specification and wrong assumption that may increase the unnecessary costs. Specification must not be very open or loose with missing important details.

Drilling and Procurement Manager shall have open meeting with all suppliers and reply to their inquiries equally, provide adequate and accurate information of specification equally 'cause missed details may lead ineffective suppliers purposely providing lower bidding price to win the contract and they know the contract price will be changed then by issuing variations or purchase orders. And this action will lead to increasing the costs.

Drilling Department and procurement shall define the evaluation criteria if there is no Corporate policy that define them. Internal auditor shall review the objectivity of evaluation criteria and if they are properly updated and applied by concerning staff. Internal auditor shall review the SOW and contracts either before it has been signed to mitigate the potential risks or after it was signed and implemented, for lessons learned and avoid the same mistakes or risks in future. Also, management accountant, cost controller or contract specialists can review the activities and terms of contracts after the implementation for lessons learned if the Control-Self Assessment (CSA) program is applied.

The major and most common services requested by Petroleum Company are as follow.

- Drilling service
- Cementing service
- Drilling Fluids service
- Logging and Testing service

3.2) Labor Cost

Labor costs in oil & gas Companies represent high part of total costs after materials/assets and services costs, even services costs contains materials and labor costs but it is not practically to determine such costs from services contractors' invoices except for Consultancy services that does not contain materials cost.

Labor costs that we need to indicate to, is the cost of employees that have a direct contracts with an Oil and Gas Company.

Oil and Gas Company should be look for the ways to improve labor efficiency. In production/operation Department, Petroleum Company shall keep track of how much oil or gas produced during specific period of time per labor hour and look for variables and correlate that can increase the productivity, such as direct labor cost, and labor costs of home office. Even

in Drilling and Exploration Department, Petroleum Company shall keep track of how much proved reserves of oil or gas discovered per labor hours, and how much unproductive hours (*Unproductive drilling hours include the time spent for lost circulation, stuck pipe, fishing*) to total drilling hours per well, cost center and overall.

Petroleum Company should know their employees' strengths, weakness and skills, determine suitable training for them, schedule them for the positions that allow Company to make optimum use of their abilities. Petroleum Company that are seriously seeking for cost control may replace high cost of their expatriates by the lower costs of high technical skilled labor after train them managerially.

Petroleum Company shall have incentive and salaries payments that are more reasonable and relating to performance of labor and managers that can change the slope of learning curves of labor to higher and reducing the unproductive time. Also, Petroleum Company shall review and update their performance measurements systems and payments system frequently to consider all the necessary appropriate combined factors that determine the payments systems for salaries, bonuses or incentives for low level of employees to high level of management. For example, Oil & Gas Company that face annual loss or will face difficulty in availability of cash and need to reduce its costs shall give more weight for factor of finding oil and commercial oil and factor of reducing costs more than other factors such as HSES factor to enable management and employee to focus on maximizing their productivity by lower costs, but if the opposite is happened. If Company pays more attention to HSES than any other factors, management and employee will focus on spending more money for HSES that its cost may exceed the benefit because it will be easily achievable for management and employee and

distract management attention and energy from generating profit from normal course of business and reducing costs, that will lead Company to generate its profit and cash flow from abnormal course of business such as selling working interests which could have been potentially and significantly profitable for the company in future. HSES is important but should be combined with other important factors and be weighted based on the strategy that company want to follow.

Also, clear promotion and recruitment policy and procedures help company to control labor costs and increase labor efficiency.

3.3) Overhead Cost

Overhead costs are costs that cannot traced to particular object of costing. Most of such overhead are fixed over time but such cost cannot be indirect for all cases, it can be traced to specific cost center but cannot be traced to specific project or production. The most likely costs that are considered overhead are Headquarter's expenses that are considered as an overhead costs. And many of PSAs does allow to recover part of foreign Headquarter's costs as cost oil but not all overhead expenses. Therefore, many Petroleum Companies are seeking to cut such costs by using their facilities and capabilities as fully as possible. However, those PSAs allow to recover all direct overhead of offices allocated in the host countries but they need to use either appropriate basis or equal basis for allocating such costs to the licenses obtained. Therefore, the part of allocated overhead to exploration block may lead Petroleum Company to reduce such this overhead cost.

4) Cost Drivers Identification

The costs that cannot be measured, it cannot be managed but may be cut or void. The costs that can be measured are costs that varied based on

independent variables and can be stated or estimated in a formula by identifying the unit of activity that causes the changes in prime activity costs and the price of unit activity. Developing cost drivers in formula is as follow.

Total Cost = Variable Cost + Fixed Cost

Variable Cost = Cost per unit x quantity used

Petroleum Company should prepare Cause and Effect Analysis to know how different factors and variables relate together and can effect the costs of particular object.

4.1) Direct Cost

Direct costs can be charged to particular object of costing, either project, cost centers or production. Most of direct costs are variable costs that are vary in total to changes or activity of project, cost center or production. labor cost formula and materials formula.

Labor Cost = Labor rate x Labor hours + Constant labor cost when labor hours is 0

Cost of Materials = Unit cost of materials x quantities of materials consumed + Constant cost of materials when consumption of materials is 0

Cost of Services = [Labor rate x Labor hours + Constant labor cost when labor hours is 0] + [Unit cost of materials/equipment x quantities of materials/equipment consumed x period of time to be used + Constant cost of equipment when equipments are not used or in standby]

4.2) Fixed and Indirect Cost

Fixed costs are stay constant regardless of activity or throughout the production level, life of a project, depth of drilling well, time spend to use equipments or materials

4.3) Sunk Costs

Sunk costs are irrelevant costs that cannot be varied by obtaining different decision and need not to be considered in decision analysis. The historical costs and fixed costs are most likely considered as sunk costs.

References

- Tom Konrad, Jan 26, 2012. The End of Elastic Oil. Forbes] & [John C.B Cooper. March 2003. Price Elasticity of demand for crude oil:estimates for 23 countries. Organization of Petroleum Exporting Countries