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COMMERCIAL FRAMEWORKS FOR NATIONAL OIL COMPANIES[1]
Working Paper

OVERVIEW OF CEE RESEARCH EFFORT

This working paper represents the first publication from a long term research effort at CEE to understand sovereign or national oil companies (NOCs), their imperatives, constraints and strategies into the future. Our research effort is linked to CEE's elite annual international energy sector capacity building and research program, *New Era in Oil, Gas & Power Value Creation*, and our energy sector development assistance initiatives.[2] As part of these and through other sponsored research grants and contracts and our custom training programs, CEE has been privileged to observe how NOCs have evolved and continue to re-shape themselves to meet energy development challenges in their home countries as well as to respond to drivers emanating from the global energy markets and energy value chain operations.

During the early 1990s, and as part of a widespread push for freer markets and energy sector reforms across broad swaths of the globe, a number of full and partial privatizations of NOCs took place. This activity was triggered by a number of factors:

- Lower prices for oil and gas commodities;
- Revenue needs among the governments engaging in restructuring programs;
- Pressure from international capital markets; and, in some cases,
- Internal shifts in public preferences with regard to market organization and the roles of government and government owned or controlled enterprises in core activities such as oil and gas exploration and commercialization.

Today, the tables have largely turned. Higher commodity prices, flush treasuries, availability of technologies from oil and gas service providers, friendlier international capital markets and other factors, not excluding political drivers, have essentially reversed the situation. Consequently, it is important to understand modern NOC organizations; their roles and emerging commercial strategies; and the various internal and external pressures (economic development, local content, community benefits) directed toward NOCs and their operations.

Several viewpoints must be considered.

- In contrast to many opinions and expectations, NOCs are likely to remain a strong energy sector feature for countries that remain net exporters of hydrocarbons, at least for the foreseeable future. Of interest are those countries that face diminishing futures as net exporters and that may, as a result, restructure their NOCs to meet other goals and objectives than those with which the NOC may have been historically charged. However, even governments of net consuming countries may retain the NOC model for various reasons. For instance, the NOC model may be retained in net

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[2] For information on CEE's New Era program, go to: http://www.beg.utexas.edu/energyecon/new-era/. For information on CEE's international energy partnerships and development assistance projects, including CEE's Smart Development Initiative supported by the U.S. Agency for International Development (USAID) go to: http://www.beg.utexas.edu/energyecon/about.php and http://www.beg.utexas.edu/energyecon/IDA/.

importing/consuming countries where government organization remains strongly centered around sovereign interests (more on this point later).

- Distinct differences exist among NOCs and their performance in achieving both commercial and non-commercial objectives. NOC performance has significant implications for world energy supplies given International Energy Agency projections that upwards of 90 percent of new primary energy production through 2030 will come from developing countries, many of whose energy sectors are NOC controlled. The IEA's projection represents a sharp jump from 60 percent in the previous three decades.[3] Thus, it is crucial to understand the factors that drive differential NOC performance.
- Yet, how should NOC performance be measured? What are the right metrics for these types of organizations? Comparisons between NOCs and IOCs (international, generally publicly traded, oil companies) are not useful given the current deviations in goals and objectives. NOC/IOC goals and objectives may converge over time as NOCs become increasingly commercial and IOCs are increasingly pressured to broaden their social and economic participation in developing countries. Moreover, NOCs are interested in being benchmarked against other, similarly situated NOCs, a reflection of how managers in these organizations view themselves and their competitive landscape, and as a more joint ventures are formed among NOCs.
- NOC-IOC relationships are changing. NOCs clearly are trying to position as preferred partners and/or operators; some NOCs have comparative advantages that can be competitive in global energy businesses. NOCs have the access to energy resources and believe that their experience with social and economic development issues makes them a preferred partner for other NOCs and, in many instances, preferred partners or operators for IOCs. Potential fruitful areas for future NOC/IOC collaboration may be in the arenas of asset swaps (upstream access traded for downstream access) and corporate citizenship/host country social and economic development.
- It is in the arena of non-commercial issues such as social and economic development, as well as with concerns about transparency, environmental protection and so on, that NOCs are most vulnerable to critique. As NOCs take more prominent roles as operators and/or seek to integrate commercial goals, objectives and performance measures into their protocols, they also become targets for scrutiny by the legions of nongovernmental organizations (NGOs) that have long sought to impact IOC operations in various countries and regions. Indigenous civil society NGOs have also become more contentious with respect to NOCs, as NOC governance and the role of NOCs in the political organization and fabric of their countries increasingly are linked.
- A key strategic issue for NOCs and for any attempt to understand NOCs is the challenge of balancing NOC commercialization (development of their hydrocarbon sectors) with national political, social and economic development objectives.

INTRODUCTION

There has been surprisingly little systematic research on NOCs notwithstanding their significant presence in and influence on the international oil and gas industry (McPherson, 2003). Nine of the top ten global companies in terms of oil reserves are NOCs, and all ten of the top ten global companies in terms of natural gas reserves are NOCs (PIW, 2005).[4] These resource-rich NOCs are primarily resident in developing countries and, as discussed below, we expect that the NOC model in those countries will

[3] International Energy Agency, *World Energy Outlook*, 2002.

[4] Top 10 companies based on oil reserves: Saudi Aramco, National Iranian Oil Company (NIOC), Iraq National Oil Company (INOC), Kuwait Petroleum Corporation (KPC), Petroleos de Venezuela (PdVSA), Abu Dhabi National Oil Company (Adnoc), Libya National Oil Company (Libya NOC), Nigerian National Petroleum Company (NNPC), Petroleos Mexicanos (Pemex) and Lukoil. The top 10 companies based on natural gas reserves: Gazprom, NIOC, Qatar Petroleum (QP), Saudi Aramco, Sonatrach, PdVSA, Rosneft, Adnoc, INOC and NNPC (*Petroleum Intelligence Weekly*, 2005).

continue at least for the foreseeable future. As a result, "getting it right" with respect to NOCs can be expected to have major political, social and developmental consequences (McPherson, 2003).

In order to understand the role of NOCs and their impact on energy sector governance, it is necessary to understand NOC performance within the context of their objectives as well as the key factors influencing NOC "success" or lack thereof. We are concerned with the "commercial frameworks" for NOCs, that is, the policy and regulatory settings in which NOCs function and that influences their performance. The most frequently cited optimal economic structure for the oil and gas sector is that of private companies operating in a regulated environment.[5] However, for many countries, this structure is not necessarily a viable option within a discernable time frame. In this project, we seek to define "best" commercial frameworks as well as "best" NOC practices and performance within existing political and economic constraints.

We propose using the business analysis approaches described in this paper for the evaluation of NOC performance and the identification of the key performance drivers. There has been limited work to date on the development of a robust performance evaluation system for NOCs even though many researchers have acknowledged the need for one.[6] In addition, NOCs want to be benchmarked with respect to other NOCs. In her recent book on Middle Eastern NOCs[7], Valerie Marcel noted that the NOCs in her study were in the process of redefining themselves and attempting to find an appropriate balance in their relations with the state. One reason that the five Middle Eastern NOCs participated in her study was their desire to be benchmarked. These NOCs felt that they knew very little about how other NOCs operated and how they dealt with common challenges. These NOCs "*showed a great deal of interest in and curiosity about NOCs outside the region.*"

Our performance evaluation analysis will require consideration of related issues in the NOC commercial framework, such as the political environments surrounding the NOCs and the relationship between NOCs and regulatory bodies that are created to facilitate investment in energy sectors where NOCs are present. We are also concerned with data availability, quality and comparability and international efforts to encourage improved quality of the data reported by NOCs. Our working paper is part of a long term research effort for which the objective is to define "best practices" in NOC organization, management and commercial operations based on performance evaluation and the key commercial frameworks that lead to these "best" NOC practices.

The authors and our colleagues are increasingly engaged in interactions with NOCs, especially through our annual capacity building program (*New Era in Oil, Gas and Power Value Creation*), custom training and through our international energy sector development assistance grants and activities. Undertaking a long term research effort on NOCs and a comparable effort on national hydrocarbon regulators will enable our team to both utilize information that is required for and incorporated into our other activities (research and training) as well as to develop new analytical tools for capacity building worldwide.

[5] Some countries lack the competitive marketplace, private capital and effective legal and regulatory system needed to make this structure work (Stevens, 2003; Wong, 2004).

[6] Ramamurti, Ravi and R. Vernon, eds., Privatization and Control of State-Owned Enterprises, The World Bank, Washington, D.C., 1991; Valerie Marcel, "*Good Governance of the National Oil Company*," Chatham House, February 2005; Helena Inniss, "*Measuring the Efficiency of State Owned Enterprises*: *Examples from the Energy Sector*, Petroleum Economics; "*National Oil Company Case Study Research Protocol,*" Baker Institute for Public Policy, Rice University, May 2005.

[7] Marcel, Valerie, Oil Titans: National Oil Companies in the Middle East, Chatham House, London, 2006. The companies studied included Saudi Aramco, Kuwait Petroleum, National Iranian Oil, Sonatrach and Abu Dhabi National Oil Company.

The output of our long term project should be of interest to NOC stakeholders including governments, international donor and financing organizations, and international oil companies (IOCs), as well as the NOCs themselves. IOCs would like more clarity in their relations with NOCs and their governments to improve the chances that mutually beneficial business arrangements can be concluded.[8] NOCs themselves have called for a reexamination of the record and future role of NOCs in their home countries and worldwide.[9]

BACKGROUND

Why were national oil companies formed, and when?

Many NOCs came into being during a period of relatively large scale state intervention in their countries' economies, a process which only began to reverse in the 1980's and 1990's (Stevens, 2003). Many economists in these times thought that the "normal" operation of market forces would not be sufficient to propel developing countries out of poverty. Only the state could marshal the resources required for economic development. Thus the stage was set for government intervention in the oil and gas sector. Within this general context favoring government intervention in the economic system, additional reasons have been cited for the creation of NOCs including: (1) the emergence of natural resource nationalism and the reduction of the state's dependence on international oil companies; (2) the "strategic" nature of oil; (3) the inability of the private sector to deal with the commercially risky and technologically complex oil and gas sectors; (4) lack of institutional frameworks to support a regulated private sector, and (5) the economic development role envisioned for the NOCs (Stevens, 2003; Heller, 1980; Foss, 2005; Grayson, 1981; Mommer, 2002). These reasons are discussed further below.

The driver for national sovereignty over natural resources in developing countries reflected "a collectively bad experience with the international oil companies" (Stevens, 2003). Nationalizations occurred not because these companies were privately owned but because they were foreign (Hartshorne, 1993). Foreign oil companies were seen as having international interests which often did not coincide with national interests. In addition, politically and financially powerful foreign oil companies brought with them the specter of foreign government interference with national objectives.

Oil was viewed as "strategic" in that oil revenues were usually the main source of hard currency inflows to national treasuries (Foss, 2005). The movement toward permanent sovereignty over natural resources combined with the "strategic" nature of oil concept together provided the key rationale for state involvement in the sector. If permanent sovereignty over oil and gas resources implies nationalization of foreign operations it also implies the creation of NOCs: some entity must be created by the government to replace the incumbent (foreign) operator to take over the oil operations (Olorunfemi, 1991).

At the times of foreign oil company nationalizations in developing countries, it was commonly thought that development of a country's oil sector could not be achieved by private companies operating in a regulated environment (Stevens, 2003). First, the oil sector was seen as simply too large a commercial risk for the small and relatively undeveloped private sectors in these countries and foreign private companies were politically unacceptable. The rationale for direct state participation in the oil sector was that it could secure crucial national interests more effectively than market forces and private initiative (Noreng, 1997). Second, regulatory institutions and expertise were virtually non-existent in these countries. Third, private companies would not accept the heavy fiscal burden and the development role of the NOCs which were considered crucial for a country's economic development (Boué, 2003).

[8] "New Recipe Needed for IOC-NOC Mix," *Petroleum Intelligence Weekly*, April 4, 2005.
[9] Ali Al-Naimi, Saudi Arabia Minister of Petroleum and Mineral Resources, Speech at the OPEC International Seminar, Vienna, Austria, September 16, 2004.

Finally, the oil sector was often seen as a leading development sector or "locomotive" for overall economic development in developing countries through establishing linkages with other industrial sectors (Auty, 1990). Given the limited capacity of the private sector, NOCs were seen as the engines to develop these physical and fiscal linkages (Stevens, 2003).

With respect to timing, the first NOC in a developing country was created in Argentina in 1922, as shown in Table 1. Post World War II, the trend toward the creation of NOCs achieved an overwhelming momentum as former colonies became independent (Baum, 1980). Although several OPEC country NOCs were created in the 1950's and 1960's, it was not until the 1970's that these NOCs achieved complete control over their countries' oil and gas sectors (Heller, 1980).

Table 1. Selected NOCs and Year Established

Country	National Oil Company	Date of Creation
Argentina	YPFA	1922
Chile	ENAP	1926
Russia	Various	1934*
Peru	PetroPeru	1934
Bolivia	YPFB	1936
Mexico	Pemex	1938
China	PetroChina	Early 1950s
Colombia	Ecopetrol	1951
Iran	NIOC	1951
Brazil	Petrobras	1954
India	ONGC	1956
Iraq	INOC	1961
Saudi Arabia	Petromin	1962
Algeria	Sonatrach	1965
Indonesia	Pertamina	1968
Libya	Libya NOC	1968
Norway	Statoil	1982
Ecuador	Petroecuador	1973
Malaysia	Petronas	1974
Kuwait	KPC	1975
Venezuela	PdVSA	1976
China	CNOOC	1982

Source: UNCNRET, State Petroleum Enterprises in Developing Countries, 1980; company reports.
**Russia nationalized its oil industry in 1918 but the industry was not consolidated into NOCs until 1934.*

What led to the criticism of the NOC model and the privatization of many NOCs in the 1990's and early 2000's?

In the late 1970's and 1980's government intervention in the economy in general came under attack. Supply side and "monetarist" economic analysis attacked much of the Keynesian basis for state economic intervention (Stevens, 2003). Developing country economies failed to perform well in many cases and this failure was attributed to inefficient, ineffective and often corrupt government intervention. The collapse of the Soviet Union was the final indictment of state controlled economies. *"The result was privatization, deregulation and general liberalization. State owned enterprises became viewed as*

dinosaurs requiring a helping hand into extinction. It seemed that removing state intervention from all but a minimal role was now an undisputed requirement" (Stevens, 2003).

In addition to the renewed credibility of market forces, NOC "dinosaurs" were subjected to other criticisms. Many governments, economists and industry stakeholders thought that conflicting objectives (development of the oil sector vs. fiscal funding of the government) led to NOC operational paralysis (El Mallakh, Noreng and Poulson, 1984). Politicians frequently deprived NOCs of sufficient investment capital to achieve their commercial goals in order to fund other state activities (Hartshorne, 1993). Subsidized prices for oil and gas products in many countries also saddled the NOC with losses (Philips, 1982; Khan, 1994).

On the other hand, NOCs were also criticized for becoming too powerful in the context of domestic politics especially when there were few countervailing powers. Information asymmetries and agency issues in the technically complex oil industry allowed the NOC to pursue rent for their own purposes. Pemex and PdVSA have been accused of behaving in such a way (Philip, 1982; Boué, 1993; Mommer, 2002).

A no-win dichotomy was believed to exist: Excessive government interference impaired the NOCs commercial effectiveness while insufficient control led to NOC disinterest in its non-commercial objectives and behavior similar to that of any private oil multinational corporation (Grayson, 1981). NOCs were monopolies operating in a highly protected business environment (Grayson, 1981). Private investment was prohibited or if permitted, the NOC was often able to create significant barriers to entry by manipulating the regulatory environment to its advantage. Lack of competition and transparency led to inefficiency, incompetence and corruption (Madelin, 1974; Van der Linde, 2000). NOCs fell behind technologically and managerially and were frequently used as vehicles to lower unemployment (Al-Mazeedi, 1992) or achieve other social and political imperatives.[10] As a result of these problems and the general movement globally away from centrally-planned economies toward market-based economies, there was a wave of NOC privatizations in the 1990's and early 21st century, as shown in Table 2. The goal of these privatizations was to eliminate conflicts of interest resulting from state ownership (political vs. economic objectives) and to promote efficiency gains by introducing competition (Aegis, 2002). It is interesting to note that most of the privatizations, and the more extensive privatizations, occurred in developed countries or the Russian transition economy. Several reasons could be attributed for this pattern, including the relative maturity or lack of hydrocarbon resources in some locations (such as France, Norway, onshore China and Argentina) and socioeconomic and political transformations in developed countries that were broadly impacting energy sector regimes (such as Britain). The Russian transition economy privatizations could be considered an outlier; a resource rich federation, the Russian companies were established during a time of chaotic upheaval following the collapse of the Soviet Union. The current stance of the Russian government is much more akin to that of governments in resource rich nations (such as the Middle East) and perhaps more typical of what should be expected or even of what might have occurred otherwise.

Table 2. Full or Partial Privatizations of National Oil Companies

Company	Date of Privatization	% of State Ownership Sold
YPF-Argentina	1993, 1999	58%, 100%
YPFB-Bolivia	1996	50%

[10] It is well known that NOCs are often the conduits for carrying out an array of activities, from road building to health care. These "non-core" activities have often been blamed for hindering NOC efficiencies in their "core" activities, production and delivery of hydrocarbon resources. The ability of NOCs to re-invest in their core activities also has been hindered by revenue capture by their host governments.

Company	Date of Privatization	% of State Ownership Sold
PetroCanada	1995, 2002	81%
Sinopec	1998	45%
PetroChina	1998	10%
CNOOC-China	1998	29%
Elf-France	1992, 1994	49%, 100%
Total-France	1992, 1998	30%, 100%
ENI-Italy	1995, 2001	15%, 70%
Yukos-Russia*	1994	100%*
Statoil-Norway	2001	20%
Gazprom-Russia	1994	61%
Repsol-Spain	1989-1997	80%
BP-UK	1979-1995	100%
Petrobras-Brazil	1995	49%
Lukoil-Russia	1994	92%

Source: Aegis Energy Advisors Corp., November 2002 and Petroleum Intelligence Weekly, April 2005
**Rosneft acquired a Yukos unit representing about 60% of its crude oil production in 2004.*

What is the situation of NOCs today?

Five of PIW's top ten world oil companies are NOCs: Saudi Aramco, NIOC, PdVSA and PetroChina. As can be seen below, nine of the top ten oil companies in terms of oil reserve endowment are 100 percent state-owned, dominate their countries' economies (with the exception of Mexico) and are the primary sources of export revenues and government fiscal revenues. In these countries, oil continues to be viewed as "strategic."

Table 3. 100% State-Owned National Oil Companies, 2003

Company	Oil/Gas % Export Revenues	Oil/Gas % of Gov't Fiscal Revenue	Oil/Gas % GDP	World Ranking By Oil Reserves
Saudi Aramco	90%	70-80%	40%	1
NIOC-Iran	80%	40-50%		2
INOC-Iraq	87%		80%	3
KPC-Kuwait		90%	40-50%	4
PdVSA-Venezuela	80%	50%	30%	5
Adnoc-UAE	70%		30%	6
Libya NOC		75%		7
NNPC-Nigeria	96%	80%		8
Pemex-Mexico	11%	35%	8%	9
Qatar Petroleum		70%		11
Sonatrach-Algeria	95%	75%	40%	16
Petronas-Malaysia	4%	29%		22
Pertamina-Indonesia	21%		7-19%	26
Petroecuador	40%	40%	12%	28
Socar-Azerbaijan	85%	50%		33
Rosneft-Russia	66%		25%	34
Sonangol-Angola	90%			38
SPC-Syria	67%	50%		39

Company	Oil/Gas % Export Revenues	Oil/Gas % of Gov't Fiscal Revenue	Oil/Gas % GDP	World Ranking By Oil Reserves
EGPC-Egypt				41
Ecopetrol-Colombia	28%	5%	7%	43
Kazmunaigas-Kazakhstan	60%	55%		35

Sources: PIW April 2005, World Bank Country Data at a Glance, EIA Country Profiles, Economist Intelligence Unit, EIA OPEC Revenues, Country Details, January 2005.

A second group of NOCs is significant in terms of resource endowment and majority ownership by their governments. The reduction in state ownership from 100 percent came about through the partial privatizations discussed previously. In these countries, the oil and gas sector plays an important but not necessarily a dominant economic role and several of the countries are net importers of hydrocarbons. These NOCs are shown in Table 4.

Table 4. Majority Owned National Oil Companies 2003

Company	% State Ownership	Oil/Gas % Export Revenues	Oil/Gas % GDP	World Ranking by Oil Reserves
PetroChina	88%	Importer[11]		15
Petrobras-Brazil	56%	Importer[12]		18
Sinopec-China	55%	Importer		31
Statoil-Norway	80%	47%	21%[13]	29-Gas
ONGC-India	84%	Importer[14]	10%	26-Gas
CNOOC-China	71%	Importer		44
PDO-Oman	60%	75%	40%	32

Sources: Same as 100% State-Owned NOCs 2003 in the table above.

Finally, a third group of NOCs exists which have minority ownership by their governments, as shown in Table 5.

Table 5. Minority Owned National Oil Companies 2003

Company	% State Ownership	Oil/Gas % Export Revenues	World Ranking by Oil Reserves
ENI-Italy	30%		29
Lukoil-Russia	7.6%	66%	10
Gazprom-Russia	38%*	66%	1-Gas
PetroCanada	19%		52

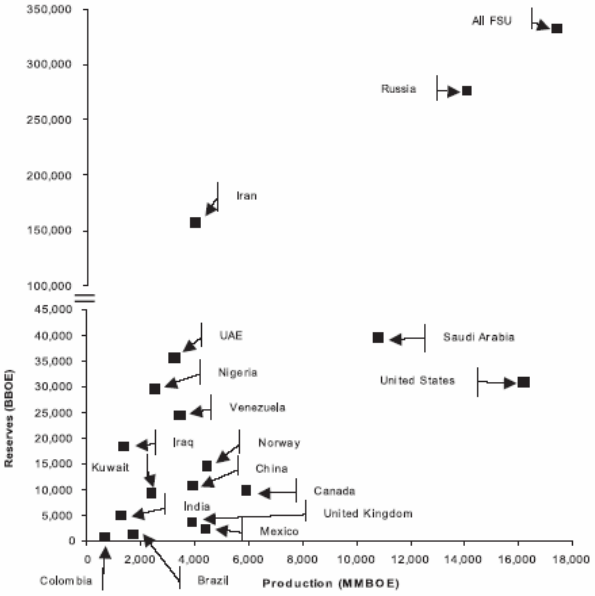
[11] In China 34 percent of domestic oil consumption is provided by imports. *U.S. EIA Country Analysis, China.*
[12] Brazil achieved oil self-sufficiency in 2006, e.g. the country's oil production equaled demand. However, due to the configuration of Brazil's refineries, the country still has to import lighter crudes.
[13] In Norway the oil and gas sector accounts for 28% of the state's fiscal revenue.
[14] In India, fuel and energy imports account for 26% of total imports. *World Bank, India Financial Profile.*

Company	% State Ownership	Oil/Gas % Export Revenues	World Ranking by Oil Reserves
Norsk Hydro-Norway	44%		37-Gas
Tatneft-Russia	31%**	66%	24

*Sources: Same as 100% State-Owned NOCs 2003 in the table above. *The government increased its ownership to 51% in 2005. **Owned by provincial not the federal government.*

Harsh fiscal regimes for both NOCs and private investors (if permitted to enter) appear to be characteristic of countries with large resource endowments and a high degree of dependency on oil and/or natural gas for export revenues and government funding. Some anomalies exist – Mexico and India, for example, have traditionally restricted their oil and gas upstream policies far beyond what is warranted by their comparative advantage in risked reserves (proven with typically a ninety percent probability) (Foss, 2005, and shown in Figure 1 below). In addition, the Mexican and Indian economies are relatively well-diversified with far less dependence on oil and gas for export earnings and government funding than many other oil-producing countries.

Figure 1. Country Hydrocarbon Resource Endowments and Distribution of Upstream Fiscal Regimes (Foss, 2005)



Sources: BP Statistical Review of Energy, 2004; U.S. Energy Information; Oil & Gas Journal Database.

Source: Based on Foss, et.al., (1999). Current approximation. Reproduced with permission.

Note that the worldwide risk capital "equilibrium" is dynamic. At time of first writing (May 2005) higher commodity prices were inducing host governments to revise fiscal regimes in ways that enable capture of "windfall" profits and accelerate a trend of increasing government "take" relative to IOC profit margins.

The recent upsurge in oil and gas prices has revived perceptions of "resource nationalism". In many producing countries, NOCs are still seen as crucial to economic development (Boué, 2003). Control of oil revenue, in particular, is often a mechanism for political control of government (Foss, 2004). Russia has nationalized Yukos and now controls 51 percent of Gazprom. Putin's government has asserted that various foreign oil and gas companies are in arrears on income taxes (see previous remarks on Russia's transition economy and NOC privatizations) and has limited foreign company participation in major oil and gas projects. Kazakhstan is considering changing the fiscal regime for foreign investors. Venezuela has tightened the fiscal regime for oil and increased state participation in oil projects. Venezuela is also alleging that foreign operators owe back taxes. Mexico's upstream sector remains largely off-limits for private investment and the issue of foreign participation continues to be a controversial political issue.

Bolivia's president, Evo Morales, renationalized the oil and gas industry in 2006. In Trinidad and Tobago, the state is seeking increased participation in the country's LNG projects. Even Argentina, an oft-cited "model" for privatized energy sectors, established a new state-owned energy company, Enarsa, in 2004 which "will become involved in all aspects of the energy sector."[15] While relatively high commodity prices persist it is unlikely that state participation in the oil and gas sectors in developing countries will decrease and fiscal regimes most likely will favor the state.

In a similar vein, NOC/IOC commercial arrangements will likely remain difficult to negotiate and implement. Limited upstream opportunities lead cash-rich IOCs to seek partnership or joint venture relationships with resource-rich NOCs. IOCs have investment capital (a continual problem for many NOCs) and technology and project management expertise which they feel would be beneficial for NOCs. However, it has been difficult to achieve these arrangements in practice in the most predominant resource-rich countries.

COMMERCIAL FRAMEWORK ANALYSIS

Given the importance of energy for economic development and the probable continuation of the NOC "model" for some time to come our objective is to identify "best practices" in NOC organization, management and commercial operations by using business analysis approaches to evaluate the performance of NOCs. In addition, we will identify the commercial frameworks, often the key drivers, influencing NOC performance and address non-commercial challenges.

The NOC Commercial Framework

Foss, et.al. (1998) suggested that energy sector efficiency could be defined by the prevailing style of organization, as shown in Figure 2.

Figure 2. Generalized Energy Sector Organization

Energy Sector Organization	***Regulated Monopoly***	***Regulated Competition***	***Free Market Competition***
Assumed Efficiency	Lowest	Higher	Highest

Source: Foss et.al. (1998).

Further work by Foss, et.al. (1999) defined a matrix to explain key outcomes in energy sector organization as a function of both economic organization of the host country and host government viewpoints with respect to strategic control of their energy sectors. This matrix is shown in Figure 3. Figure 3 suggests that in countries that tend toward centrally-planned economies and where energy is considered to be a strategic material, government-based solutions for energy are more frequently observed. Good examples are Mexico and Venezuela. In countries that tend toward market-based economies and where energy is generally regarded to be a commodity like any other, market-based solutions are more frequently observed. Examples of this situation at this time are the U.S. (strong) and Canada (less strong), which have been moving in this direction for some time. In essence, in those situations in which host governments view energy as "too important to be left to the market" government intervention will be strongest. If the country is a hydrocarbon producer, a net hydrocarbon exporter, and

[15] U.S. EIA, *Country Analysis Brief - Argentina*, January 2005.

hydrocarbons are the patrimony of the state, the probability of the NOC form of organization being utilized will be strongest.

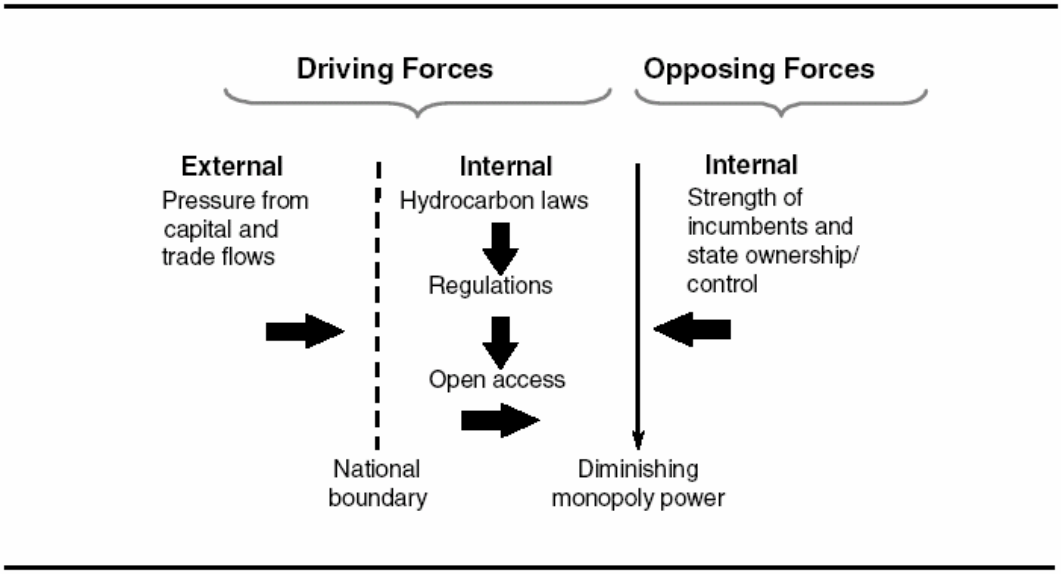
Figure 3. Energy Sector Organization and Presence of NOCs

Conditions	IF: energy is strategic ("too important")	IF: energy is a commodity	Outcomes
IF: tendency is toward centrally planned economies	High	Moderate to low	THEN: government-based solutions for energy
IF: tendency is toward market-based economies	Moderate to low	High	THEN: market-based solutions for energy

Source: As published in Foss, et.al, "Hydrocarbon Regulation and Cross-border Trade in the Western Hemisphere", Chapter 16 in *Energy Cooperation in the Western Hemisphere: Benefits and Impediments*, Center for Strategic and International Studies, 2007, http://www.csisbookstore.org/index.asp?PageAction=VIEWPROD&ProdID=163. First published in Michelle Michot Foss et al., *Best Practices in Energy Sector Reform*, Final Technical Report, Energy Institute, University of Houston, 1999 (available from Center for Energy Economics [CEE], www.beg.utexas.edu/energyecon).

A specific addition to the NOC commercial framework in recent years is the hydrocarbon regulator. The U.S. has long had regulators at both the national and state levels (examples are the U.S. Minerals Management Service, which oversees federal interests offshore, and the Texas Railroad Commission, the oldest hydrocarbon regulator in existence). In the U.S., hydrocarbon regulators have authority over entry and exit on public lands (with private lands being left to market forces), implement conservation practices (to ensure efficient and optimum resource exploitation), and oversee health, safety and environment (HSE) requirements (although numerous other regulatory entities exist in domains such as air and water quality). Outside of the U.S., government ownership over hydrocarbon resources is dominant and tends to be at the national level (albeit with provincial crown ownership in Canada). In countries with government control of hydrocarbon resources, and especially where NOCs exist, the hydrocarbon regulator is typically viewed as providing the mechanism for private capital flows and especially foreign capital flows to enter the energy sector. This approach nearly always pits the regulator against the NOC. A typical model is shown in Figure 4.

Figure 4. The Role of Hydrocarbon Regulator



Source: As published in Foss, et.al, "Hydrocarbon Regulation and Cross-border Trade in the Western Hemisphere", Chapter 16 in *Energy Cooperation in the Western Hemisphere: Benefits and Impediments*, Center for Strategic and International Studies, 2007, http://www.csisbookstore.org/index.asp?PageAction=VIEWPROD&ProdID=163. First published in Michelle Michot Foss et al., *Best Practices in Energy Sector Reform*, Final Technical Report, Energy Institute, University of Houston, 1999 (available from Center for Energy Economics [CEE], www.beg.utexas.edu/energyecon).

The commercial framework for a typical NOC thus can be summarized as shown below. NOCs today exist in both domestic and international environments. Any of the prevailing forces within these environments can overwhelm a NOC's own management structure, decision making processes, and performance outcomes. These forces may be mutually exclusive, or interact strongly.

Table 6. NOC Commercial Framework and Critical Forces

Internal (Domestic) Factors Impacting NOC		External (International) Factors Impacting NOC
Internal energy and materials requirements		Export strategies for regional, global markets
Political organization and "golden share"		Global supply-demand balances and commodity prices
Labor unions and labor politics	**NOC**	Goals, objectives of investors (foreign and domestic)
Revenue priorities for host government		Minimum requirements of global capital markets
Emerging regulatory framework and conditions for access		Interactions between investors and regulator
Domestic civil society groups and other nongovernmental organizations (NGOs)		International civil society groups and other NGOs

NOC Objectives

In order to evaluate NOC performance, NOC objectives must first be defined in order to determine what NOC success looks like. The literature on oil and gas producing country NOCs generally places their objectives in one of two categories: (1) Effective development of the country's hydrocarbon sector,[16] and (2) Contribution to the overall social and economic development of the country (Zakariya, 1980; Megateli, 1980). The literature also acknowledges the often conflicting nature of NOC objectives (Megateli, 1980; Grayson, 1981; UNCNRET, 1978). In its 2003 Annual Review Saudi Aramco speaks of "honing the company's dual role as a commercial enterprise that continually strives to maximize its financial performance and to contribute to the national interests." This conflict is well-articulated by Petrobras in its 2005 20-F filing with the U.S. Securities and Exchange Commission:

> *"The Brazilian government has pursued, and may pursue in the future, certain of its macroeconomic and social objectives through us…As a result, we may engage in activities that give preference to the objectives of the Brazilian government rather than to our own economic and business objectives…Accordingly, we may continue to make investments, incur costs and engage in sales on terms that may have an adverse effect on our results of operations and financial condition."*[17]

Examples of goals in the first category include efficient finding and development, production and marketing of hydrocarbons as well as meeting targeted profitability measures. Examples of goals in the second category include capital formation by generating profit and foreign exchange earnings from hydrocarbon sector operations and making this capital available to the state in order for the non-oil sector to grow as well as provision of adequate affordable energy to its citizens (Al-Naimi, 2004; Ecopetrol annual report, 2003).

Previous studies advocate that NOCs should be evaluated in light of their own objectives given the multidimensional differences in the history, resource endowment, organization, and the financial, economic and even political conditions of the petroleum industries in their countries. These could include the objectives assigned to it by the government and/or the specific corporate goals and targets specified in operational and financial terms during the evolution of the NOC (Megateli, 1980). Scholars as well as NOCs warn against comparing NOCs with IOCs given the dual objectives of the NOCs (Megateli, 1980; Al-Naimi, 2004).

Many NOCs are now explicitly stating their objectives. Examples of stated NOC objectives based on public disclosures can be seen below.

Category 1. Effective Development of the Country's Hydrocarbon Sector

- Increase production while replenishing/increasing reserves (Pemex, Petrobras, Ecopetrol, Saudi Aramco);
- Attain/maintain oil and/or gas self-sufficiency (Petrobras, Ecopetrol, Pemex);
- Modernize productive infrastructure and operations (Pemex);
- Increase upstream investments (Pemex);
- Improve operating margin, EBITDA and return on operating assets (Ecopetrol);
- Reduce lifting costs and meet targeted return on capital employed of 15% for 2010 (Petrobras);
- Use advanced business practices to improve operating efficiency (Saudi Aramco);
- Rationalize labor expense (Ecopetrol);

[16] For oil importing country NOCs, this first goal category becomes assuring affordable and reliable hydrocarbon supplies (Grayson, 1981).
[17] Petrobras Form 20-F, 12/31/03, pg. 24.

- Operate successfully and transparently in a deregulated market (Petrobras);
- Achieve internationally competitive business and technical expertise levels (Qatar Petroleum, Saudi Aramco, Ecopetrol);
- Improve health, safety and environmental performance (Pemex, Petrobras, Ecopetrol, Saudi Aramco, and Qatar Petroleum).

Category 2. Contribute to the Overall Social and Economic Development of the Country

- Make a significant fiscal contribution to the state (Ecopetrol);
- Provide the state with a reliable cash flow, of maximum value, from diversified business interests (Qatar Petroleum);
- Maximize the benefits from operations and place those benefits at the service of the country (Saudi Aramco);
- Leverage oil and gas resources to expand/diversify the economy (Saudi Aramco);
- Maximize the creation of economic value (Pemex);
- Maximize employment (Saudi Aramco, Qatar Petroleum);
- Contribute to social, cultural and economic programs (Ecopetrol);
- Contribute to the country's overall development (Petrobras).

NOC Performance Evaluation Analysis

NOC Selection

We selected five NOCs to illustrate our performance evaluation analysis: Pemex, PetroChina, CNOOC, Petrobras and Statoil. All five companies provide easily accessed, good quality and comparable data in their annual filings of the U.S. Securities and Exchange Commission's (SEC) Form 20F. The SEC standards are considered to be quite good relative to other international reporting standards. All of the companies have filed the Form 20F over a time period sufficient to permit longitudinal analysis. With respect to accounting standards, CNOOC, Petrobras and Statoil use U.S. generally accepted accounting principles (U.S. GAAP). Pemex uses Mexico generally accepted accounting principles (MAAP) and PetroChina uses International financial reporting standards (IFRS): both companies provide reconciliations to U.S. GAAP and over the time period of our analysis there was not a material difference between their standards and U.S. GAAP with respect to our performance metrics. Four of the companies (PetroChina, CNOOC, Petrobras and Statoil) use the "successful efforts" (SE) accounting methodology for reporting the results of upstream operations. Pemex does not explicitly claim to use the SE methodology but their disclosed methodology is practically identical to SE. All five NOCs have stated goals and objectives.

All five companies report results of upstream operations in accordance with U.S. accounting standard FAS 69. Upstream domestic and international operating results are disclosed separately. We have chosen to focus on domestic upstream operations given their importance to the five countries. (However, we expect the international upstream operations of these NOCs to become increasingly important to the companies and their governments given the increasing recognition that domestic energy security is dependent on sufficient worldwide oil and gas supplies.) The proved oil and gas reserves of all five companies are audited by third party independent and recognized petroleum engineering consulting firms.

With the exception of CNOOC, which operates solely in the upstream oil and gas sector, the other four companies are integrated firms with significant operations in the midstream (processing, storage and transportation) and downstream (refining, petrochemicals and retail marketing of hydrocarbon products) sectors of the oil and gas industry.

In addition to good data quality and comparability, these five NOCs have been repeatedly identified by other NOCs as companies having commercial results and governance frameworks that could be worthy of emulation. The managements of Middle Eastern NOCs in Marcel's 2006 study wanted to know more about Statoil, Petronas[18] and Petrobras. Pemex in its reports has mentioned these three companies as well as PetroChina as companies with superior operating and financial performance. Colombia's NOC, Ecopetrol, is explicitly modeling its reforms on the Petrobras model in Brazil.

Finally, these five NOCs span the spectrums of commercial frameworks and country economic reliance on the hydrocarbon sector. At one end of the commercial frameworks spectrum is Pemex which has a complete upstream monopoly and a dominant midstream and downstream position. At the other end of the spectrum, there is Statoil which must compete with other public and private (including foreign) companies on a relatively level upstream playing field. In addition, as discussed later in this paper, Statoil no longer dominates the midstream sector of the hydrocarbons industry and the downstream sector is slated to become increasingly competitive. As a result, Statoil accounts for 15 percent of Norway's proved reserves whereas Pemex accounts for 100 percent of Mexico's proved reserves. Interestingly, the governments of Norway and Mexico are also the most reliant on hydrocarbon export revenues for funding of the public budget but have evolved almost diametrically opposed commercial frameworks.

China permits public and private (including foreign) companies to participate in the upstream sector but has specific upstream policies favoring its own NOCs as discussed in more detail in the commercial frameworks section of this paper. The Chinese NOCs also dominate the midstream and downstream sectors of the oil and gas industry which can discourage upstream competition. PetroChina still controls 66 percent of the country's reserves. Competition is allowed in Brazil's upstream sector but Petrobras continues to dominate the upstream in part due to its superior knowledge of Brazil's exploration prospects and accounts for 77 percent of the country's reserves. Like the Chinese NOCs, Brazil dominates the midstream and downstream oil and gas sectors. China and Brazil are net hydrocarbon importers with large domestic markets for energy.

These spectrums of commercial frameworks and country economic structures will allow us to assess the impact of country economic structure on oil and gas sector commercial frameworks as well as the impact of commercial policies, practices and regulation on NOC performance.

Domestic Resource Endowment

It is important to note that the composition (oil/gas), quality (sour heavy oil vs. sweet light oil), quantity (size of proved reserves), diversification (number of geographic areas and geological basins), location (onshore/offshore, deep/shallow, remote/near markets) and maturity (proved undeveloped or PUD vs. proved developed reserves) of a country's oil and gas resource endowment will affect NOC performance. The NOC does not have control over these factors: it is the hand the NOC has been dealt by nature. However, the characterization of hydrocarbon endowments has performance-related consequences. Large resource endowments that are not overly complex for production and/or treatment generally translate into greater financial resources, liquidity and economies of scale. Resource composition, quality, quantity and location can affect realized prices and costs, monetization strategies and value enhancement. Highly mature reserve bases can result in higher costs and decreasing production. Lack of diversification can lead to operating disruptions with negative financial consequences.

These differences in resource endowment could make inter-NOC comparisons difficult if the differences are wide. Nevertheless, a NOC can be measured against itself over time.

[18] We did not include Petronas, an otherwise much discussed example, in this paper because it does not file a Form 20F.

The 2005 domestic resource endowment profile of the five NOCs researched for this paper can be seen in Table 7 below. MMBOE refers to million barrels of oil equivalent.

Table 7. 2005 Domestic Resource Endowment Profile

Company/Metric	Weight	Pemex	PetroChina	CNOOC	Petrobras	Statoil
Proved Reserves (MMBOE)	0.15	16,470	19,556	2,113	10,479	3,462
% Oil/Gas	0.075	83/17	59/41	62/38	86/14	33/67
% PUD Oil/Gas	0.075	30/39	20/71	53/55	55/56	31/28
Revenue/BOE	0.125	$41	$39	$43	$39	$41
Production (MMBOE)	0.15	1,605	1,053	141	673	360
Oil Prod. (MMB)	0.075	1354	829	122	585	205
Gas Prod. (BCF)	0.075	1305	1344	108	496	869
% Prod. Oil/Gas	0.075	84/16	79/21	87/13	87/13	57/43
Production Concentration	0.075	61% oil and 15% gas from Cantarell complex	41% oil from Daqing region	49% oil from Bohai Bay; 68% gas from West South China Sea	83% oil from Campos basin	49% oil from Tampen NCS;70% gas from Troll NCS
% Prod. Onshore/Offshore	0.10 0.025	17/83-Oil-Shallow 66/34-Gas	90/10 -Oil 90/10 -Gas	0/100- Oil-Shallow 0/100- Gas	18/82-Oil-Deep 18/82-Gas[19]	0/100-Oil-Harsh 0/100-Gas

For each metric, similar companies' results are highlighted in the same color for emphasis. For example, Pemex, PetroChina and Petrobras are similar in terms of proved reserves as are CNOOC and Statoil; these data are highlighted in yellow. Outliers (e.g., a company's results are not shared by any other company) are highlighted in red. Statoil stands out as a natural gas company in terms of proved reserves and production composition where the other four are oil dominant. CNOOC has the smallest gas production by far of the five companies. PetroChina is an onshore oil producer where the other four are primarily offshore oil producers.

Greater weightings are given to the size metrics (proved reserve volumes and production volumes) as a high degree of correlation has been observed among larger results on these metrics and other positive characteristics such as asset diversification, financial resources and liquidity, cash flow durability, operating success and longevity. Companies that have similar size metrics tend to share these other characteristics. Revenue/BOE (reflects resource composition, quality, and location) and percentage of production onshore vs. offshore have similar impacts on realized prices and production costs. Companies with similar results tend to share revenue and cost profiles. With respect to production onshore vs. offshore, greater weight is given to resource with greater production. As there is no more than a 10 percent variance in revenue/BOE, all the companies share similar results on this metric.

Table 8. Domestic Resource Endowment Comparability among NOCs

Company	Pemex	PetroChina	CNOOC	Petrobras	Statoil
Pemex	100%	75%	30%	57.5%	20%
PetroChina	75%	100%	27.5%	42.5%	20%
CNOOC	30%	27.5%	100%	30%	45%

[19] 75% of gas production is from associated gas.

Company	Pemex	PetroChina	CNOOC	Petrobras	Statoil
Petrobras	57.5%	42.5%	30%	100%	32.5%
Statoil	20%	20%	45%	32.5%	100%

Pemex is most comparable with PetroChina. To a lesser extent, Pemex and PetroChina are comparable to Petrobras. CNOOC and Statoil approach 50 percent comparability with respect to the resource endowment metrics. Although the comparability among the companies is less than 50 percent in many cases, this does not preclude companies learning from each other in the areas where there is comparability.

Performance Evaluation Methodologies

The objectives of the five NOCs in our study generally fall into two categories: commercial and non-commercial. Commercial goals typically address the effective development of the country's hydrocarbon sector while non-commercial goals pertain to the overall social and economic development of the country.

Commercial Objectives. With respect to determining whether or not a NOC effectively develops its country's hydrocarbon resources, we undertake the following analysis:

1. We focus on the **upstream sector (oil and gas exploration and development)** since it is critical to all subsequent oil and gas value chain components and typically is the most politically sensitive part of the industry. One part of the analysis will focus on the **NOC's ability to find and develop hydrocarbons** in a cost effective manner. It can be argued that performance in this arena is critical: an upstream company's sustainability is threatened if it cannot replace production cost-effectively. According to Moody's Investors Service *"To survive a company must reinvest substantial capital consistently and successfully over a long period of time to find new reserves and replace and grow its production."*[20] Otherwise reserves and production will decrease and the company will eventually liquidate.

2. The second part of the upstream sector analysis will concentrate on the **NOC's ability to profitably produce hydrocarbons.** The ability of the five NOCs to sustain themselves and the development of their countries' hydrocarbon sectors is an important objective.

Performance metrics are defined in Table 9 and Table 10; unless otherwise specified all data is sourced from the SEC Form 20F. Most of these performance metrics are within the control of the NOC. Items not within NOC control include the fiscal regime (tax burden); any government imposed limitations on capital available for investment; any government/labor union requirement to provide employment and/or "out-of-market" compensation levels; provision of price subsidies. Recognizing that a NOC may not be totally responsible for performance on these metrics, it is still useful from a policy analysis perspective to know which government policies are influencing NOC performance and to what degree.

Table 9. Metrics for NOC's Ability to Find and Develop Hydrocarbons Cost Effectively

Performance Metric	Definition	Attribute Measured
Exploration Success Rate	Number successful exploration wells/total exploration wells drilled in time period	Exploration competence; ability to replace reserves
Development Success Rate	Number successful development wells/total development wells drilled in time period	Development competence; ability to produce reserves
3 Yr. Ave. All Source Reserve Replacement	Total costs incurred per FAS 69 (acquisition+exploration+development)/reserve additions	Project selection; capital & project management &

[20] "*Global Integrated Oil & Gas Industry Rating Methodology*," Moody's Investor Service, October, 2005.

Performance Metric	Definition	Attribute Measured
Cost (RRC) (BOE)	(extensions & discoveries, improved recovery, net purchases)/(sales+net reserve revisions)	Effectiveness. Competitiveness and sustainability
3 Yr. All Source Production Replacement Ratio (PRC) (BOE)	Reserve additions (as defined above)+net reserve revisions/production	Drilling/operating success
(Cash Margin/BOE)/3 Yr. Ave. Reserve Replacement Cost /BOE	FAS 69 upstream revenue-(production and exploration expenses)/3 Yr. Ave. RRC/BOE	Level of embedded production and reserve replacement costs relative to the operating cash margin; ability to generate cash for investment
Upstream Op. Cash Flow/Upstream Cap. Ex.	FAS 69 upstream earnings after tax+depreciation/upstream capital expenditures	Ability to generate sufficient investment capital from upstream operations
Production and Reserve Growth Rates	Current period production or reserve level/prior period production or reserves level	Technical competence; sustainability; capital adequacy

Table 10. Metrics for NOC's Ability to Produce Hydrocarbons Profitably

Performance Metric	Definition	Attribute Measured
Upstream Operating Results/BOE	FAS 69 upstream results of operations ((revenue-(production and exploration expenses+depreciation+taxes))/annual BOE production	Operating efficiency and competitiveness; impact of the fiscal regime on NOC sustainability
EBTDA/BOE	FAS 69 ((revenue-production and exploration expenses)/annual BOE production	Operating efficiency and competitiveness
Upstream After Tax Earnings/Upstream Long Term Assets	FAS 69 upstream earnings after tax/ upstream long term assets as reported in Form 20F segment information	Capital management effectiveness; profitability

3. The third part of the analysis will concentrate on the **consolidated operating and financial performance of the NOC**. This is done more for diagnostic than comparative purposes as the business models (integrated oil companies vs. upstream only companies vs. primarily natural gas companies) and resource endowments vary considerably across NOCs. The main purpose of this part of the analysis is to identify any "red flags" in the overall corporate profile that could influence upstream performance such as: high corporate debt levels and/or tax burdens and/or poor interest coverage ratios that could limit access to capital; unusually high levels of non-financial non-operating expenses; ability to generate investment capital from operations; competing capital requirements of the non-upstream sectors, and overall NOC profitability.

Performance metrics are defined in Table 11; unless otherwise specified all data is sourced from the SEC Form 20F. The same issues surrounding NOC control of factors that could influence performance discussed above should also be considered here.

Table 11. Metrics for Consolidated NOC Operating and Financial Performance

Performance Metric	Definition	Attribute Measured
EBITDA/Revenues	Earnings before interest, taxes and depreciation/Revenues	Cash margin from operations; competitiveness, sustainability
EBIT/Net Interest	Earnings before interest and taxes/Net Interest	Ability to pay interest; financial strength
FFO/Capital Expenditures	Funds from operations/ cap. exp.	Ability to generate sufficient investment capital from operations
Net Income/Average Total Capital Employed (ATCE)	Net Income/(average of two year short and long term debt minority interest	Profitability, competitiveness, capital management effectiveness

Performance Metric	Definition	Attribute Measured
	deferred taxes operating leases equity)	
Gross Debt/ATCE	Short and long term debt operating leases/(average of two year short and long term debt minority interest deferred taxes operating leases equity)	Ability to service debt; financial strength
Gross Debt/Total Proved Reserves	Short and long term debt operating leases/total proved reserves	Ability to generate future revenues from current asset base to service debt

Five Company Performance Evaluations

The company profiles in Table 12 provide context for the performance evaluations and aid in results interpretation in Table 13.

Table 12. Company Profiles

Company	Pemex	PetroChina	CNOOC	Petrobras	Statoil
Country	Mexico	China	China	Brazil	Norway
Type Company	Integrated	Integrated	Upstream Only	Integrated	Integrated
Non-NOC Participants in Upstream	No	Yes but specific policies favor NOCs.	Yes but specific policies favor NOCs.	Yes but NOC is dominant.	Yes-Most level playing field.
NOC % Country's Reserves	100%	66%	7%	77%	15%
Upstream Assets ($MM)	$78,326	$57,102	$11,505	$25,869	$12,809
Significant International Upstream Assets	No	No	Yes	Yes	Yes

Table 13. Performance Metrics re: Ability to Find and Develop Hydrocarbons Cost Effectively

Company/Metric	Pemex	PetroChina	CNOOC	Petrobras	Statoil
3 Yr. Average Exploration Success 2005 vs. 2003 (05-03)	51%	49%	53%	46%	69%
3 Yr. Ave. Development Success, 05-03	92%	98%	100%	97%	100%
Extensions, Discoveries, Improved Recovery & Net Revisions, 02-05	Oil-135 MMB Gas-3,084 Buff MMboe-890	Oil-3,296 MMB Gas-3,162 Buff MMboe-5,866	Oil-441 MMB Gas-1,339 Buff MMboe-663	Oil-3,556 MMB Gas-3,656 Buff MMboe-4,163	Oil-656 MMB Gas-2,973 MMboe-1,175
3 Yr. Ave. All Source RRC ($/BOE), 05-03	$19.42	$5.90	$7.62	$6.61	$8.66
3 Yr. Ave. All Source RRC ($/BOE), 04-02	$41.29	$4.72	$6.24	$3.35	$7.83
Upstream Capital Costs Incurred 2005/2002	192%	217%	237%	194%	191%
Cash Margin/BOE	176%	519%	465%	508%	423%

Company/Metric	Pemex	PetroChina	CNOOC	Petrobras	Statoil
3 Yr. All Source PRC (%), 05-03	25%	152%	176%	140%	82%
Production Growth (BOE) 2005/2002	106%	111%	129%	111%	101%
Proved Reserve Growth (BOE) 2005/2001	-25%	119%	116%	119%	-6%
Upstream Operating Cash Flow/Upstream Capital Expense	35%	235%	206%	369%	181%

Note: Outliers highlighted in yellow.

Findings

- With the exception of Statoil's high exploratory success rate, all five companies have had comparable drilling success in their exploration and development programs. Statoil is exploring in a very mature area, the Norwegian Continental Shelf (NCS), where the probability of success is relatively high. In addition, Statoil has 30 years of exploration experience on the NCS: the geology is well understood and the infrastructure is well developed. The high success rate, however, is offset by smaller sized discoveries as borne out by Statoil's relatively smaller reserve additions and its recent inability to replace production.
- With respect to adding oil reserves through the drill-bit (extensions plus discoveries plus improved recovery, net of revisions), Pemex has had a dismal record especially when compared with similar companies PetroChina and Petrobras. Excluding revisions, Pemex's oil reserve additions remain very low at 310 MMB (million barrels) over the period. Pemex sees three alternatives for increasing oil reserve additions and production (Chicontepec development, mature field development, and deep water development) but all three alternatives require new technical solutions, new technical applications for enhanced recovery, intensive drilling and execution capacity and a high degree of efficiency.[21] However, Pemex has limited access to new technology and best practices in project management and are calling for "strategic alliances" in deepwater exploration and production.[22]
- Pemex's gas reserve additions are comparable with those of the other four companies. However, the poor oil drilling performance has resulted in failure to replace 75 percent of its production since 2002 leading to a 25 percent decrease in proved reserves. Moody's considers Pemex's performance on the RRC and PRC metrics as sub-investment grade (Caa). The other four companies' performance on the RRC and PRC metrics is investment grade (Statoil-Baa; PetroChina, Petrobras, CNOOC-A-Aaa).
- Mexico is the only country in this group which prohibits non-Pemex entities from participation in the upstream sector. As a result, Pemex has not had the same access to knowledge transfer from highly competent foreign companies nor the incentives to improve performance that come from competition.
- All five companies have seen their capital costs double since 2002 due to high commodity prices and increased exploration and development activity. As a result, reserve replacement costs have increased for every company except Pemex. Pemex's RRC improved between 2004 ($23.27) and 2005 ($19.57) as net oil revisions went from -109 MMB to +197 MMB. However, the absolute level of Pemex's RRC is by far the highest of the five, attributable to poor oil drilling performance. Similarly, Pemex's cash margin/BOE is much lower than those of the other four companies. This indicates that Pemex's level of embedded production and reserve replacement costs is high which impairs its ability to generate cash for future investment. As a result, upstream sustainability is threatened.

[21] Pemex presentation, October 13, 2006.
[22] Ibid.

- Statoil's production is flat over 2002-2005; Mexico's increased 6 percent showing that Pemex can produce what it currently has; PetroChina's production and proved reserves increased 11 percent and 19 percent, respectively, despite the maturity of its major three producing areas and the production and proved reserve increases of CNOOC and Petrobras reflect the relative immaturity of their reserve bases.
- All companies except Pemex can fund their capital expenditures comfortably from operating cash flow (Table 14). Pemex needed outside financing to fund about 65 percent of its upstream capital expenditures in 2004 and 2005. As will be seen in the following section, this results in an extremely high debt level for Pemex that would be rated sub-investment grade (Caa) if not for "*the extraordinary implicit support of the Mexican government*" (Moody's, 2005).[23]

Table 14. NOC's Ability to Produce Hydrocarbons Profitably

Company/Metric	Pemex	PetroChina	CNOOC	Petrobras	Statoil
2005 Upstream Operating Results/BOE[24]					
Revenue/BOE	$41.44	$38.58	$42.87	$41.41	$41.09
Production Costs/BOE	6.93	6.11	6.24	6.46	3.34
Prod. Costs & Exploration Exp.	7.23	7.95	7.45	7.80	4.45
EBTDA/BOE	34.20	30.63	35.42	33.61	36.64
DDA/BOE	2.17	3.04	4.71	2.35	4.93
EBT/BOE	32.04	27.59	30.71	31.26	31.71
Taxes/BOE	31.90	7.63	9.21	16.50	24.49
After-tax income/BOE	0.13	19.96	21.49	14.75	7.21
Taxes/EBT	99%	28%	30%	53%%	77%
After-tax income/Long Term Assets	0.2%	37%	26%	38%	20%

Findings

- Statoil is the most efficient producer of the group; Pemex has the lowest production costs plus exploration expenses of the other four companies.
- Earnings before taxes and depreciation expense/BOE are comparable among the five companies. Statoil is the best performer, benefiting from its low operating costs. As a producing company, Pemex is as efficient as PetroChina, CNOOC and Petrobras. It should be noted that the Chinese companies may have an advantage due to the circumstances of their privatization processes. Many of the general administrative functions of the companies, including education, health, research and development and downsizing compensation either remained at the parent holding company level or were transferred to local governments.
- The largest difference among the companies is the tax burden imposed by their governments. Pemex's tax regime is punitive at 99 percent of earnings before taxes. It deprives the company of needed investment capital and contributes to the company's high leverage position. The lack of capital becomes a bottleneck for reserve and production growth. Statoil's tax burden is also high at 77 percent of earnings before taxes and puts it at the lower end of the return on long term assets

[23] See Footnote 20.
[24] Authors' calculations based on information contained in the 2005 Form 20Fs, Notes to Financial Statements, Supplemental Information on Oil and Gas Producing Activities (FAS 69) filed by the companies in this study. Available on the company websites and www.sec.gov.

spectrum. The tax burden may become a problem for Statoil as it extends its operations into frontier and international areas and its capital needs increase. The Petrobras tax burden is high by U.S. standards, but the company is showing the best return on long term assets in the group. As an importing country, China's tax policies are not onerous as the country wants its NOCs to have the capital available to grow reserves and production.

Table 15. Consolidated NOC Operating and Financial Performance

Company/Metric	Pemex	PetroChina	CNOOC	Petrobras	Statoil
EBITDA/Revenues	60%	44%	61%	35%	30%
EBIT/Net Interest	23X	229X	487X	35X	27X
FFO/Cap. Exp.	46%	171%	184%	146%	122%
Net Income/ATCE	-14%	20%	28%	19%	17%
Gross Debt/ATCE	99%	25%	21%	40%	27%
Gross Debt/Proved Reserves	304%	110%	99%	207%	178%

Findings:

- Pemex and CNOOC generate the most cash margin before interest, depreciation and taxes. CNOOC is not burdened with lower cash margin non-upstream business segments and Pemex's non-upstream business segments are not large in relation to the exploration and production segment. The lower cash margins of PetroChina, Petrobras and Statoil reflect the impact of non-upstream business segments.
- For the reasons discussed above, Pemex's tax burden renders it unable to fund 54 percent of its capital requirements from operations and has led to negative returns on average total capital employed and very high debt levels.

Performance versus 2005 Company Upstream Commercial Goals

Table 16 provides a comparison of NOC performance relative to the companies' stated or implied commercial goals.

Table 16. Commercial Goals and Performance

Company and Goals	Performance
Pemex	
Increase BOE Production	Flat '05/'04; Increased 6% 2002-2005
Increase Operating Efficiency	BOE Op. costs increased each year 2002-2005
Improve Production Replacement Ratio	26% '05; 23% '04; 26% '03
Reduce Accident Frequency Rate	Decreased 29% from '04
PetroChina	
Contain Operating Cost Increases	20% Inc. 05/04; 9% 04/03; 11% 03/02
Accelerate Oil Production Growth	1% Inc. 05/04; 1% Inc. 04/04; 5% Inc. 03/02
Significantly Grow Gas Production	26% Inc. 05/04; 17% Inc. 04/03; 15% 03/02
Grow Proved Reserves	Proved reserves increased each year 2001-2005 for a 19% increase over the period

Company and Goals	Performance
CNOOC	
150% Production Replacement	3 Yr. Ave. 176%
19% Production Increase	14% '05; 14% '03; Flat '03
Production Costs in Top Quartile Peers	$6.24 versus $5.71 average for other 4 companies
Maintain Capital Discipline	Gross Debt/Total Capital did not exceed 25%
Petrobras	
Increase Production and Reserves	BOE prod. Up 12% '05 & 11% 2002-2005
Minimum reserve/production life of 15 years	15.5 '05; 17 '04; 17% '03
Strengthen deep water expertise	37 operating wells in depths more than 1,000 meters; drilled 400 wells in depths over 1,000 meters
Accelerate gas production	4% Inc. '05; 5% '04; 2% '03
Operational excellence	BOE Op. Cost at high end of the 5 companies
Improve Return on Total Capital	38% '05; 31% '04. High end of group.
Statoil	
Maintain NCS production at 1 MMBOE/D beyond 2010	Production flat at 986 MMBOE/D '04 and '05
Reduce Production Costs	Production costs flat 2005/2004
Replace Production	PRR 114% 2005
Maintain Proved Reserves	2% Increase in 2005
Improve Return on Total Capital	20% '05; 15% '04. Low end of group.
Strict Capital Discipline	Gross Debt/ATCE down from 30% to 27%

Note: Goals achieved are highlighted in yellow

Findings

- Petrobras and Statoil had the best performance relative to their stated goals. The two companies also had the most formalized and robust performance evaluation systems in place.
- The Chinese NOCs achieved half of their goals. CNOOC's performance evaluation system was more sophisticated than PetroChina's.
- Given the magnitude of its problems, it is not surprising that Pemex had the weakest performance evaluation process and failed to achieve most of its goals. As discussed previously, this failure is largely due to the government's commercial frameworks for the upstream hydrocarbon sector.

Non-commercial Goals and Implications for Performance

The non-commercial goals of NOCs may be the most controversial issue with respect to these companies. One school of thought contends that the social and economic development objectives of NOCs erodes their commercial efficiency and makes it less likely that they will successfully deliver the fuels to meet the world's energy demand over the next twenty years.[25] Many industry observers claim that the social

[25] Some researchers contend that NOCs are only 35-65 percent as efficient as the privately held (publicly traded) international oil majors, a consequence of NOC non-commercial objectives, especially domestic fuel price subsidies. See *The Changing Role of NOCs in International Energy Markets: Introduction and Summary Conclusions,"*

and economic development objectives outlined in Table 17 are the responsibility of governments and international aid and development agencies. However, this latter claim ignores the considerable evidence that governments and aid agencies in developing countries have not been able to effectively address these issues due to lack of capacity, corruption, poorly designed programs, and so on. In many developing countries, the NOC has greater resources and management capacity than their host governments.

Table 17. Measuring NOC Contribution to Social and Economic Development

Related Sub-objective/Goal	Performance Metric	Cite
NOC as "engine" to develop other economic sectors	Development of refining, petrochemical and other related industries	Stevens, 2003; Taher, 1980; Grayson, 1981; Mommer, 2002; Saudi Aramco, 2003.
Capital Formation	NOC fiscal contribution to state as % of oil/gas revenues; NOC fiscal contribution to state/BOE	Mommer, 2002; Boué, 2003; Saudi Aramco, 2003.
Technology Development/Training	Establishment of research institutes/training programs; Awards/Recognition; Joint ventures with technical experts.	Al-Naimi, 2004; Zanoyan, 2002; Alleyne, 1980; Sastri, 1980.
Full Employment	% unemployed; number of employees; labor expense	Megateli, 1980, Saudi Aramco, 2003.
Reduction of State Dependence on Oil Revenues	Oil % GDP, export revenues, public budget	Zanoyan, 2002.
Provision of affordable energy products to citizens	Price subsidies; % population served.	Megateli, 1980; UNCNRET, 1980.
Spending on social and environmental programs	Dollars spent by NOC and partners; number and type of programs	Ecopetrol, 2003,

The failures of government and international agencies have prompted a push for increased, not decreased, private corporate involvement in social and economic development.[26] The appropriate types and levels of this involvement depend on specific country conditions and this subject continues to generate substantial debate. Over the last fifteen years, however, there seems to be a growing consensus that there is a role for extractive industries' corporate involvement in the social and economic issues of the developing countries where they operate even though the definition of that role is still evolving.

In the future, IOCs may well find that access to a country's resources may depend on assuming a more active role in that country's social and economic development. This could be a fruitful area for NOC/IOC

Presentation, 3/1/07, Baker Institute of Public Policy at Rice University, Houston, Texas. Available at www.rice.edu\energy.

[26] There is considerable literature on this subject including, but not limited to: *"Corporate social responsibility and transnational companies from developing and transition economies,"* World Investment Report 2006; *Corporate Social Responsibility and International Development*, Michael Hopkins, Earthscan, Sterling, Virginia , 2007; "*The Virtue Matrix: Calculating the Return on Corporate Responsibility,"* Roger L. Martin, Harvard Business Review on Corporate Responsibility, Harvard Business School Press, 2003; *Extractive Industries and Sustainable Development*, World Bank , Washington, D.C. 2005; Charles O. Holliday, Jr. et. al., *Walking the Talk: The Business Case for Sustainable Development*, Berrett-Koehler, San Francisco, 2002. Also see Graham Davis and John Tilton, Colorado School of Mines, 2002, *Should Developing Countries Renounce Mining? A Perspective on the Debate* for a lucid and rigorous analysis of socioeconomic costs and benefits associated with extractive industry operations. See http://www.mines.edu/academic/econbus/pdf/Davis/Davis%20and%20Tilton%202002.pdf.

cooperation. IOC management practices and resources coupled with NOC experience and insights into these issues could yield a better result for all parties.[27] NOCs could act as "strategic bridging" organizations that aid collaboration between IOCs, governments, non-government agencies and local communities.[28]

Table 18 summarizes the contributions of NOCs (and non-NOCs where appropriate) to the social and economic development of the four countries in our study.

Table 18. NOC Socioeconomic Contributions – Company and Country Levels

Country	**Mexico**	**Brazil**	Norway	Norway	**Norway**	China	China	China	**China**
Company	**Pemex**	**Petrobras**	Statoil	N Hydro	**Total**	CNOOC	PetroChina	Sinopec	**Total**
Country Prod. MMBOE	**1,620**	**699**	360	506	**1,575**	140	1,053	317	**1,639**
NOC Production as % of Total	**99%**	**96%**	23%	32%	**55%**	9%	64%	19%	**92%**
Upstream Taxes, $MM	**51,205**	**11,106**	8,817	4,463	**13,280**	1,299	8,032	2,387	**11,718**
Other Taxes	**397**	**0**	0	0	**378**	427	0	202	**629**
Dividends	**987**	**1,178**	1,256	350	**1,606**	636	5,852	1,191	**7,679**
Signature Bonuses	**0**	**214**	0	0	**0**	0	0	0	**0**
NOC Direct Payments	**52,589**	**12,498**	10,073	4,813	**15,264**	2,362	13,884	3,780	**20,026**
Over-Employment	**WIP**	**WIP**	WIP	WIP	**WIP**	WIP	WIP	WIP	**WIP**
Price Subsidies (Cost)	**2,458**	**1,440**	0	0	**0**	0	2,421	428	**2,849**
Domestic Social Development	**109**	**194**	0	0	**0**	0			
Sub-Total	**2,567**	**1,634**	0	0	**0**	0	2,421	428	**2,849**
Total NOC Contribution, $MM	**55,156**	**14,132**	10,073	4,813	**15,264**	2,362	16,305	4,208	**22,875**
State Direct HC Interests	**NA**	**NA**			**17,375**	NA	NA	NA	
Total State Contribution	**55,156**	**14,132**	10,073	4,813	**32,639**	2,362	16,305	4,208	**22,875**
Non-NOC Upstream Taxes, $MM	**NA**	**NM**			**11,610**				**NM**
Non-NOC Signature Bonuses	**NA**	**286**			**NA**	11			**11**
Non-NOC Other Taxes	**NA**	**NM**			**310**				**NM**
Total Non-NOC Contribution	**NA**	**286**			**11,920**	11			**11**
Total Sector Contribution, $MM	**55,156**	**14,418**	**10,073**	**4,813**	**44,559**	**2,373**	**16,305**	**4,208**	**22,886**
Total Sector Contribution/BOE Prod	**34.05**	**20.62**			**28.28**				**13.96**

NM=Not meaningful
NA=Not applicable

[27] In five Middle Eastern countries, Valerie Marcel found that NOC professionals "*felt that IOCs develop expensive programs that NOCs and states could carry out more cheaply…..and considered that IOCs, unlike national institutions, do not understand domestic needs. There is great pride in many NOCs for having hitherto responded to the needs of the nation.*" Further IOC efforts in this regard "*must be coordinated with existing programs handled by the relevant ministries and put in place by the NOCs.*" Such IOC/NOC collaboration could help address the trust issue, e.g. "*The crucial issue for NOCs is trust and the lack of it is a serious obstacle to IOC-NOC partnerships…IOCs should not underestimate the knowledge of NOCs,*" Valerie Marcel, Oil Titans: National Oil Companies in the Middle East, Chatham House, London, 2006, pages 215-217.

[28] For a description of strategic bridging see "*Building Corporate Citizenship through Strategic Bridging in the Oil and Gas Industry in Latin America,*" Percy Garcia and Harrie Vredenburg, University of Calgary, Canada, JCC 10, Greenleaf Publishing, Summer 2003.

Findings

- The analysis above suggests that a robustly competitive upstream sector like Norway's produces an acceptably performing NOC structure with a fiscal contribution to the country, in total and on a BOE of production basis, which approaches Mexico's. Norway's model produces this result in spite of sovereign control of just over half of Norwegian output, while Norwegian total production nearly equaled Mexico's for 2005. (The above analysis does not include additional investment income generated by oil funds and Norway's is currently valued at $300 billion.) The crucial difference between the structures of the hydrocarbon sectors in Mexico and Norway is that the current structure in Mexico appears to be unsustainable while Norway's is widely considered to be sustainable.
- Increasing non-NOC participation in Brazil and China's hydrocarbon sectors to levels like that in Norway could benefit total sector contribution (on a $/BOE basis) to their economies.
- The countries with significant domestic fuel price subsidies (Brazil, Mexico and China) are also importers of refined oil products. The price subsidies charged against their NOCs both encumber NOC performance and reduce incentives for investment in domestic refining capacity.
- Pemex, Petrobras, Statoil and CNOOC provide the most detailed information on their social and economic development contributions in separate reports available on their web sites. Petrobras, CNOOC and Statoil provide these contributions outside their home countries as well. Petrobras and Statoil are acknowledged as industry leaders in this regard.

Commercial Frameworks: Identifying Key Factors Driving NOC Performance

In order to gain deeper insight into how and why NOCs with similar upstream endowments, objectives and priorities perform differently, we define the independent variables that influence NOC performance on the metrics previously discussed. The literature on state-owned enterprises in general and on NOCs in particular suggests that the following factors have significant impact on NOC performance.

Public Sector Governance

- The presence of a well-defined national hydrocarbon policy addressing oil and natural gas issues as well as the roles for permitted participants in the sector (Bacon, 1999; Khelil, 2002);
- Clearly defined and publicly stated objectives ranked by priority for NOCs (Wong, 2004);
- Clear objectives and management separation among oil and gas policymaking (executive branch function); regulation (a separate and autonomous executive branch function) and commercial operations (NOC) (Khelil, 2002; McPherson, 2003; Zanoyan, 2002; Al-Naimi, 2004; Ecopetrol 2003);
- Non-commercial objectives (including price subsidies) that are publicly disclosed as well as associated costs and sources of funding. These activities are reported and measured separately from the NOC's commercial activities (Wong, 2004);
- The fiscal regime (royalties, taxes, dividends, cost sharing, profit sharing, etc.) is clearly defined for all sector participants (Al-Naimi, 2004; Ecopetrol, 2003).

Corporate Governance

- Only one government entity is the NOC "owner" and entitled to exercise shareholder rights; other government agencies interact with the NOC on an arm's length basis (Wong, 2004);
- The NOC has an independent Board of Directors selected by merit and professional expertise which approves and oversees the NOC's business plan, capital budget and strategies (Al-Naimi, 2004; Wong, 2004);
- Merit and performance guides NOC manpower recruitment, placement and development (Al-Naimi, 2004);

- The NOC has an independent financial structure with audited financial results (Al-Naimi, 2004; McPherson, 2003; Wong, 2004);
- The NOC possesses strong internal financial oversight and controls as well as a strong corporate planning function (Al-Naimi, 2004; Wong, 2004).

Fiscal Regimes

- The fiscal regime for the NOC allows for net cash flow retention adequate to meet its objectives and plan over a reasonable time horizon (Al-Naimi, 2004; McPherson, 2003);
- The fiscal regime permits the NOC to obtain a credit rating sufficient to attract the appropriate amount of external financing (Wong, 2004);
- The fiscal regime for non-NOC participants in the upstream sector, if permitted, attracts the level of investment and operating results established by the government (Sultan, 2003).

Commercialization

- Non-NOC participants are permitted in the upstream sector in order to provide the performance incentives associated with competition (Bacon, 1999; McPherson, 2003; Wong, 2004);
- Joint ventures and/or other alliances exist between the NOC and third parties domestically and/or internationally in order to promote efficiency and new technology assimilation (Al-Naimi, 2004; Zanoyan, 2002; McPherson, 2003);
- The NOC contains profit-oriented business units that are adequately capitalized and accountable for results (McPherson, 2003).

Regulation

Separate work is being undertaken to assess the key goals and objectives of energy sector regulators and to determine and evaluate best practices.[29] An independent and transparent agency exists to:

- Compel NOCs to adopt practices that would render results similar to those in competitive markets with respect to prices, access to and quality of energy services (Australia, 1999);
- Assure market transparency, especially the availability of good quality, unbiased data and information (Foss, 2005);
- Resolve disputes and conflicts and address public concerns about development of and access to oil and gas resources and infrastructure (Foss, 2005).

Table 18 provides our subjective rankings of commercial framework variables for each NOC and for their host countries overall.

Table 18. Country Hydrocarbon Sector Commercial Frameworks Evaluation

Company/Commercial Framework	Weight	Mexico	China	Brazil	Norway
Public Sector Governance	**15%**	**7.3%**	**8.85%**	**10.95%**	**12.75%**
Well defined nat'l hydrocarbon policy	3.75	1.8%	1.8%	1.8%	3.75%
Clear NOC goals	3.75	1%	3.75%	3.75%	3.75%
Separation among policy, regulatory & commercial functions	3.75	1.5%	1.8%	2.4%	3.25%

[29] See the separate working paper prepared by Dr. Gürcan Gülen on our research team (not yet published; contact CEE for more information, energyecon@beg.utexas.edu).

Company/Commercial Framework	Weight	Mexico	China	Brazil	Norway
Full disclosure of NOC non-commercial goals	3.75	3%	1.5%	3%	2%
		Pemex	**PetroChina/CNOOC**	**Petrobras**	**Statoil**
Corporate Governance	**15%**	**7%**	**13%**	**13.3%**	**14%**
Independent BOD	3.0	0%	1%	1.3%	2%
Merit & Performance Based Personnel Policies	3.0	1%	3%	3%	3%
Audited Financials	3.0	3%	3%	3%	3%
Audited Reserves	3.0	2%	3%	3%	3%
Strong internal financial oversight & planning	3.0	1%	3%	3%	3%
		Mexico	**China**	**Brazil**	**Norway**
Fiscal Regimes	**25%**	**6%/18.75%**	**18.5%**	**18.5%**	**23.75%**
Allows for sufficient capital investment	6.25	2%	6.25%	6.25%	6.25%
Permits good credit rating	6.25	3%	6.25%	6.25%	6.25%
Attracts desired level of non-NOC investments	6.25	NA	3%	3%	6.25%
NOC budget process predictable and separate from gov't	6.25	1%	3%	3%	5%
Commercialization	**30%**	**2%**	**10.7%**	**14%**	**26%**
Upstream Competition	10.0	0%	2.7%	2%	10%
NOC/Non-NOC JVs, alliances	5.0	1%	2%	4%	5%
Midstream Competition	5.0	1%	1%	1%	4%
Partial Privatization	10.0	0%	5%	7%	7%
Regulation	**15%**	**3%/10%**	**3%**	**6%**	**15%**
Effectively limits NOC market power upstream	4.5	NA	1%	1%	4.5%
Limits NOC market power midstream	4.5	2%	1%	2%	4.5%
Provision of good quality, unbiased data to all participants	3.0	1.5%	.5%	1.5%	3.0%
Resolve disputes & conflicts	3.0	1.5%	.5%	1.5%	3.0
OVERALL	**100%**	**28%**	**54.05%**	**62.75%**	**91.5%**

Weightings Rationale

Based on the performance evaluations of the five NOCs in our study group and NOC statements in presentations and other public documents, it appears to us that the commercial frameworks with respect to

fiscal regimes and commercialization have the greatest impact on NOC performance. Accordingly, we have given them greater weight. The remaining weights were assigned based on NOC statements and other industry analysis.

Findings

Public Sector Governance

- Only Norway has a well-defined hydrocarbon policy addressing all sectors (upstream, mid-stream and downstream) as well as the roles for permitted participants in the sector. Brazil and China have well-defined policies for the upstream sector but lack a coherent policies for the mid and downstream natural gas sectors. Mexico has well-defined policies for the mid and downstream sectors but they don't fit well with the current upstream sector organization.
- The three NOCs with partial private ownership (Statoil, PetroChina, CNOOC and Petrobras) have clearly defined and publicly stated objectives; disclose performance versus those goals; and have performance evaluation systems to hold management accountable to those goals. Mexico has publicly stated goals but lacks the management performance evaluation systems.
- In Norway's upstream, the policy and regulatory functions are the responsibility of the Ministry of Petroleum and, at times, the Norwegian Congress (the Storting). There is not an independent upstream regulator. Statoil is responsible for commercial operations. However, Norway has required Statoil to market the Norwegian's state's directly held oil and gas interests together with its own as a single economic unit. This coordinated marketing strategy means that Statoil may not be able to fully pursue its own commercial interests as it must ensure "an equitable distribution of the total value creation between the state and Statoil." In the midstream, the policy and regulatory functions reside with the Ministry of Petroleum and Energy and commercial operations reside in a producer-owned gas pipeline system which is operated by wholly-owned Norwegian state company Gassco SA. Statoil provides technical operating services to Gassco on a cost basis. Gassco holds no ownership in the gas pipelines or gas production. The pipeline ownership interests and transportation access of Statoil and the other producers were not affected. Statoil owns approximately 21% of Norway's gas pipeline and terminals system. The Ministry of Petroleum and Energy sets tariffs based on operating costs and a return on capital to the producers who made the investments. There is no independent midstream regulator.
- In Brazil's upstream, the policy functions belong to Ministry of Mines and Energy and the regulatory functions belong to an independent agency, the ANP. Commercial functions are the responsibility of Petrobras and other exploration and production companies. In the midstream sector, Petrobras controls the oil and gas pipeline infrastructure. There is independent regulation of the gas pipelines with respect to access and tariffs.
- In China's upstream, policy functions are decentralized and highly fragmented. As a result, there has been inadequate development of national institutions responsible for policy and regulations. Even though upstream governance lies officially with the National Development and Reform Commission, local governments and the companies themselves frequently assume the policy/regulatory functions. In addition, the role of the Communist Party in both national institutions and the companies themselves adds additional opaqueness to an already complicated governance situation.[30] Access to resources for non-NOC upstream participants is the responsibility of the 100 percent state-owned administrative companies China National Petroleum Corp. and CNOOC. These administrative companies own varying majority interests in the partially privatized commercial companies PetroChina Limited and CNOOC Ltd. All of the exploration and production assets and operations are controlled by the commercial companies. The administrative companies provide some services to the commercial companies and are responsible for negotiating production sharing agreements with non-

[30] Jin Zhang, *Catch-up and Competitiveness in China: The case of large firms in the oil industry*, London: Routledge-Curzon, 2004.

NOC participants, at times with input from the commercial companies. Once established, the PSAs are transferred to the commercial companies. In the mid-stream PetroChina controls almost all gas transportation infrastructure. Similar to the upstream, midstream policy and regulatory functions are fragmented over a large number of entities, impeding the development of infrastructure and rendering the sector opaque for non-NOC participants.

- In Mexico, upstream policy and regulatory responsibilities are the responsibility of the President and various Cabinet-level ministries which creates myriad "bosses" and sometimes conflicting mandates for Pemex. Commercial upstream operations are not clearly separated from the government as Pemex is a decentralized public entity of the government. In the natural gas midstream, policy belongs to the energy ministry, Secretaría de Energía or SENER; regulation belongs to CRE (which reports to SENER) and commercial operations belong to Pemex and other non-NOC participants.
- With respect to full disclosure of non-NOC goals, Mexico and Brazil provide the fullest disclosures.

Corporate Governance

- Following is the independent composition of the Board of Directors of Pemex, PetroChina, CNOOC, Petrobras and Statoil, respectively: 0 percent, 23 percent, 42 percent, and 67 percent.
- Pemex provides its audited reserves one year in arrears, e.g., the 2005 audited reserves will be provided in 2006.
- According to Pemex, it complies with only 48 percent of the best practices described in the Code of Best Practices in Corporate Governance of the Mexican Stock Exchange. It has no audit committee and the BOD does not participate in decisions like management nomination and compensation and strategic planning.

Fiscal Regimes

- The tax burdens and capital investment resources of the five companies have been discussed previously.
- All of the companies have investment grade credit ratings. Pemex's lower score is due to the fact that it would approach a sub-investment grade rating based on its own metrics. Its investment grade rating is due to the extraordinary implicit support of the Mexican government.
- The capital budgets of Pemex and Petrobras must be approved by their legislatures. The Storting's approval must be obtained for certain Statoil investments. The wholly state-owned parent companies of the Chinese NOCs must approve their capital investments.
- In China, CNOOC has the right to back in for a 51 percent interest in any commercial discovery made by a non-NOC upstream participant without paying any portion of the exploration costs. This could discourage non-NOC investment. In Brazil, Petrobras has used its superior knowledge of Brazil's exploratory prospects to either "cherry pick" the best blocks or to negotiate joint ventures with non-NOC participants that favor Petrobras.

Commercialization

- Upstream competition matters. The Norwegian government attributes Statoil's success and the overall success of Norway's hydrocarbons sector to having competent non-NOC participants in the sector. First, there was an initial strong element of knowledge transfer from foreign oil companies and supply/service companies. Second, the coordination and competition among commercial players often yields the best results in activities that include many complicated decisions of a commercial and technical nature. These elements exist in China and Brazil as well, although to a lesser extent.
- There is no upstream competition in Mexico. In China, PetroChina and CNOOC still control over 70 percent of China's reserves. In Brazil Petrobras has a 98 percent market share in oil production and controls over 80 percent of the country's reserves. In Norway, non-NOC participants account for the majority of oil and gas production and reserves.

- In Mexico, China and Brazil, the NOCs control over 90 percent of oil and gas mid-stream assets. In Norway, Statoil's percentage is lower at 21 percent.
- NOC control of midstream assets can discourage investment in the upstream sector if companies perceive that the NOCs can block third party access or cross-subsidize their marketing and transportation activities.
- The four companies that have non-government shareholders all point to the following benefits from partial privatization: (1) Opportunity to divest less productive assets; (2) Implementation of management accountability systems; (3) Opportunity to align compensation systems with performance; (4) The requirement to have clearly stated goals and strategies with disclosure of performance; (5) Equity share price and equity analyst coverage allows the company to measure performance over time and to measure performance against other hydrocarbon companies and provides incentives for reasonable tax, investment and debt policies.

Regulation

- Understanding the role of hydrocarbon regulation needs further work. Our ratings are subjective based on anecdotal information and country observation, and more research is required on the structure and effectiveness of the Chinese system.

NEXT STEPS IN CEE-UT RESEARCH

We have attempted in this working paper to put forth a synopsis of work in progress as well as raise questions and challenges for how NOCs are viewed today and going forward. Our research agenda going forward will include the major items outlined below.

- Complete analysis of the fiscal contribution of the hydrocarbons sectors to each of the five countries;
- Conduct additional research on regulatory effectiveness in the four countries, especially China;
- Evaluate the effectiveness of NOC social and economic development measures as well as the factors that drive performance in this area;
- Make recommendations on the steps the NOCs in our study group can take to improve performance and better manage social development issues (where applicable);
- Analyze the impact of the performance evaluations on NOC/IOC and NOC/NOC collaboration and identify areas for future collaboration.

CEE is actively exchanging information with certain NOC organizations, and monitoring analysis of NOC's by other research groups. We encourage questions and comments on this working paper. The authors and CEE research team can be contacted at energyecon@beg.utexas.edu.

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