

**A METHODOLOGY FOR ASSESSING THE
PERFORMANCE OF NATIONAL OIL COMPANIES**

*Background Paper for a Study on National Oil Companies
and Value Creation*

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Executive summary

National oil companies (NOCs) matter because they dominate the proven oil reserves that are expected to supply the world's growing need for liquid fuels. Also, in many countries, the oil sector dominates the economy and is seen as the major source of economic development.

This study seeks to help define a methodology for assessing NOCs' effectiveness, performance, and ability to create value.

Creating value in oil and gas

Value is created in the sector by the various links in the oil industry value chain, which starts from the resource base and moves through production, processing, transportation, and, finally, to the market. While the resource base is a gift of nature, translating this into reserves and production requires investment and effort. For many NOCs, however, reserve estimates are the result of assumed arithmetic rather than any effort, and so should be discounted as a measure of performance. The production link in the value chain is related to field recovery factors and production costs, both of which have technical and managerial dimensions. The same is true of the processing and transport stages of the chain. The market value of oil—both crude and petroleum products—and gas can be assumed to be outside the control of NOCs in most cases around the world.

The role of the national oil company in creating value

NOCs directly create value since, in many cases, they are operators with control over costs and efficiency. They do so also by virtue of their “national mission,” which differentiates them from international oil companies (IOCs). Thus, the “shareholder” (that is, the government) may have many different objectives, both honorable (maximizing social welfare) and not (rent seeking). This makes defining the national mission difficult and measuring its accomplishment problematic. Three dimensions can, however, be identified: (i) protecting national hydrocarbon wealth, (ii) promoting economic development, and (iii) promoting the political interests of the state abroad. Protecting hydrocarbon wealth requires maximizing the recovery factor on fields and “optimizing” resources, which concerns a country's depletion policy. This involves a number of choices, such as whether to produce today versus tomorrow and how to deploy current revenues. Promoting national development requires an NOC to maximize its financial and productive linkages, both forward and backward. The pursuit of national political interests abroad is more difficult to define and the role of “national champion” more controversial.

An NOC can also create value indirectly—as an advisor to other elements of the government and as a regulator—although this can prove problematic when the NOC is also the operator.

Factors affecting the role of national oil companies

These can be divided into exogenous and endogenous factors, although sometimes the distinction is blurred. *Exogenous* factors relate to (i) politics, including the role of ideology, the political system, the way in which a sector is structured, and international obligations; (ii) economics—the level of oil dependency, fiscal sustainability, immediate revenue needs, and overall depletion policy; and (iii) technical issues, such as the legal and competitive environment, factor input, quality, and availability.

Endogenous factors relate to (i) objectives—commercial versus “national mission” issues, the role of rent seeking, and the desire to operate abroad; (ii) decision making—corporate governance, the nature of the incentives system, the role of the board of directors, and the nature of the budgetary system under which the NOC operates; and (iii) capacity, including the quality of management and technicians.

Measuring performance

Assessing the relative importance of the individual factors that affect NOC performance in any scientific or objective way is impossible. But, collectively, it is possible to assess whether an NOC is performing well or not. This section considers aggregate and specific measures of performance; of the latter, the main one is “reputation,” which can be assessed via the Delphi Method (as the example of NOCs in the Middle East shows).

Specific measures of performance concern efficiency and operational and financial measures. Such measures would be used to assess any company, IOC or NOC. But, in addition, performance measures relating to the “national mission” must be considered. Under each heading, various measures are defined and discussed, especially in the context of how to be quantified.

The section then examines how these measures can be used to compare performance. The two bases for comparison—cross-section and time series—are then considered. In both cases, there are problems arising from comparing apples to oranges. Yet another problem inherent in comparing NOCs is how to aggregate the measures. Different measures have different metrics, making addition difficult. Weighting measures is also problematic. For companies listed on a stock exchange, weighting and assessment are effectively done by the market, as reflected in the share price, but for nonlisted companies this represents a major problem.

Performance matrix

A major obstacle to translating the above ideas into operational measures is lack of transparency, which characterizes many NOCs. Some NOCs are listed on stock exchanges, however, and this number is increasing under pressure to improve commercial performance and to get NOCs off state budgets.

But, for many NOCs, there is a vested interest in minimizing transparency to deepen the information asymmetry at the heart of the “principal-agent analysis.” While there are growing

pressures for greater transparency, its lack remains a major challenge to the accurate measurement of NOC performance.

The report lists specific and quantifiable measures that can be used to assess an NOC. These are categorized as (i) general financial ratio analysis—including of leverage, liquidity, profitability, and market value ratios; (ii) performance measures specific to the oil industry, both operational and financial; and (iii) “national mission” measures—fiscal, forward, and backward linkages. The report explains how the “golden quadrant” approach used by Saudi Aramco can be used, at least at a conceptual level, to assess the portfolio of an NOC’s projects.

The report also suggests categorizing NOCs to account for different information levels and operating contexts. This is then used to create a performance matrix, although the aggregation problem remains unsolved. As described in box 6.1, linking the performance indicators to the dimensions of analysis detailed in Study on NOCs and Value Creation¹ is effectively impossible without using of some form of the Delphi Method.

Conclusion

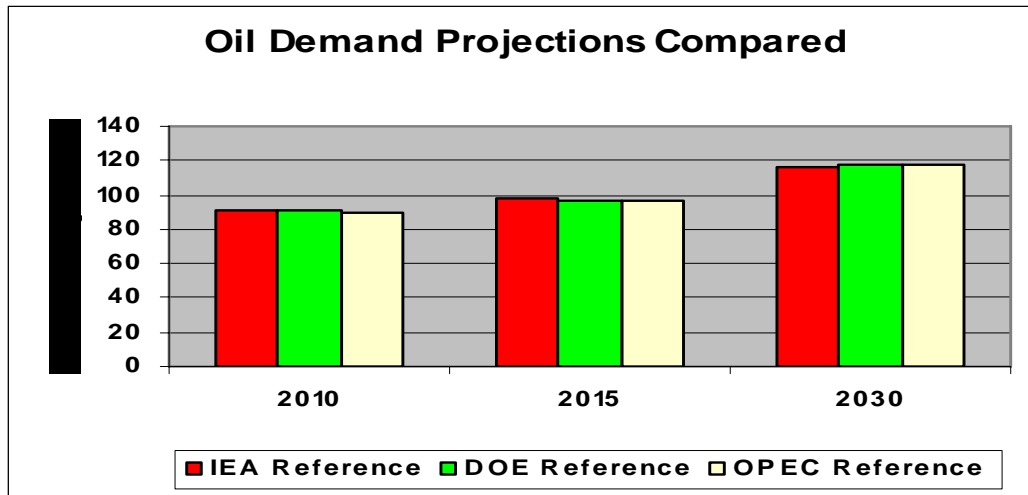
Measuring NOC performance is difficult. As previously stated, challenges include the “national mission,” a general lack of transparency, and the so-called aggregation problem. But there are metrics to assess performance. Much more work is needed to consider which of these metrics is crucial and how, in the absence of share prices, they can be distilled into a single metric in order to allow intercompany comparison.

¹ The objectives and dimension of analysis of Study on NOCs and Value Creation are detailed at: <http://www.worldbank.org/noc>

1 Why national oil companies count

The performance of national oil companies (NOCs) is of concern for two reasons. First, NOCs dominate proven reserves and crude oil exports into the international oil market. In 2005 NOCs controlled 77 percent of world reserves, compared to 10 percent controlled by private international oil companies (IOCs), 6 percent by Russian oil companies, and 7 percent by NOC-IOC joint ventures (Hartley and Medlock, 2007). Thus, NOC performance will be a crucial factor in transforming reserves into producing capacity. An ability to deliver on their geology will determine whether the expected production of crude oil illustrated in figure 1.1 will emerge. Failure carries serious implications for oil prices and global energy markets.

Figure 1.1 Expectations of future oil production



Sources: IEA, 2007; DOE, 2007; OPEC, 2007.

Second, in many oil-producing countries, the oil sector is the major economic sector. Its performance will be the key to the promotion of economic development. Development is defined as the promotion of the nonhydrocarbon economy, both nationally and regionally. This is to ensure sustainability when hydrocarbons have either been exhausted or no longer have value. Development also requires a reduction in national poverty since many major oil producers suffer high levels of poverty.² Development, as defined here, arises through Hirschman's (1977) financial (consumption and fiscal) and production (forward and backward) linkages, to be discussed further in this report. The magnitude and effectiveness of these linkages will be reflected in the performance of the NOC.

This report draws up a methodology to assess the effectiveness of an NOC, its performance, and its ability to create value. Section 2 outlines a conventional view of how value is created in the oil and gas industry. Section 3 considers the role of the NOC in this process and how it may

² Indeed this is one of the symptoms of the so-called resource curse (Collier, 2007).

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be different from the role of an IOC. Section 4 outlines the factors that affect the role of NOCs. Section 5 considers the way in which the performance of an NOC might be measured to allow assessment for performance both on a cross-sectional and time-series basis. Section 6 concludes with a list of possible measures and a matrix that can be used on a “tick-box” basis to compare NOCs and IOCs.

2 Creating value in oil and gas

Table 2.1 presents a stylized model of how value is created in the oil and gas industry. It also identifies the various links in the value chain that are under the control of the operating company and therefore relate to performance. Effectively a gift of nature, hydrocarbon resources are the starting point. Of course, if the company is operating internationally then, assuming access, the resource base is effectively global. The key link is knowledge of the existence of these resources, which requires exploration and development and is a key part of assessing the extent of the resource base. This gives rise to an extremely important point regarding the use of “reserves” in the measurement of performance. This matters because—as will be discussed below—many of the (relatively few) studies of NOC performance use reserves in elements of the measurement. As previously stated, the “gift of nature” is the oil in place. Assessment of this requires exploration. But it is only when the oil in place is developed that reserves are created. Thus the reserves booked by an IOC are in some sense “earned” and reflect effort on the part of the IOC, which reflects performance. But for many NOCs, reserve numbers are based upon estimates of the oil in place³ and simply reflect mathematical extrapolation rather than any effort. As such, they should not be used as part of a performance assessment.

Table 2.1 The oil and gas value chain and its links

The chain	Resource base	Production of oil and gas	Processing	Transport to market	Market value
The links	Knowledge of the resource base	<ul style="list-style-type: none"> - Technical issues - Private cost issues - Social cost issues - Timing issues 	<ul style="list-style-type: none"> - Refining crude - Stripping the gas 	<ul style="list-style-type: none"> - Private cost issues - Social cost issues 	<ul style="list-style-type: none"> - International crude - Domestic crude - International product - Domestic product - International gas - Domestic gas

Source: Author.

Production has a number of links, and each link in the chain is expected to add value to the initial gift of the resource base. First, there are the technical issues concerned with recovery factors and reserve replacement. Costs of production can be thought of in terms of private costs per barrel, but social costs—such as environmental damage from spills, drilling muds, gas flaring, and so on—are also important. Timing also matters since how quickly or slowly the reserves are produced will affect their value.

Processing in the case of crude oil relates to the removal of associated gas and consequent refining. Gas processing requires the stripping of the liquids from wet gas. Processing also involves private and social costs.

³ In reality, it is not at all clear in many cases what the reserve estimates for the oil-producing countries are based upon.

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Transport to market involves getting the crude oil to refineries, either domestically or abroad, by means ranging from road transport to pipelines to sea transport. Oil products also involve marketing and distribution networks. Gas is either piped to market, domestically or abroad, or converted into liquefied natural gas (LNG) for export, normally by sea.

Finally the market value relates to the price for which the crude, petroleum products, or gas might be sold. Except for the large producers in the Organization of the Petroleum Exporting Countries (OPEC), the international prices of crude and petroleum products can be assumed to be a given, outside the control of the operator.

3 The role of national oil companies in creating value

National oil companies have both a direct role and an indirect role in creating value. We will consider the direct role first, dealing with the indirect role at the end of this section.

As the operator of the value chain, whether alone or in joint ventures⁴ with other companies, the NOC has direct control over costs and the efficiency of operations. The purpose is to maximize the value added. But unlike an IOC, the NOC also has a set of national objectives which go beyond the simple commercial concerns of an IOC. In the literature, this is referred to as the “national mission.”

The national mission

The performance of any company needs to be assessed in terms of the objective set for it by its owners. In the case of an IOC, owned by its shareholders, the objective is maximizing shareholder value, subject to certain ethical and environmental constraints for some shareholders. This aim is clear and relatively unequivocal. But the owner, or shareholder, of an NOC is the government. As a result, NOCs were intended at their creation to do more than simply produce oil or gas for a nation (Marcel, 2006; McPherson, 2003; Stevens, 2008; Van der Linde, 2000). Their other objectives compose their so-called national mission, which can be complex, difficult to fathom, and often contradictory.⁵

Part of this complexity arises because of the nature of the shareholder. Any government is far from a monolithic entity. The simplest division can be made between politicians and bureaucrats; further differences are feasible depending upon the nature of the political system.⁶ Also, how the various players interact will differ considerably, depending upon a range of variable factors.⁷

Thus the objectives of the shareholder are inevitably many and varied. They can be divided roughly into honorable and less honorable. Honorable motives would involve trying to maximize social welfare by promoting nonhydrocarbon economic growth and reducing poverty. NOCs may also want to take care of the interests of future generations either through saving some of the current national wealth and/or protecting the natural environment. Less honorable motives might involve rent seeking, securing the fruits of corruption, or maintaining political power. The nature

⁴ “Joint ventures” in upstream oil jargon have a very specific meaning, different from “production sharing agreements” and “service agreements,” of which there are many variations. Thus, “joint venture” is a term used simply to imply partnership in some shape or form.

⁵ Within Saudi Aramco, decisions related to the “national mission” are often referred to, somewhat disparagingly, as “strategic decisions.”

⁶ For example, in a parliamentary system, politicians can be divided between cabinet members and “back benchers.” The bureaucracy is often divided into the administrative and executive branches.

⁷ For a detailed discussion of different political systems and how they impact the way NOCs operate, see Myers and others (2006).

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and objectives of other stakeholders must also be considered. These include operators using private capital, workers, consumers, regulators, and (increasingly) nongovernmental organizations (NGOs) representing various dimensions of civil society.

Because the objectives are complex and conflicting, defining the “national mission” is difficult and, as will be seen, measuring the ability of an NOC to deliver on that mission is problematic. But two uncontroversial components can be used to help define the mission: (i) protecting the national hydrocarbon wealth and (ii) promoting economic development. Some would add a third, more controversial, component, which is to use the NOC as a “national champion” to promote the political interests of the state abroad.

Protecting national hydrocarbon wealth

Protecting a nation’s hydrocarbon wealth includes two issues. The first is ensuring that the resources are produced to maximize the recovery factor. This is normally described in upstream oil agreements as “pursuing good oilfield practice.” The concept is relatively easy to understand since it is essentially a technical issue involving natural decline rates and recovery factors. The second issue is “optimizing” the resources. This is a much more difficult concept to manage since it is concerned with the hydrocarbon depletion policy of a country. Any depletion policy involves choices made by the government as the owner of the subsoil hydrocarbons.⁸

The first choice is whether to produce the oil now or later. If production is postponed, this choice earns a rate of return that will be positive if the future rent from the barrel is higher than today, either because oil prices have risen and/or production costs have fallen. If the oil is produced today, then the choices are either to invest the revenue domestically or invest it abroad—or both. Investing domestically will earn a rate of return, although how much will be a function of the government’s ability to use the revenue productively and avoid attacks of “resource curse.” Investing abroad also earns a rate of return, although how much will be a function of how well the fund and its portfolio is managed and whether the assets are secured from the political interference of other governments. Figure 3.1 illustrates this.

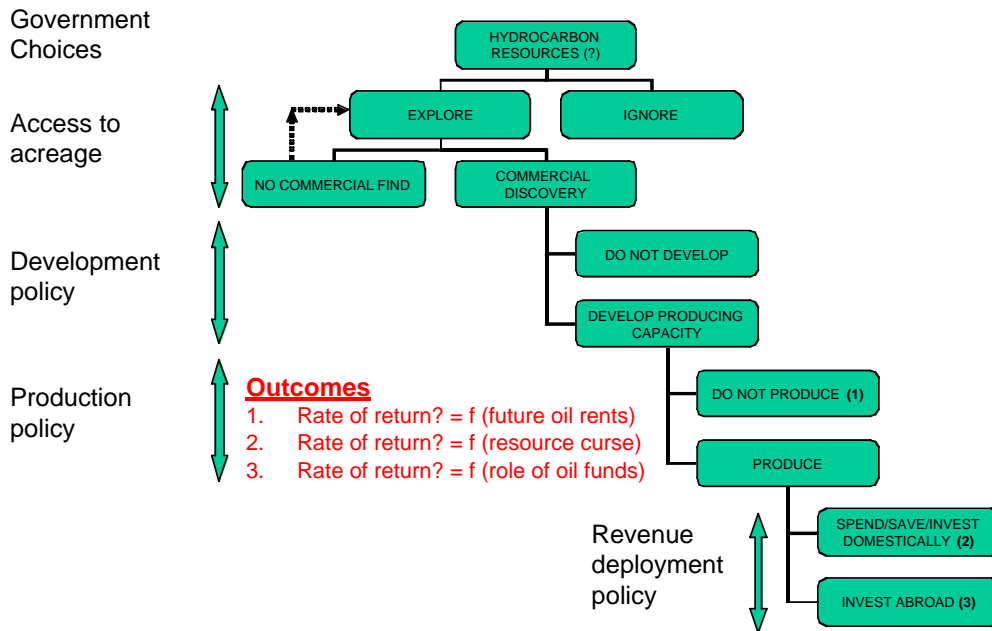
Optimizing the depletion policy is choosing a course of government action that maximizes the return, given the three options.⁹ Inevitably this can only be assessed on an ex post basis. Clearly any assessment of NOC performance must account for the context of the depletion policy set by the government. If the policy is (for example) to slow development, then clearly many of the operational measures of performance applicable to the IOCs will not be relevant. For example, Victor (2007), examining 90 firms, showed that the largest private companies are nearly three times better than NOCs at converting reserves into actual production. But this could simply reflect the depletion choices of the producer government rather than the effectiveness of the NOC. The NOC may be under instructions not to expand capacity.

⁸ In the United States, subsoil minerals are the property of the landowner, which may or may not be the federal or state government.

⁹ The role of the NOC in determining the depletion policy will vary between countries. At the very least the government will need to consult the NOC on what is technically feasible to produce both now and in the future.

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Figure 3.1 Government choices and national depletion policy



Source: Author.

Promoting national development

The second component of the national mission is the promotion of national development by means of maximizing the linkages to and from the oil and gas sector. National development is an elusive concept but can be defined as maximizing the growth of the nonhydrocarbon economy, thereby making oil production sustainable¹⁰ and reducing poverty. National development arises because of the linkages between the hydrocarbon sector and other elements of the economy. It is the role of the NOC to maximize these linkages. This is the key component of the “national mission.” The linkages are of two kinds: financial and productive. These are explained in box 3.1 below.

¹⁰ Sustainable production of oil or gas is an oxymoron since oil or gas produced today cannot be produced tomorrow. The issue arises because conventional national income accounting treats oil revenue as an income, whereas in reality it is simply reshaping the asset portfolio of the nation by swapping oil and gas below the ground for currency above the ground. Sustainability therefore requires using the currency to create productive activities that can continue to generate income when the oil or gas is gone or no longer required.

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Box 3.1 Financial and production linkages between the hydrocarbon sector and other elements of the economy

Financial linkages

Financial linkages concern consumption linkages and fiscal linkages. Consumption linkages relate to the way in which the factor incomes generated by the sector are spent by consumers, since this can influence the pattern of domestic output and imports. But these patterns are unlikely to be influenced by the behavior of the NOC and therefore it is the size and nature of the fiscal linkage that is of concern since this is directly influenced by NOC behavior.

The fiscal linkage refers to the ability of the NOC to create economic rent by producing oil and gas and then to maximize the capture of the rent for deployment by the government on the promotion of development. This ability to capture rent depends very much upon how the oil sector is structured, the capacity of the players in the oil sector, how the NOC reacts to other players in the sector, and how the fiscal system is configured (ESMAP, 2007). Obviously how the revenue is deployed in terms of promoting development will be a key factor in the success of the oil sector's contribution, but normally this is the responsibility of the government rather than the NOC.

Production linkages

There are two kinds of production linkages: (i) *forward linkages*, whereby the sector supplies inputs to the rest of the economy, and (ii) *backward linkages*, whereby the sector draws on inputs from the rest of the economy. When considering these production linkages, it is important to remember what Hirschman called "technological strangeness." This refers to the extent to which the oil industry presents an "alien" technology to the host environment. If the gap is too wide, then it is unlikely that production linkages will develop or at least will take a long time to do so.

One forward linkage concerns energy inputs to the rest of the economy. Energy is a key factor input into any economy and also a major influence on peoples' standard of living. The role of the NOC relates to its ability to ensure the physical availability of oil and gas to the domestic market, either for energy or feedstock purposes at "acceptable" prices.

Another forward linkage concerns manpower inputs from the NOC to the rest of the economy. Often, the NOC is the most competent organization in a given country. If trained NOC staff leave to enter another part of the economy, this can represent a major contribution. The classic example was Operation Bultiste, undertaken by Aramco in the 1950s, whereby a number of the brightest young Saudis working for the company were encouraged to leave, with contracts and access to capital, to set up activities to supply Aramco's operational needs (Coon, 1955). In a similar vein, the NOC can provide an example of good business practice to be copied by other entities in the rest of the economy. Again, Saudi Aramco has been instrumental in encouraging better business practices among its suppliers.

But not all forward inputs to the rest of the economy are positive. An undesirable linkage from the NOC to the rest of the economy is environmental damage. One of the arguments used for the creation of an NOC is that it would look after the national environment in a way that would be superior to that of private companies (Stevens, 2008). Unfortunately, casual empiricism suggests the reverse has been the case, and many NOCs have developed a very poor reputation for environmental management.

Finally, another forward linkage from the NOC relates to nonhydrocarbon projects done by the NOC. In many countries, because the NOC is viewed as the most competent managerial organization, it is often given projects—with little or no relationship to oil or gas—to manage. In effect, these NOCs become contractors on behalf of the government. For example, Saudi Aramco was recently requested to take on the management of the brand new King Abdullah University of Science and Technology at Thuwal, north of Jeddah.

Backward employment linkages relate to the use of nationals in the NOC labor force, their development and training, and the local content. Developing the local content of the oil and gas sector can be a major contribution to increasing the size of the nonhydrocarbon sector and creating some form of sustainable future when oil or gas revenues dry up.

Source: Author.

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National champions

The final possible component of the national mission is the global role of the NOC as a “national champion.” This is more controversial. Probably the most discussed version of this dimension in recent years relates to Vladimir Putin and Russia. In 1997 Putin defended a Candidate of Sciences thesis at the St. Petersburg Mining Institute, which was followed in 1999 by an article in the institute’s journal, *Zapiski Gornogo Instituta* (Brill Olcott, 2004). The thesis was simple. Hydrocarbons are the key to a country’s economic development. Thus the state must regulate and develop the sector. To do this, the state requires “national champions” who can develop hydrocarbon resources and use their control of these resources to achieve the state’s wider political objectives globally. To this end, Gazprom and Rosneft have been groomed to be used as instruments to achieve Russia’s foreign policy objectives. Other NOCs who appear to also have been given this sort of role include *China National Petroleum Corporation* (CNPC) and Sinopec, *Petróleos de Venezuela S.A.* (PDVSA) since the election of Hugo Chavez, *Petronas*, and *Petrobras*. Arguably, Saudi Aramco’s investment to create spare capacity to produce crude oil as a means of influencing the international oil market also comes into this category since this provides Saudi Arabia with a major political lever in the international scene. Clearly, measuring this dimension of performance is impossible to do accurately. But this is not to deny its importance when considering NOC performance.

Inevitably, as will be seen, the existence of the “national mission” makes measuring the performance of an NOC much more complex than that of an IOC and makes cross-comparisons of performance more difficult. Clearly, the national mission will depend upon the level of development in the economy. Thus, on both a cross-sectional and time-series basis, the nature of the national mission will change, which greatly aggravates the “apples and oranges” problem to be described in Section 5. It is also not clear what skills and talents an NOC needs to be able to achieve its national mission. Obviously, administrative competence is a necessary condition, but other factors must also be in place, ranging from managerial independence to knowledge of local conditions.

The indirect role of the NOC as advisor and regulator

The NOC also has the possibility of an indirect role as advisor and regulator in the hydrocarbon value chain of a country.

One of the arguments used for the creation of the NOCs in the 1960s and 1970s was the existence of serious information asymmetries between the IOCs (as agents) and the producer governments (as principals). It was argued that the creation of NOCs would reduce these information asymmetries and give the producer governments much greater control over the IOCs (Stevens, 2008). The fallacy with this argument was that the information accrued to NOCs and not the government; so when, after the nationalization processes of the 1970s, the NOCs became the agents, it was in their interest to keep the information to themselves to allow greater rent

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seeking. But, in many cases, NOCs do provide advice to other elements of the government, particularly the petroleum ministry.¹¹

In some systems, the NOC also acts as the regulator (thereby wearing two hats). This frequently leads to sloppy regulation where the NOC is a monopoly operator. Where other operators are involved, it may lead to concern over what should be a “level playing field,” since the NOC may regulate to its own advantages compared to other operators. In general, the lack of an independent and capable regulator in the hydrocarbon sector is seen to destroy rather than create value (Myers and others, 2007).

¹¹ For example, in Saudi Arabia, a number of the advisors to the oil minister are actually on secondment from Saudi Aramco.

4 Factors affecting the role of national oil companies

Many factors affect the role of an NOC in value creation. These include exogenous factors, which create the NOC's operating context, and endogenous factors, which involve how the NOC responds to its operating environment. Subfactors are listed in table 4.1, although it is important to note that, in many cases, the distinction between exogenous and endogenous factors blurs because the NOC is a creature of its operating environment.

Table 4.1 Outline of factors affecting value creation

The specific dimensions of analysis mentioned in the terms of reference are marked with an asterisk (*).

Exogenous factors	Endogenous factors
<i>Political</i>	<i>Objectives</i>
Ideology	Source
Political system (type of system, capacity of state and civil society)	In relation to the rest of the hydrocarbon sector
Public sector governance*	Mission and objectives—clarity and cohesion*
Oil sector structure and the sector decision process	Vertical integration*
International obligations*	Domestic versus overseas operations
<i>Economic</i>	<i>Decision making</i>
Oil dependency*	Ownership structure*
Fiscal sustainability and revenue needs	Nature of the board*
Depletion policy	Role of the board*
Hydrocarbon policy	Decision processes*
Desire for energy self-sufficiency	Budgetary system and level of commercialization*
Energy policy	Disclosure and transparency*
Credit rating	
<i>Technical</i>	<i>Capacity</i>
Operating conditions*	Recruiting and replacing executives*
Regulatory and legal environment	Corporate culture
Separation between regulatory and commercial functions	Sources of funding—Capex and Opex*
"Technological strangeness"	Skill base*
Infrastructure	Research and development (R&D) provisions
Manpower quality	Role of trade unions
Service industry access and costs	
Expectations regarding the "national mission"	
Access to domestic and foreign reserves*	
Competitive pressures (upstream, mid-stream, downstream)	

Source: Author.

Although it is possible to list the factors that will create value in the hydrocarbon sector, it is impossible to weight their individual importance and relevance on any objective basis.¹² A key

¹² Young (2002) identifies five functional areas—planning, measurement, rewards, project evaluation and management, and behavior—with the greatest impact on performance. But, there is no attempt to rank these factors, although the article does conclude that success requires a leader with power and vision to drive change, set clear goals, and prioritize effort. An attempt to assign weights to the various factors affecting value creation is made by the Consortium for

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conclusion that emerged from the joint Chatham House/Centre for Energy, Petroleum and Mineral Law and Policy (CEPMLP) project on “Good Governance and National Oil” was that no one size fits all.¹³ At best, certain issues can be seen as more important than others (Myers and others, 2007), but this derives from subjective assessment.¹⁴ A brief discussion of some of the main aspects of the factors follows.¹⁵

Exogenous factors

Political

The role of political ideology is a crucial input into the nature and role of the NOC (Stevens, 2003). During the 1950s, 1960s, and 1970s, acceptance of state intervention in the economy was the prevailing ideology in the context of market failure, Keynesian macroeconomic policy, and the example of Soviet planning that legitimized the creation of many NOCs. Then, in the 1980s and 1990s, the spread of the “Washington Consensus” and accompanying disapproval of government intervention in resource allocation caused NOCs to become unpopular and encouraged their commercialization and, in many cases, privatization. The political system is also a key influencing factor. Indeed, attempts to categorize NOCs are often based upon the political system in which they operate (Charles Rivers Associates, CRAI, 2004). For example, the Program on Energy and Sustainable Development (PESD) National Oil Company Study at Stanford University is in the process of explaining differences in NOCs resulting from differing political systems.¹⁶ The oil sector structure has also been found to be an extremely important factor in explaining NOCs’ role and performance (ESMAP, 2007). Frequently, this structure is the product of the prevailing ideology and the political system. The structure also determines public sector governance within a country, which also informs NOC behavior (Myers and others, 2006). Finally, international obligations can play an important role in constraining NOC behavior. Thus OPEC membership may restrict production levels, while World Trade Organization (WTO) membership may influence domestic pricing policies.

Economic

The level of oil dependency in an economy, its fiscal sustainability, and immediate revenue needs will all influence the NOC role.¹⁷ Depletion policy, already discussed alongside the

Energy Efficiency (CEE, 2005). Five factors are identified: public sector governance, corporate governance, fiscal regimes, commercialization, and regulation. Each is then further subdivided. But, as discussed below, the weighing is entirely arbitrary.

¹³ Details and results of this project can be found on http://www.chathamhouse.org.uk/research/eedp/current_projects/good_governance/.

¹⁴ The only possible method to generate some form of coefficient of relative importance would be to use the Delphi Method described above.

¹⁵ The brevity is explained by two factors. First, the problem already mentioned of assigning relative importance in any objective or scientific manner. Second, the main focus of this paper is to measure NOC performance (sections 5 and 6). Consideration of the relative influencing factors is concerned with explaining performance, which is a separate study.

¹⁶ For further details of this project, see <http://pesd.stanford.edu/research/oil/>.

¹⁷ Chatham House in London is currently undertaking a major project examining depletion, dependence, and development. The findings are currently restricted but in the near future the results will be publicly available. See http://www.chathamhouse.org.uk/research/eedp/current_projects/rddd/.

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“national mission,” is also an important factor. This is normally derived from the government, although the NOC may also play a role even if only an advisory one.¹⁸ Attitudes of the government to issues of domestic energy, self-sufficiency, and energy policy also play a role in what an NOC may do. In terms of the downstream, it will certainly inform decisions on refinery capacity and domestic pricing. But it can also influence decisions by the government and NOC to operate abroad in the upstream.¹⁹

Technical

The general operating conditions for an NOC are clearly central to its role and effectiveness. The conditions can range from the legal environment, which constrains NOC action, to the quality and availability of factor inputs, which constrain performance. The concept of “technological strangeness”—already discussed—is also important in terms of the ability of the NOC’s operating context to support (or not) different types of activity. The competitive environment will also affect the NOC role. In the upstream, the legal environment can play a major role in the nature of the NOCs’ access to reserves. Where the NOC has a monopoly,²⁰ this can obviously inhibit efficiency. Also, in many countries, the extent of competition in the downstream, especially in terms of marketing and distribution, can also affect the role of the NOC (ESMAP, 2007).

Endogenous factors

Objectives

The starting point for considering the role of the NOC is the set of objectives that will direct the company’s activities. The NOC is only one player in the hydrocarbon sector of an economy. Other players will include the government in its various guises, including those of politicians and bureaucrats, regulatory bodies, other operators, and other stakeholders. Each player will have its own objectives, which maybe formal or informal, explicit or implicit. Thus, an NOC’s objectives and “national mission” will emerge from the way the various players interact. Of particular importance is the extent to which the objectives are commercial and how far the national mission is imposed upon the NOC.²¹ There is also a problem if objectives involve rent-seeking behavior,

¹⁸ A good example is the discussion of upstream capacity in Kuwait. The decision to raise crude producing capacity appeared “. . . to go back and forth between institutions with a degree of confusion for all” (Marcel, 2006; page 80). Thus, Kuwait Petroleum Corporation’s (KPC’s) Corporate Planning Department projected a possible call on Kuwaiti crude (within the OPEC quota context) of 7 mbd by 2020. Kuwait Oil Company (KOC) indicated that 4 mbd was the maximum sustainable capacity under prevailing conditions. KPC presented this as the target but was overruled by the Supreme Petroleum Council (SPC), who wanted a target of 5 mbd although it is not clear that there was any analytical basis for such a number. In any case, the SPC backed down and reverted to 4 mbd for 2020 (ESMAP, 2007).

¹⁹ For example, the Chinese obsession with energy security of supply has been an important factor in allowing the Chinese NOCs to operate abroad (Andrews-Speed, 2005) although it is difficult to see how producing oil in Sudan can enhance China’s energy security.

²⁰ In recent years only two countries, Mexico and Saudi Arabia, had a de jure monopoly. But, a number of countries, including Kuwait and Iran, had a de facto monopoly because although the upstream was “open” to IOCs, in practice, the political environment effectively excluded them.

²¹ Of course, the NOC may be more than happy to take on its “national mission” as a source of challenge and pride. Certainly this appears to be the case with Saudi Aramco (Marcel, 2006; ESMAP, 2007)

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in which case a key instrument will be to increase the information asymmetries between the NOC management and the controlling ministry. There has been a growing trend in the 1990s to encourage NOCs to become more commercially oriented, with the option of becoming listed on international stock exchanges. In part this was driven by governments anxious to encourage efficiency to increase their revenues,²² but it was also driven by NOCs' own management, who saw this as a route to improve their position materially and consolidate power (Stevens, 2008). One important observation is that the effectiveness of the NOC depends very much upon its having clear and consistent objectives (Myers and others, 2006).

Integration and international operations relate to the nature of an NOC's objectives and play an important role in the creation of value. Presence in all parts of the value chain is often seen as a necessary condition for a successful NOC, despite generally much poorer performance in the downstream (Antill and Arnott, 2002). It is also generally seen as part of the commercialization process. Many of the NOCs conventionally are regarded as success stories—ranging from Statoil to Petronas to Petrobras—increase their overseas operations. But, as will be developed below, where NOCs use operational vertical integration rather than markets, this tends to increase the information asymmetries needed for rent seeking (and corruption), which tends to destroy value for the country.

Decision making

Decision making revolves around corporate governance. Of crucial importance is how the decision-making process creates an incentive system within which the managers operate. The actual process of decision making obviously varies with the formal and informal structure of an NOC.

The formal structure relates to the precise details of ownership. Of key importance is the board of directors, which should guide the decision-making process. It is generally seen as important that the NOC has an independent board of directors appointed by merit and professional expertise (Al-Naimi, 2004). The informal system relates to the political context in which the NOC operates and the extent to which powerful individuals within the system can impinge on decisions. For example, it is clear that one of the reasons for the apparent success of Saudi Aramco and the apparent failure of KPC is that the former is protected from political interference while the latter is bombarded it (ESMAP, 2007).

The effectiveness of the decision-making process in creating value is strongly influenced by the nature of the budgetary system—which rules the NOC's operations—and the levels of discretion and signing limits on purchase and project expenditure. For example, NOCs that operate on a commercial basis—whereby they provide their own funds for investment and operations, make profits, and then pay royalties, taxes, and dividends to their governments—have an incentive to minimize costs since they benefit from improved efficiency. By contrast, NOCs that operate on the government's budget have little or no incentive to be efficient (ESMAP, 2007). Disclosure and transparency of the decision-making process is important in so far as it will

²² The evidence certainly bears out the fact that “privatization is associated with comprehensive and sustained improvements in performance and efficiency” (Wolf and Pollitt, 2008).

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create the basis for accountability both within the NOC and between the NOC and the other stakeholders in the sector.

Capacity

Capacity relates to the quality of management and technicians, how far they are motivated by the incentive system created by the decision-making process, and the corporate culture. This, in turn, will depend upon the quality of the potential managerial and technical intake, plus whatever training and professional development the NOC is willing and able to invest in. Of key importance is that merit and performance are at the forefront of manpower recruitment, placement, and development.

5 Measuring performance

As indicated in Section 4, assessing the relative importance of the individual factors that affect the performance of an NOC in any scientific or objective way is impossible. But, collectively, it is possible to assess whether the NOC is performing well or not, even if the reasons for this performance are not necessarily absolutely clear. This section discusses in detail a number of possible measures of performance relevant for an NOC, their problems, and shortcomings. It begins by considering aggregate measures and then concentrates on specific measures. But if an NOC is to be assessed, then a check list needs to be created which, in an ideal world, could be used to compare and contrast NOC performance both on a time-series and a cross-sectional basis. This is presented in Section 6.

Aggregate impressions of performance

The “reputation” of a company provides an aggregate impression of performance. Reputational issues for any company relate to public perception of their record on a number of issues, ranging from managerial style and environmental issues, to human rights. Amid the growing concern of “ethical” investors worldwide, these latter dimensions are becoming ever-more important. Managerial reputation can also be very important in terms of performance, since, as will be developed below, this can determine how far the various performance measures outlined are actually reflected in the company share price.

Trying to measure reputation specifically would be extremely difficult, though not impossible, and many IOCs do commission polling agencies to assess their “image.” One measure of reputation concerns marketing performance and relates to the development of brand awareness together with customer satisfaction and retention. But such measures (normally derived by polling techniques) tend to be kept for internal assessment and usually remain confidential.

One means of measuring reputation is the Delphi Method. This simply consists of asking a number of experts to give a subjective opinion on the performance of the company measured on some suitable scale, then averaging the results to produce a consensus view represented (hopefully) in a normal distribution curve. A recent example of such an exercise related to NOCs (Nield, 2007) gives the results presented in Tables 5.1 and 5.2.²³

²³ The article does not state how many “experts” were consulted. Rather they were described as “senior government figures, regional managers of the world’s biggest oil companies, academics, and other industry experts.”

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Table 5.1 Performance measures for NOCs

Measure	Meaning
Commercial performance	Profitability, return on investments, and commercial prospects
Production	How effectively and consistently is production being maintained given the constraints within which the NOC operates?
Reserves replacement	How effectively is the NOC replacing reserves?
Downstream investment	How effectively is the NOC addressing refineries' challenges and diversifying its means of monetizing resources?
Partnership	How successful are contract terms in attracting partners and how innovative is the NOC's approach to partnering?
Technology	How developed is in-house technology, R&D, and expertise in unconventional resources?
Overseas investment	How competitive is the NOC as a commercial company operating abroad?
Independence	What degree of commercial independence does the NOC have?
Environment	How well has the NOC developed strategies for clean hydrocarbon and emissions reduction?
Human resources	How strong are the NOC's policies on staff training, recruitment, and quality of staff?

Source: Author.

Table 5.2 Results of performance measures

Score for each element described in table 5.1 is 1–10, 10 being the highest

Measure	Saudi Aramco	ADNOC	Sonatrach	NIOC	KPC
Commercial performance	9	7	8	5	8
Production	9	8	6	5	6
Reserves replacement	7	7	4	4	4
Downstream investment	8	7	4	5	5
Partnership	7	8	5	5	3
Technology	9	8	6	4	2
Overseas investment	8	6	8	6	8
Independence	8	7	7	3	4
Environment	6	8	7	5	3
Human resources	9	7	8	4	2
Total	80	73	63	46	45

Source: Middle East Economic Digest, May 18–24, 2007.

Attempts at measuring corporate reputation also have come to the fore with growing interest in corporate social responsibility (CSR) and related issues. Recent years have seen much discussion on how to assess and measure CSR and there is much literature on the subject, some of which can be found on the Global Reporting Initiative (GRI) website (www.globalreporting.org). GRI is a large multistakeholder network of thousands of experts in dozens of countries worldwide who participate in GRI's working groups and governance bodies, use the GRI guidelines to report, access information in GRI-based reports, or contribute to developing the reporting framework in other ways—both formally and informally.²⁴

²⁴ A good overview of CSR issues is also provided by Hopkins (2007).

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Some CSR projects are undertaken by IOCs outside of their “normal” business activities. They are generally aimed at specific communities in order to create and strengthen their license to operate.²⁵ As community projects, their assessment would normally be based on a cost-benefit analysis. As will be seen below, in some ways CSR can be seen as similar in its nature to the NOCs’ “national mission” (Myers and others, 2006).

Another method of internally assessing aggregate performance that has been gaining popularity, especially in many NOCs, is the Balanced Score Card Approach (Kaplan and Norton, 1996). This tries to widen the performance criteria and to focus on operations rather than just the numbers. Originally, it was designed as a tool to measure the success of corporate strategy but has subsequently developed into a tool for operational and management control. Normally, different score cards are developed for different managerial levels. From the perspective of comparison, however, such an exercise is kept very much within the corporation, making any meaningful comparison between companies impossible.²⁶

The terms of reference for this study required an assessment of “corporate governance.” What this means is uncertain and this report takes it to involve the nature of decision making within the corporation. As such, the general performance of the NOC is an overall reflection of corporate governance and can be viewed as an aggregate measure of performance, although, as will be developed below, how to translate this into a single measure presents considerable challenges.

Specific measures of performance

Efficiency measures

Economists normally define performance in terms of three kinds of efficiency. There is the engineers’ concept of efficiency, which is expressed in terms of the economists’ production function where physical inputs generate the maximum physical output. Economic efficiency relates either to (i) productive efficiency, which means operating at least cost and (ii) allocative efficiency, whereby society secures as much of the good as it desires.²⁷ But translating these concepts into any sort of performance measurement for oil companies is complex and often raises more issues than it resolves.²⁸ It is also worth remembering the observations of George Stigler, one of the great economists of the twentieth century, that society is not greatly preoccupied with economic efficiency (Stigler, 1980).

²⁵ Not to put too fine a point on it, such projects are effectively a “bribe” to local communities. This is especially relevant where the operations cause local disruption and/or where regional and national governments lack the capacity to convert their hydrocarbon revenues into benefits for the local community.

²⁶ It is also a very complex system and the author is aware of a number of NOCs who have experienced great difficulty in introducing the “balanced scorecard approach.”

²⁷ Productive efficiency in a competitive market is achieved when price equals the minimum average cost and allocative efficiency when price equals marginal cost.

²⁸ For example, see the theory and practice applied in Hartley and Medlock (2007), Eller, Hartley, and Medlock (2007), and Al-Obeidan and Scully (1991). It is important to realize that “profitable” operation does not necessarily translate into efficient operation. A monopolist may be highly profitable but extremely inefficient. This is relevant when NOCs are considered since they are often monopolists and monopsonists in their own countries.

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In one of the few quantitative studies, Al-Obeidan and Scully (1991) examine technical, scale, and allocative efficiency differences between 44 integrated oil companies. They find that state-owned enterprises (SOEs) were only 61 to 65 percent as technically efficient as privately owned for-profit firms, although covering only the period 1979–82 (the height of the “second oil shock”) the data is questionable. More recently, Eller, Hartley, and Medlock (2007), using Data Envelope Analysis (DEA) on a sample of 80 firms—IOCs and NOCs—in the period 2002–4 found an average DEA technical efficiency score for NOCs of 0.27 compared to a sample average of 0.40 and an average score for the five largest IOCs of 0.73.

A commonly used measure of efficiency in oil companies derives from the announcement of corporate “targets.” Performance is then measured against whether the company delivers on these targets in terms of date and budget. These can range from operational targets such as production and reserve replacement to financial targets such as returns on capital and environmental targets relating to reductions in CO₂ emissions and other environmental measures. A widely used variation on this idea to assess internal performance within a corporation is an ex post project evaluation using the ex ante appraisal as the benchmark. But it is unusual for such studies to be made publicly available, making performance comparison impossible.

Operational measures

Operational measures of performance can include physical and financial measures and can be used to consider the growth of the firm. Commonly used physical measures for the upstream relate to production levels and reserves.²⁹ These include the “reserve replacement ratio” which indicates the ability of the company to operate in the future. There is also the “reserve life ratio,” which indicates how long the company can produce at its current levels without adding reserves. Others include “average reserves per well” and “average daily production per well.” Such measures present many problems of interpretation—not least, as will be developed below, when it comes to making cross-sectional comparisons between companies facing different geological operating conditions. But a major problem is how reserves are actually defined.³⁰ Normally, oil companies listed on stock exchanges face strict definitional requirements³¹ before reserves can be booked, but even here there is room for “interpretation,” most obviously with assumptions about the recovery factor from the oil in place.³² Recovery factors and natural depletion rates can also be a guide to the competence of operations, although they are highly sensitive to the geology of

²⁹ It is worth remembering the reservations about the use of reserves expressed in Section 2.

³⁰ This is a complex and controversial subject that is currently under review by a number of different institutions in an attempt to get greater clarity. For example, see the Joint Oil Data Initiative (JODI) organized by the International Energy Forum (IEF).

³¹ These involve the United States Statement of Financial Accounting Standards 69 (FAS 69).

³² An obvious recent example is provided by Shell, which was forced in 2004 to lower its reserves estimates by 20 percent. In the mid 1980s, a number of OPEC countries dramatically increased their reserve estimates by simply changing the recovery factor on the producing fields. Currently there are widespread concerns about the accuracy of the NOC reserves if only because, in general, they do not seem to change over time, and there are no details on how they are actually assessed.

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the fields as well as operating practices. Other operational measures can include employment levels per barrel produced.³³

For downstream oil operations, often an important performance measure relates to refinery capacity utilization. This is especially important because refining operations, with their very high fixed costs, require maximizing capacity utilization—or the average fixed costs rise exponentially as throughput falls, doing serious damage to the refinery margins. Thus the length of downtime for scheduled (and unscheduled) maintenance can be an important measure. The structure of the product barrel can also indicate performance, where maximizing the yield of lighter products and “destroying” fuel oil is an important determinant of financial performance.

Financial operating measures relate to costs. These include discovery, development, and lifting costs on a per barrel basis in the upstream and processing costs in the downstream. They can also involve identifying spending on specific items such as R&D and training, which also relates to performance.

There are also “health safety and environment” (HSE) measures used to assess performance. A commonly used measure of safety is the number of days lost as a result of accidents.³⁴ Environmental performance is increasingly important, although how this is measured can be complex and controversial. Obviously, things such as spills and explosions can be measured and—using cost-benefit analysis—valued. But other environmental damages, such as gas flaring and other emissions, are harder to assess and their valuation is more controversial.³⁵

Financial measures

Accountants normally use a variety of financial ratios to assess the performance of companies drawn from the annual accounts of those companies. They can be summarized as leverage/gearing ratios, liquidity ratios, profitability or efficiency ratios, and, finally, market-value ratios.³⁶ Interpreting such ratios to draw conclusions on company performance requires considerable skill and experience. There are no obvious criteria, not least because different ratios indicate differing characteristics of the company. Average actual financial ratios for the petroleum sector are widely available, for example, from the U.S. Department of Commerce.

An obvious but important point is that if such financial ratios are to be used there has to be a set of audited accounts available. General concern over such measures relates to the accuracy of these accounts, especially following the Enron collapse, although Security Exchange Commission (SEC) regulations have been tightened in the aftermath of that scandal.³⁷

There are specific financial issues which relate to the oil industry and its peculiarities (Johnston, 1992; Gallun and others, 2001; Antill and Arnott, 2002; Dickens, 2007). For example,

³³ A comprehensive list of such operational measures is provided in Section 6.

³⁴ It is common practice in IOC offices to post such data in public areas.

³⁵ This has become part of CSR measurements.

³⁶ A detailed list of such ratios and their interpretations can be found in table 6.1, derived from Brealey and Meyers (1988).

³⁷ The most prominent change has been the Sarbanes-Oxley (2002) legislation, which affects how public boards of U.S. companies and public accounting firms can behave.

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there are different procedures for managing cash outflows. The “full cost” approach is used by oil companies on a country-by-country basis, whereby capital expenditure (CAPEX) on all operations is included, irrespective of success or failure. By contrast, the “successful efforts” approach used on a field-by-field basis includes CAPEX only on commercial fields.³⁸

Using financial performance measures can also create problems when oil companies are vertically integrated. Vertical integration can take two forms (Stevens, 2003). Financial vertical integration is when different stages in the value chain are owned by one holding company that controls their cash flows. Operational vertical integration occurs when the crude and products move between these affiliates. Operational vertical integration requires the presence of financial vertical integration but the reverse is not true. Markets can substitute for operational vertical integration. The key point is that with operational vertical integration, companies try to use transfer pricing to shift profits between their affiliates in order to minimize their global tax bill. Thus the profit of any particular affiliate in the value chain may simply be the figment of an account’s imagination rather than a reflection of performance.³⁹

A final problem specific to oil companies is that there is a great deal of rent in the oil price. This comes from two sources. There is producers’ surplus, which arises because of low production costs, which may reflect better geology or greater efficiency. There is also super-normal profit arising from OPEC’s control of the oil market, restricting supply and thereby pushing prices above their competitive equilibrium. Thus, large profits by oil companies do not necessarily reflect performance since a large part can be viewed as being generated exogenously by geology or OPEC.

The ultimate financial measure might be thought of as the “profit” of a company but in reality this can be far more complex.⁴⁰ As has been said, “cash is fact, profit is opinion” or, in a similar vein, “profit is vanity, cash is sanity.” For example, “profit” is simply income less costs, but this ignores the complexities of what to include and when.⁴¹

Arguably, all of the performance measures listed above can be considered under the concept of “value-based management” whereby the performance of the company is measured by the return to the shareholders. The concept was developed at a theoretical level in the business schools and universities in the 1970s and 1980s in the context of work on the corporate cost of capital (Brealey and Myers, 1988). It was widely used by the IOCs in the late 1980s and early

³⁸ The “full cost” approach is likely to disappear because International Financial Reporting Standards (IFRS) 6 only allows the approach up to the end of the exploration and evaluation phase of the project. IFRS was applicable to all accounts by quoted companies after January 1, 2005, and will apply to nonquoted companies after 2010 (Dickens, 2007).

³⁹ Tax authorities are getting better at preventing such behavior, but regulatory frameworks often grant enough leeway to companies to minimize their tax bills. For further discussion of problems with the vertically integrated nature of IOCs and interpreting their performance, see Antill and Arnott (2002).

⁴⁰ Some have advocated the use of “economic profit” also known as “economic value added” (McCormack and Vytheeswaran, 1998; Antill and Arnott, 2002). This is the difference between net operating profit after tax (NOPAT) over a year and a charge which represents its cost of capital times its invested capital.

⁴¹ For problems with assessing oil company profitability see Antill and Arnott (2002). They believe that “. . . published accounts are a fairly worthless measure of profitability and they do not accurately reflect the underlying value of the asset base” (page 2).

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1990s. The underlying idea is that if the company cannot perform (in terms of shareholder value) better than competing firms, then the company should return money to the shareholder, who can employ it more productively. The return to the shareholder is the dividend paid on the share, plus any capital appreciation on the share price. The greater the value to the shareholder, the better the performance of the company. A commonly used measure to assess shareholder return is the return on capital employed (ROCE),⁴² but there are a number of problems with this measure and indeed with other dimensions of value-based management (Antill and Arnott, 2002).⁴³

An important issue is how far the actual performance of the company is reflected in the share price. In theory, if the stock market is an efficient market, then all available information should be reflected in the share price. But sometimes the behavior of the share prices appears perverse—for example—by not increasing when the oil price increases. One explanation is that the share price is influenced by the role of corporate reputation, which is an intangible and difficult to measure. Another explanation is that the “efficient market hypothesis” is misguided since it ignores the shareholders’ potential for ignorance and lemming-like behavior (Lux, 1995).

Measures of social value creation—fiscal, forward, and backward linkages

A crucial difference between NOCs and IOCs is that the NOC must take account of the “national mission,” which is why considering the performance of an NOC is far more complex than is the case for an IOC. There are large differences between NOCs when it comes to considering their national mission. This has arisen because the NOCs have different histories and operate in very different political and economic contexts. Such differences relate to ownership, with some NOCs listed on stock exchanges and others not. They relate to their operational role, with some having a monopoly and monopsonist status in differing stages of the value chain. The differences also relate to the location of NOC operations at home versus abroad. They relate to how the NOC fits into the structure of the hydrocarbon sector and many other differences. As discussed in Section 3, the national mission can be measured under three headings—fiscal, forward, and backward linkages.

Fiscal linkages

The level of production, the price of the output, and the cost of producing it will determine the size of the rent that is the starting point for the fiscal linkage. Clearly, NOC performance will influence production levels since NOCs have the responsibility to explore for, develop, and produce the oil or gas either alone or possibly in conjunction with IOCs. But measuring their ability to produce is complicated by several factors. First, as already discussed, the depletion policy is normally set by the government and the NOC must operate within the constraints set by this policy. Thus, a “slow” development or “underutilization” of capacity may simply be the result of a government decision to slow development or constrain production for purposes of

⁴² This can be defined as operating earnings after tax but before interest payments (NOPAT), divided by capital employed, which equals shareholder funds (plus minority interest) and net debt. It effectively measures the surplus distributable to the shareholders divided by the money invested in them by their providers of capital (equity or debt).

⁴³ Antill and Arnott (2002) assert that “we believe that target returns on capital are far too high and current accounting returns on capital are largely delusive. . . . The upstream is a lot less profitable than it looks . . .” (page 1).

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limiting revenue inflows or in order to meet OPEC obligations on quotas. Equally, domestic consumption levels will also determine the availability of oil and gas for export that will be a major earner of revenue. As will be developed below, clearly the NOC can play an important role in determining the level of domestic energy consumption. But, again, the government and probably not the NOC will set the policy context—for example, the presence of subsidy—although it may have a hand in the formulation of the policy. Thus, simply looking at production levels or reserve/production levels will not necessarily be a good indicator of performance.

One possible solution to this problem—which also provides a measure of efficiency if lack of transparency causes problems—is to consider targets. Most oil-producing countries announce targets for the oil sector. These can relate to capacity and production levels in the upstream and refinery capacity and output in the downstream. A simple test of NOC effectiveness is to establish if the targets are met on time and (if the information is available) on budget. Such information on the timing of completion is widely available in the trade press and, although not a definitive guide (since projects can be delayed for many reasons), provides a qualitative measure of aspects of NOC performance.⁴⁴

International or regional markets normally determine the price of oil or gas and are thus outside NOC control although, as will be developed below, the price used for domestic transactions can be set by the NOC. An area where the NOC performance can directly influence the size of the rent created is the production costs. Other things being equal, the lower the production costs, the higher the rent created. Thus, if the NOC can pursue low-cost objectives, this will help develop the fiscal linkages.

Ultimately, the revenue accruing to the government at various levels measures the effectiveness of the fiscal link. But there are serious problems in trying to assess the role of the NOC in revenue capture, especially given the very high levels of rent in oil operations already explained. There is also a time dimension of short term versus long term. For example, a very tough fiscal regime may well increase current rent capture but, if this inhibits investment, then clearly revenue capture in the future may well be compromised. Thus, for example, the “league tables” commonly used to assess fiscal systems do not tell the full story since they take no account of prospective acreage, which in turn will determine the impact of the fiscal system of investment levels.

Another way to think of the fiscal linkage is the dependence of the economy on hydrocarbon revenues. This can be measured by looking at the trends of the nonhydrocarbon fiscal and current account deficits. Reducing economic dependence on hydrocarbons is a major objective for most producers. This requires the development of the nonhydrocarbon economy to prepare to replace hydrocarbon revenues and foreign-exchange earnings. But while the NOC can play some role in this process—not least by developing its backward linkages—it is really the responsibility of government.

⁴⁴ Over the last five years, with the exception of Saudi Aramco, most NOCs not listed on stock exchanges have missed their formal targets by some considerable gaps although, to be fair, this in part can be explained by the very high costs of oil industry services in this period.

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Forward linkages

Assessment of physical availability of energy to the rest of the economy can be measured by considering whether consumers are forced to queue and for how long, although this inevitably involves a degree of casual empiricism. Another measure is how far domestic consumption can be met by locally produced oil and gas as opposed to imports.⁴⁵ The NOC's ability to build and maintain refineries and their ability to maximize throughput will be crucial, as will their management of oil and gas-product distribution systems. For gas, the share of gas in the nation's primary energy mix can give some indication of this aspect of the "national mission" over time, but it is dependent upon the availability of gas for distribution. Gas flaring is also quite a good measure since flared gas represents a waste of energy (to say nothing of the environmental impacts).

Provision of energy to the rest of the economy, however, involves more than just physical availability. Price and affordability are also important. What constitutes an "acceptable" price for oil and gas products in the domestic economy and the NOC's role in this is complex. Economic theory argues that the "correct price" should be the border or international price since this reflects the real opportunity cost of the oil or gas consumed.⁴⁶ But there are many arguments that can be presented to favor a deviation from a border price approach. The first applies to the large oil exporters who can be regarded as price makers. In this case the "correct" price should be the long-run marginal cost of producing the barrel.⁴⁷ The second is the equity argument. Thus, it is argued that subsidizing oil and gas prices is an effective means to distribute some of the benefits from the hydrocarbon sector to the mass of the population. While it is true there are better methods to protect the poor such as direct income transfers, the option of direct transfer of income to the poor is not feasible.⁴⁸ But there is also the fact that subsidies cause distortions and encourage smuggling in many countries.

Whatever the view taken on "correct" prices, there is also the issue of how far domestic pricing is under the control of the NOC. In most cases, the subsidized prices are imposed against the wishes of the NOC, if only because they are required to cover the difference between production cost and sales price. Also, many governments are discovering the attraction of using oil products to raise revenue by means of sales taxes⁴⁹ so the relevant price to assess downstream

⁴⁵ This needs to be treated with care since imports are not necessarily a sign of poor performance. For example, many developing countries suffer from a very unbalanced demand barrel, which requires imports of light products and exports of heavy products. This may be cheaper than the huge investment required for reconfiguring the refineries to convert heavy into light products.

⁴⁶ In the case of gas, what constitutes an "international price" can be extremely contentious because gas tends to be a regional market or in many cases, there is no obvious export market for the gas because of prohibitive transport costs.

⁴⁷ The logic is simple. The border price is the correct price since if a lower price is charged, the country forgoes the revenue it could have earned by exporting the barrel. But if the producer is a price maker, exporting the barrel will lower the international price. It is on the basis of this logic that Saudi Aramco supplies crude to its Saudi-based refineries at little above \$2 per barrel (ESMAP, 2007).

⁴⁸ It is also the case that in developing countries the poor do not directly consume oil products but rather use traditional energy sources such as wood and animal and vegetable residues.

⁴⁹ For oil products the tax base is large since oil products are widely used. Demand is inelastic thereby allowing for very high tax rates without reducing consumption. Collection costs of oil product sales taxes are also extremely low. In all, oil products represent a tax collector's dream target!

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efficiency would be the refinery gate prices rather than the market price—and, often, this is not publicly available. A measure of the forward linkage performance by the NOC might also be the proportion of the population in fuel poverty, although it is unlikely such data are available in emerging market economies (Foster, Tree, and Wodon, 2000). There are several options to measure this. A commonly used definition in Organisation for Economic Co-operation and Development (OECD) economies is that fuel poverty exists where more than 10 percent of the household income is spent on energy. Another measure might be the proportion of the population with access to the gas or electricity grid.

One way to measure employment contribution as a forward linkage is to measure the turnover rate of NOC employees and how many who leave but remain in the country.⁵⁰

In theory, forward linkages in the form of environmental damage can be measured but, in the case of NOCs, being able to measure this is often difficult since an NOC would not wish to advertise its poor performance.⁵¹

As for nonhydrocarbon projects as forward linkages, there is an extensive methodology from social cost-benefit analysis to assess the performance of such projects but, as so often with NOCs, getting the underlying data can be extremely difficult. Ideally, it would be helpful to try and separate out the NOC spending on nonhydrocarbon projects but often the accounts, such as they are, preclude this option.

Backward linkages

A simple measure of the employment dimension of backward linkages would be the proportion of nationals in the NOC labor force. One virtue of this measure is that it is one of the few pieces of data that are available for virtually all NOCs. But this may not be a useful measure of performance. It may simply measure the ability of the NOC to employ nationals rather than making any contribution to the economy. Employing larger numbers of poorly skilled workers would not be conducive to a good performance by the company.⁵² In many of the oil-producing countries, the NOCs are coming under ever-increasing pressure to employ more nationals as a means of solving their country's problems of unemployment despite the fact that oil and gas are extremely capital-intensive industries. A large labor force is not necessarily a measure of sound performance.

Measuring the amount of local content used by the NOC and the oil sector generally might be seen as a fairly straightforward measure of NOC performance, with the larger the percentage the better. But there are complications. First, as already discussed, the extent of local content will be strongly influenced by the degree of “technological strangeness.” An economy that is very limited

⁵⁰ A rather sad example is given in Mauritania, where a commonly heard saying in the oil sector is “train abroad, stay abroad!”

⁵¹ A recent World Bank project, Global Gas Flaring Reduction Partnership (GGFR), has independently been able to assess the extent of gas flaring by the use of satellite technology.

⁵² An example often quoted is China National Petroleum Corp. (CNPC) which at one point was employing 1.4 million workers. Another extreme example (Marcel, 2006) is Saudi Aramco, which has a large office building where poorly performing staff are given offices to do nothing, but at least keeps them away from interfering with the operations of the company and is regarded to be more socially more acceptable than sacking them.

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or primitive can hardly be expected to quickly be able to supply services. Thus a low percentage of local content may have little or nothing to do with the performance of the NOC. Furthermore, the ability of the rest of the economy to develop a service capability often depends upon the speed with which the oil or gas resources are developed, which is the result of the government's depletion policy. For example, Norway decided to develop its hydrocarbons more slowly than the United Kingdom, with the specific objective of allowing a Norwegian service sector to develop. By contrast, the United Kingdom's speedy development of its North Sea resources simply sucked in a great deal of American service companies and expertise (Hallwood, 1990).

Second, local content often involves multiplier effects and it might be argued the higher the multiplier, the greater the backward linkages. For example, it has been estimated that the oil sector multiplier for construction and services in Kazakhstan is 0.47 compared to 2 in northeastern Scotland, while for the Tengiz project in Kazakhstan it is 1.52 (Auty, 2005; Kashani, 2005). But multipliers are difficult and complex to track, especially if the economy does not have an up-to-date input-output table.

Third, in transition economies where a number of economic sectors from the former Soviet period have been destroyed, economic recovery can often be hindered by the oil sector "crowding out" other economic sectors by securing for itself the pick of the factor inputs. Thus, strong backward linkages may well inhibit the development of the nonhydrocarbon sector.

Finally there is how "local" is actually defined. Increasingly, producer governments are insisting upon maximizing local content and to this end they are legislating for minimum local content. For example, Nigeria recently required that 60 percent be local by 2012. This tends to encourage overseas service companies to set up local joint ventures whose only function is to manage the paperwork for the imported equipment and skills; but because this is "local," it is counted as "local content."

Comparing performance across companies

Measuring performance is one thing, but comparing performance is another and can be equally complex. The two bases for comparison are cross-sectional and time-series analysis.⁵³

Cross-sectional comparison of operations and, indeed, costs, suffers from the problem of comparing apples and oranges. For oil companies in the upstream, the key problem is that geology differs. It differs in terms of where it is located—onshore/offshore or accessible/inaccessible. It also differs in terms of the geology itself—large/small fields, uniform/fragmented strata, porosity, reservoir pressure, and so on. Thus, good operators can appear to perform badly and poor operators appear to perform well (Schenckery, 2005). In the oil downstream, this is much less of a problem since the laws of chemistry are universal and so the operational performance of refineries is more easily comparable.

But in terms of financial measures (most obviously returns to shareholders), the basis of cross-sectional comparison is the performance of other oil companies, although such comparisons

⁵³ Pooled cross-sectional analysis is also commonly used, especially when the data sets are small.

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often distinguish between different categories of oil company—upstream/integrated or domestic/international. Comparison is also often made with companies in different sectors. Assuming the audited accounts are honest and have used a similar methodology, then such comparisons have validity. NOCs, however, have many differences and any inter-NOC comparisons probably need to start with some form of categorization if the comparison is to have any operational significance. This is developed further in Section 6.

Time-series comparisons also present problems. It would appear that looking at the performance of the same company over time would solve the apples and oranges problem. But this is a doubtful proposition since the context and the nature of the company changes over time. Operational conditions change. Normally, companies will develop and produce from the “easiest” fields first, then move onto the more difficult and higher cost fields. Fiscal systems also change. This alters the return to the IOC and also the incentive structure to invest in more capacity. Technology changes affects costs of production. Most spectacularly, after the oil-price collapse of 1986, there was a major technological revolution in oil production involving a large range of technologies ranging from four-dimensional seismic to horizontal and coiled tube drilling, which dramatically reduced production costs, especially offshore. More recently, the costs of oil-industry services have increased dramatically as a result of capacity shortages in the industry.⁵⁴ Finally, as will be developed below, the activities of the NOCs represented by the “national mission” change over time as the national economic context begins to develop.

Despite these problems, the IOCs themselves place great store upon how their share prices perform over time, and certainly financial analysts and others use this measure above all others to assess the performance of the company.⁵⁵

A major problem in assessing NOC performance also relates to the “aggregation problem.” As has been explained at length above, it is possible to objectively measure individual performance measures ranging from rate of ROCE to reserve replacement ratios. But if a number of measures are to be used, then there are two problems with the required aggregation. First, individual measures have different metrics—ratios, percentage growth rates, dollars-per-barrel basis, and so on. Thus, adding those up is practically impossible unless the metrics are measured on some form of ranking basis or some form of performance scale (as in table 5.1). Second, even assuming the metrics can be made additive there is the question of how they should be weighted. There can be no logic to assigning equal weights to a number of performance measures. For example, the CEE (2007) study assigns arbitrary weights to the influencing factors. While this is entirely reasonable, although there is no discussion of the basis of the weighting, different observers might well assign different weights.⁵⁶ A key point is that in the case of companies listed on stock exchanges, the “aggregation problem” disappears because the market makes its

⁵⁴ More generally, the problem with financial time-series measures is how to manage and account for inflation.

⁵⁵ This statement needs qualification. There are effectively two kinds of stock markets, the “Anglo-U.S. model” and the “German-Japanese model.” In the latter, the major shareholders are large banks who tend to take a longer-term view of company performance. In the former, the major shareholders are investors such as pension funds where fund managers’ pay and bonuses are highly dependent upon short-term performance. These tend to respond very quickly to changes in share prices, which put enormous pressure on company management to deliver on a short-term basis.

⁵⁶ This problem could be solved by use of the Delphi Method.

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collective judgment of company performance and the various metrics by virtue of the stock price and its movements. According to belief in efficient markets, this is the aggregate judgment of performance.

There is an extensive literature looking at the historical performance of IOCs (Antill and Arnott, 2002; Bleakley, Gee, and Hulme, 1997; Lynch, 1995; Ollinger, 1994).⁵⁷ But, given the focus of this paper on NOCs, this will not be elaborated upon further. More recently, there have been attempts to measure the comparative performance of NOCs (Young, 2002; Schenckery, 2005; CEE, 2005; Aegis Energy, 2007;⁵⁸ Nield, 2007; Eller, Hartley, and Medlock, 2007), but, as will be developed below, such comparisons are constrained by the lack of data for the NOCs,⁵⁹ by the role of their “national mission,” and by the differences among NOCs.

⁵⁷ There are also many sources of oil company benchmarking, but these are either done internally and remain commercially confidential within the company or they are only available on a commercial basis.

⁵⁸ It is indicative of the transparency problem with NOCs, to be developed below, that in this study only two NOCs—Pemex and PDVSA—are included for some of the metrics.

⁵⁹ For example, Eller, Hartley, and Medlock (2007) effectively use only revenue, employment, and reserves as the performance measures.

6 Performance matrix

Translating the ideas in Section 5 into operational measures on paper is fairly straightforward, as this section will show. But, in applying them to NOCs, we find a serious obstacle in the lack of transparency among NOCs.

Some NOCs are now listed on stock exchanges. As such, they need to provide audited accounts and other documents in the same way as IOCs and, from that perspective, their performance can be assessed on the same basis.⁶⁰ Certainly the number of NOCs being listed is increasing, which can be explained by several factors. First, it is part of their drive for commercialization, which is driven either by governments in an attempt to improve performance and/or by the NOC management seeking better pay and conditions associated with commercial entities as opposed to public bureaucracies. Second, it is seen as a mechanism to raise capital for NOCs off the government budget and also as a prerequisite for the international operation of an NOC.

But generally, many NOCs are notorious for their lack of transparency (Marcel, 2006; Stevens, 2008). This in part can be explained by the application of “principal-agent” analysis. In this view of the world, the “agent” is the NOC management and the “principal” is the controlling ministry. In many countries, this is actually the ministry of finance since the ministry of oil has often been “captured” by the NOC. The agent pursues rent seeking, which can be described simply as absorbing the resources of the NOC for its own benefit by improving the working environment. This is allowed to happen by the principal because of the presence of information asymmetry, whereby only the agent knows the true cost of the provision of the services provided by the NOC. Therefore, it is in the vested interest of the agent (that is, the NOC management) to limit the availability of information. In particular, as already discussed, it is clear that operating abroad is a very effective way of deepening the information asymmetry between the NOC and the controlling ministry (Mommer, 1998; ESMAP, 2007). If this overseas operation also involves the use of operational vertical integration as opposed to markets, then the asymmetry is deepened even further.

The extent or lack of transparency varies enormously between NOCs, both internally and externally. For example, some NOCs have very good internal transparency, but this is not made available to the general public. A good example is Saudi Aramco, which has an internal auditing process of which any IOC would be proud. The accounts are audited internally and are also approved by external international auditors. But when these accounts are presented to the shareholder (as is the case with any IOC), the shareholder (that is, the government) chooses not to release them to the public. By contrast, other NOCs are notorious for their lack of internal

⁶⁰ Some NOCs that are unlisted still produce audited accounts, which are made public, although access to these accounts can be erratic and the data old. For example, while it is possible to get a hard copy of KPC's 2005–2006 Annual Report and Accounts from KPC, it is not yet available for download from the KPC website.

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transparency, largely as a result of managerial problems often associated with a lack of capacity, rent seeking, or corruption.

There are growing pressures on NOCs to improve their transparency (Myers and others, 2006). This has arisen in part as a result of the Extractive Industry Transparency Initiative (EITI), which is encouraging private IOCs to reveal details of their payments to governments.⁶¹ But, in many upstream oil agreements, the NOC is the recipient of very considerable volumes of oil and so the pressure to reveal its activities is growing as more governments join the EITI.

The result of this lack of transparency is that measuring the performance of an NOC is much more complex than that of an IOC. It also makes NOC performance comparisons difficult, if not impossible, because often what information is available for an NOC, it is in a particular format or follows specific definitions.

With these qualifications in mind, tables 6.1–6.3 list possible specific and quantifiable measures by which the performance of an NOC might be assessed. Table 6.1 is a conventional list of the various financial ratios that would be used to assess the performance of any privately owned company. On balance, in a world of “value-based management,” probably the single most important measure is the price-earnings ratio (*P/E ratio*), which is measured by the stock price/earnings per share since this encapsulates the idea of “shareholder value.” Table 6.2 provides a list of operational and financial measures specific to the hydrocarbon sector. They are divided into the three stages of the value chain. Table 6.3 lists possible measures to assess the “national mission.”

⁶¹ This is being further encouraged by the “publish what you pay” campaign, which is a coalition of 300 NGOs internationally.

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Table 6.1 Financial ratio analysis for consolidated assessment

	Defined	Comments
Leverage / gearing ratios	Measures the firm's financial leverage, that is, its ability to borrow.	High gearing = high risk because debt interest must be paid regardless of profit levels.
Debt ratio	Long-term debt / (long-term capital + leases + equity)	Makes use of accounting rather than market values, thus tends to exclude intangible assets.
Debt-equity ratio	(Long-term debt + leases) / equity.	Makes use of accounting rather than market values, thus tends to exclude intangible assets.
Times interest earned	(Earnings before interest and taxes [EBIT] + depreciation) / interest.	Often averaged over several years to smooth peaks and troughs. Measures the regular interest payments, which must be made to avoid default.
Earnings variability	Variability of earnings over time.	Used to assess the uncertainty over future earnings, which is relevant to the debt burden.
Liquidity ratios	Measures the ability of the company to repay debt quickly.	The figures tend to be more reliable compared to book values of assets but ignores the ability to borrow.
Net working capital to total assets	Net working capital / total assets.	Roughly measures the company's potential cash reservoir.
Current ratio	Current assets / current liabilities.	Provides an indication of the company's market liquidity and ability to meet creditors' demands.
Quick ratio	(Cash + marketable securities + receivables) / current liabilities.	Indicates a company's capacity to maintain normal operations in bad periods by drawing on current cash or near cash reserves.
Cash ratio	(Cash + marketable securities) / current liabilities.	A financial metric used to determine a company's ability to pay off its short-term debt obligations
Interval measure	(Cash + marketable securities + receivables) / average daily expenditures from operations.	Looks at the size of the liquid assets in relation to the firm's regular cash outflows.
Profitability or efficiency ratios	Measures how effectively the company is using its assets.	"Cash is fact, profit is an opinion" (Dickens, 2007).
Sales to total assets	Sales / total assets.	A high ratio implies working close to or at capacity.
Sales to net working capital	Sales / average net working capital.	Net working capital can be more accurately measured than other assets.
Net profit margin	Net income / sales.	Indicates the proportion of sales which goes to profit.
Inventory turnover	Cost of goods sold / Average inventory.	High turnover often seen as a sign of efficiency.
Average collection period	Average receivables / Average daily sales.	Measures the speed with which customers pay their bills.
Return on total assets	Net income / average total assets.	Provides an indication of a company's earnings in relation to all of the resources at its disposal
Return on equity	Net income before common stock dividends / average equity.	Measures the rate of return on shareholders' capital, that is, a company's ability to turn investments into earnings growth
Payout ratio	Dividend / earnings per share.	Gives the proportion of earnings paid as dividends. If this is multiplied by the return on equity it shows how rapidly the shareholders investment is growing.
Price-earnings ratio	Stock price / earnings per share.	Reflects the esteem with which investors regard the company but interpretation needs care.
Dividend yield	Dividend per share / stock price.	A high yield suggests investors expect low dividend growth or that they require a high return.
Market-to-book ratio	Stock price / book value per share.	Provides an indication of undervaluation or overvaluation of a company's stock.
Tobin's q	Market value of assets / estimated replacement cost.	When $q > 1$ firms have an incentive to invest. When $q < 1$ it may be cheaper to acquire assets by means of merger.

Source: Based on Brealey and Meyers, 1988.

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Table 6.2 Performance matrix for the value chain

	Upstream	Midstream	Downstream
Operational	Exploration well success rate %	Pipeline throughput	Refinery throughput
	Development well success rate %	Leakages	Refinery fuel and losses
	Reserve replacement rate %	Downtime	Days lost through accidents
	Production growth %		Downtime
	Days lost through accidents		Sales per employee
	Production per employee		
	Sales per employee		
	Net profit per employee		
	Associated gas utilization/flaring		
	Financial (per barrel oil equivalent unless otherwise stated)	Finding cost	Throughput costs
Development cost		LNG plant financial measures	Marketing and distribution costs
Production cost			Refinery opex/refinery capex
Reserve replacement costs			Refinery margins
Upstream operating cash flow/upstream expenditure			
Cash margin – upstream revenue – production + exploration expenses			
Upstream operating expenditures / upstream capital expenditures			
Revenue – (production + exploration expenses + depreciation + taxes)			
Earnings before interest, taxes and depreciation, depletion, and amortization			
Upstream after tax earnings/ upstream long term assets			
Gross debt/total proved reserves			
Proportion of costs spent on R&D			

Source: Author.

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Table 6.3 National mission matrix of performance

Fiscal linkages	Revenue per barrel
	Total revenue
	Taxes as a proportion of revenue
	Upstream tax revenue by type
	After-tax income of the NOC
	Hydrocarbon foreign exchange earnings as a % of merchandise exports
Forward linkages	Domestic energy supplies as % of total consumption
	Cost of domestic subsidy or sales-tax revenue
	Number of wholesale and retail outlets
	Extent of national fuel poverty
	Household access to electricity
	Spending on training % of total spend
	Employee turnover
	Petrochemical contribution to gross domestic product (GDP)
	Metal smelting contribution to GDP
	Other high-energy-intensive industries (paper, cement) contribution to GDP
	% oil in primary energy consumption
	% gas in primary energy consumption
	Gas flaring % gas produced
Backward linkages	Nationals in the labor force
	Local content %
	Spending multiplier
	Spending on nonhydrocarbon projects
	Creation of training/education institutions
	Links with universities and research centers

Source: Author.

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The measures suggested above are many, often not measurable, and frequently duplicating. Therefore, it is proposed to pick a selection of these measures that might best represent the performance of NOCs and should be generally available.⁶² But several of these measures will be more relevant to some NOCs than to others.⁶³ It therefore makes sense to divide the NOCs into categories. There are a number of possible categorizations. For example, CRAI (2004) identifies five categories, guardians of the patrimony, stewards for future generations, new kids on the block, the new believers, and market disciples. Table 6.4 suggests five categories, with a few specific examples of each.

Table 6.4 Types of NOCs

Category	Examples	Category	Examples
Ex-NOCs	YPF	Monopoly incumbents	Saudi Aramco
	Elf		Pemex
	Total		KPC
	Britoil		NIOC
Partial NOCs	StatoilHydro	Post-box NOCs	NNPC
	Petronas		Sonangol
	Petrobras		ADNOC
	Sinopec		
	Repsol		
Competing operators	PDVSA		
	Sonatrach		

Source: Author.

⁶² A key difference is between companies listed on stock exchanges that are obliged to file accounts and other data (such as FAS 69s) and those that are unlisted.

⁶³ For example, the issue of the use of reserves as a measure has already been discussed in Section 2.

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Such categorization is also relevant for the IOCs if they are to be used for purposes of comparison. In table 6.5 they are simply divided into the large IOCs and the smaller independents with only upstream operations. Table 6.5 is a matrix to be used to identify which measures are appropriate for which company.

Table 6.5 Proposed performance measures

	IOC		NOC				
	Majors	Small independents	Ex-NOC	Partial NOC	Competing operators	Monopoly incumbents	Post-box NOCs
Asterisk in cell (*) indicates that relevant data are available							
Financial							
Earnings per share	*	*	*	*			
Net profit margin	*	*	*	*	*	*	*
ROCE	*	*	*	*	*	*	*
Return on total assets	*	*	*	*	*	*	*
EBITDA	*	*	*	*	*	*	*
Operational							
Production growth	*	*	*	*	*	*	*
Reserve replacement	*	*	*	*			
Production per employee	*	*	*	*	*	*	*
Gas flaring % gas produced	*	*	*	*	*	*	*
Refinery utilization	*		*	*	*	*	*
National mission							
% total revenue paid to government				*	*	*	*
Revenues as % of total taxes				*	*	*	*
Domestic energy supplies as % of total consumption				*	*	*	*
Spending on nonhydrocarbon projects				*	*	*	*
% of nationals employed				*	*	*	*
% of local content				*	*	*	*

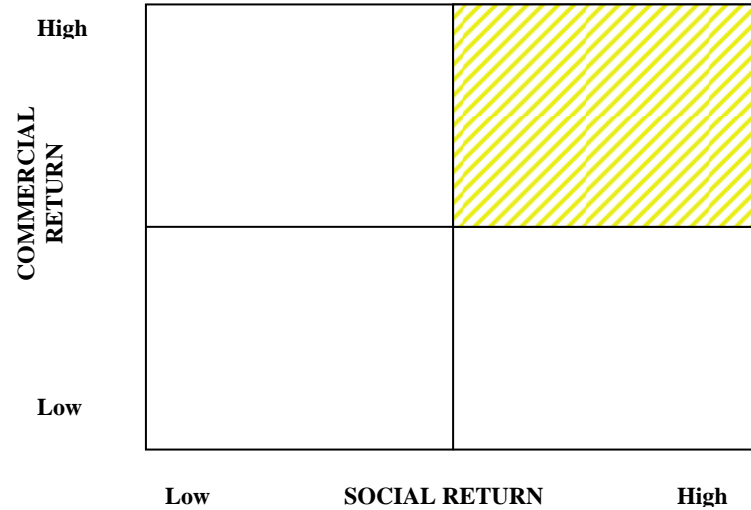
Source: Author.

Note: ROCE = return on capital employed; EBITDA = earnings before interest, taxes, depreciation and amortization.

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Linking the three performance measures outlined in table 6.5 can be done via the use of what in Saudi Aramco is referred to as the “golden quadrant” diagram.⁶⁴ Figure 6.1 shows a space upon which the company will place all of its projects individually. The vertical axis measures operational and financial performance on the basis of a singly measure, such as the private rate of return on the project (net present value,

Figure 6.1 The Golden Quadrant



Source: ESMAP, 2007.

NPV, or internal rate of return, IRR). The horizontal axis measures the rate of return based on the “national mission” dimension of the project, measured as a social-cost-benefit rate of return. The optimum bit of the diagram to be is in the top-right-hand quadrant—“the golden quadrant,” where commercial and social returns are highest.

Trying to relate the performance indicators discussed in this section to the dimensions of analysis in the terms of reference presents serious challenges. Box 6.1 sets out the reasons for this, along with a suggested solution.

⁶⁴ “In the past, Saudi Aramco has been central to the economic development of the eastern province, and has always gone to considerable lengths to try and maximize the backward linkages to the rest of the economy to encourage the availability of local factor inputs. This reflects the very strong sense of national mission that has characterized the company even before it was the NOC. But attempts to maximize local input have always been done on a commercial basis with no regulatory requirements. Thus, within Saudi Aramco there is talk of the need to locate projects within the so-called Golden Quadrant, where projects have both high commercial returns and high social returns for the Kingdom.” ESMAP, 2007.

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Box 6.1 Dimensions of analysis and performance metrics: a fundamental problem

An issue of key importance is the question of how the performance metrics can be used to measure the dimensions of analysis (DAs) in the terms of reference of the study. The DAs are gathered under three headings: corporate governance structure, value creation, and other factors.

Value creation, which in the terms of reference covers only operating and financial performance, as this report argues should also include the “national mission,” which is an integral part of an NOC’s value creation. Much of this report is an attempt to consider how each might be measured. But the first of the DAs effectively identifies the factors that will determine the behavior of the NOC in its pursuit of value creation and item 3 identifies the factors that will affect the context in which the NOC seeks to pursue value creation. Thus, 1 and 3 are effectively the drivers of value creation. Table 4.1 of this report effectively gathers 1 and 3 into exogenous and endogenous factors that will determine value creation. The specific dimensions of analysis mentioned in the terms of reference are actually marked with an asterisk.

The question is which performance measures are more significant to measure each DA and, once the performance measures have been calculated, how they might be used. It is this request to quantify that creates the problems facing the report.

The options to measure the operating and financial performance of an IOC are well known and much used, and many consultancy companies do precisely this in benchmarking exercises available on a commercial basis. The measures used are explained and discussed in this report. For NOCs, the exercise is complicated because for many NOCs the financial and operating data are not available. It is also complicated because when considering the value creation of an NOC, the “national mission” must also be considered. Measuring this is difficult, not least because much involves a social cost-benefit approach rather than a simple private project-appraisal approach. This report attempts to outline how such performance measures might be employed. Thus, the DAs relating to value creation can be addressed.

The problem arises with the other DAs under the headings of “corporate governance structure” and “other factors.” It is possible to list indicators to assess the various DAs under these headings. Indeed the Center for Energy Economic (CEE-UT) report (Appendix 1) prepared by the Bureau of Economic Geology at the University of Texas at Austin, June 30, 2008, does precisely that in great detail. But there are two insurmountable problems with this, which have already been elaborated in this report.

First, although some of the indicators can be quantified, many are, by their nature, qualitative. For example, under the heading “Corporate Governance—Ownership Structure and its Organization” the “percentage of shares controlled by the government” can be quantified, but “description of incorporation and ownership” cannot. In such circumstances, qualitative and quantitative indicators cannot be aggregated. Indeed, even quantitative indicators in differing units suffer the same problem.

Second, the DAs are listed (as the analysis in Section 4 of this report outlines) as the drivers of value creation. But the nature and size of the coefficients between the DA driver as the independent variable and the DA outcome (that is, value creation) as the dependent variable are unknown and unknowable in any objective manner. Thus, long lists of indicators will not help develop the study and will not help in trying to identify in any objective manner what are the key determinants of value creation.

The only way—if the study must link the performance indicators to the DAs—to establish which the most important would be, as the report has already suggested, is to use the Delphi Method.^a This, by its nature, is subjective based upon (alleged) expert opinion. But the larger the numbers consulted, the more the objectivity of the result, always assuming the opinions result in a normal distribution rather than a bimodal distribution. It seems that such an approach is the only viable way to take the study further.

a. Implicitly the CEE-UT Study applies a small-sample Delphi Method to define the scoring for the cluster analysis. But the scoring, based on a range from 0 to 100, treats the various DAs as equally important when it comes to aggregation.

7 Conclusions

Measuring NOC performance is difficult for three reasons. First, there is the problem of an NOC's "national mission." The definition of what the mission actually is varies across countries, and some of the components of the mission are extremely abstract and would be difficult to quantify in any meaningful sense. Second, many NOCs suffer from a lack of transparency. In some cases this is the result of deliberate policy by NOC management to deepen the information asymmetry that underlies the "principal-agent" relationship and allows rent seeking by the management. In some cases it is simply the result of the way in which the oil sector is organized. Finally, there is the "aggregation problem." Thus, the performance measures present different metrics, which are difficult to combine. At the same time the relative weighting of the performance measures is a matter of subjective judgment. While this is true in the case of IOCs, it is overcome by the fact that the IOCs are listed on stock exchanges, where the market gives its overall verdict on performance by virtue of the share price and its movements. The fact that an increasing number of NOCs are being quoted on such exchanges assists this process of assessment.

But there are metrics that can be used to assess the performance of an NOC. These should not in most cases include reserve figures, which are exercises in arithmetic rather than any reflection of effort on the part of the NOC. But other performance metrics face the problem of differing definitions although the increased number of NOCs listed on stock exchanges helps reduce this problem, as more NOCs are subject to producing data in the same format and on the same basis. But to manage an aggregation requires fewer metrics and those suggested in Tables 6.1, 6.2, and 6.3 probably need to be refined further to assess their importance. Further thought also needs to be given to how the metrics can be condensed into a single figure in the absence of a share price. One possible way forward, as suggested in box 6.1, is the use of the Delphi Method to assess performance.

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