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National Oil Companies and Value Creation



THE WORLD BANK

Silvana Tordo
with Brandon S. Tracy
and Noora Arfaa

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Contents

Acknowledgments.....	vii
Abbreviations and Acronyms.....	ix
Executive Summary.....	xi
1. The Petroleum Sector Value Chain.....	1
1.1 Overview of the Value Chain	1
1.2 Policy Decisions Affecting Value Creation.....	3
1.1.1 Industry Participation.....	4
1.1.2 Licensing and Petroleum Contracts	4
1.1.3 Taxation	5
1.1.4 Depletion Policy.....	5
1.3 Value Creation Through Integration	7
1.4 Local Content Policies and Value Creation.....	8
1.5 Conclusion	11
2. The Establishment of a NOC: Advantages and Issues	15
2.1 A Brief History of NOCs	15
2.1.1 Industry Participation	15
2.1.2 The Emergence of NOCs.....	16
2.1.3 OPEC Revolution and Post-Colonial World	17
2.1.4 The Reaction of Consumer States	19
2.1.5 A New Agenda: Liberalization and Privatization	19
2.1.6 The End of History?	20
2.1.7 Developments Since 2000.....	21
2.2 Arguments in Favor of NOCs.....	22
2.2.1 Historical Context	22
2.2.2 The Importance of the Petroleum Sector	22
2.2.3 Political Gains from State Control.....	23
2.2.4 Efficiency and Monitoring of Operations	23
2.2.5 Petroleum Rent Maximization	23
2.2.6 Socioeconomic Issues and Priorities.....	24
2.3 Practical Difficulties and Setbacks with NOCs	24
2.3.1 Historical Context and Ideology.....	24
2.3.2 Economic Cost of Political Control.....	25
2.3.3 Operational Inefficiencies.....	25
2.3.4 Lack of Competition	26

2.3.5 Subsidies and Noncommercial Objectives.....	26
2.3.6 Weak Corporate Governance.....	27
2.3.7 Funding Strategy and Requirements.....	27
2.3.8 Conflict of Interests and Balance of Control.....	28
2.4 Conclusion.....	29
3. The Performance and Value Creation of NOCs: A Conceptual Model.....	38
3.1 A Conceptual Model of Value Creation.....	38
3.2 Measuring the Performance of NOCs: The Value Creation Index.....	39
3.2.1 Proxy Measures Used in VCI.....	40
3.2.2 Determination of VCI.....	44
3.3 The Value Drivers.....	44
3.3.1 Selection of Proxy Variables.....	45
3.4 Conclusion.....	47
4. Case Studies and Lessons Learned.....	50
4.1 Exploratory Analysis of Value Drivers.....	50
4.1.1 Selection of Proxy Variables.....	50
4.1.2 Indications from the Statistical Analysis.....	52
4.2 Case Studies.....	53
4.3 The Corporate Governance of NOCs.....	54
4.3.1 Context Variables and NOC Corporate Governance.....	54
4.3.1.1 External Governance.....	67
4.3.1.2 Internal Governance.....	72
4.3.2 Selected NOCs Corporate Governance Scorecard.....	81
4.4 Lessons Learned.....	84
5. Conclusion.....	102
Appendixes.....	107
Appendix 1 Key Stages of the Value Chain.....	109
Appendix 2 Examples of Local Content Policies.....	116
Appendix 3 Overview of Key Research on NOCs.....	121
Appendix 4 Exploratory Statistical Model: Data Limitations and Issues.....	128
Appendix 5 Relevance of Government Support to the Credit Rating of NOCs.....	130
Tables	
Table 2.1 Founding dates of selected NOCs.....	17
Table 3.1 Value drivers and their proxy measures.....	56

Table 4.1 NOC sample for statistical analysis.....	51
Table 4.2 VCI for the sample NOCs.....	51
Table 4.3 Results of model estimation.....	52
Table 4.4 Case studies: overview	55
Table 4.5 Composition of corporate governance sample	67
Table 4.6 External governance arrangements for selected NOCs.....	68
Table 4.7 Internal governance structure for selected NOCs.....	73
Table 4.8 Internal governance processes for selected NOCs.....	80
Table 4.9 Governance standards: sample NOCs vs. large oil and gas companies.	82
Table 4.10 Governance scorecard for selected NOCs.....	83

Boxes

Box 4.1 The Grant of Special Privileges to a NOC: Opportunities and Pitfalls.....	87
Box 4.2 Local Content Policies and NOC Value Creation	89
Box 4.3 Consistency and Speed of Government Reforms and NOC Value Creation	91
Box 4.4 Geology and NOC Value Creation	93
Box 4.5 Openness and NOC Value Creation.....	95
Box 4.6 Corporate Governance and NOC Value Creation	97

Figures

Figure 1.1 Petroleum value chain	2
Figure 1.2 Options for the level of competition and participation in the petroleum sector	4
Figure 3.1 Petroleum sector value creation	39
Figure 3.2 Components of the VCI	41
Figure 4.1 Value creation flow chart.....	86

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National Oil Companies and Value Creation, Volume I, is part of a study aimed to explore the determinants of value creation by national oil companies (NOCs). The study comprises three volumes (downloadable from <http://go.worldbank.org/UO-QSWUQ6P0>): volume I presents the findings of the study, volume II contains detailed case studies on the NOCs analyzed in the study, and volume III contains the full dataset and calculation of the value creation indices and value drivers for each NOC in the study sample. The study was undertaken and written by Silvana Tordo (lead energy economist—Oil, Gas, and Mining Policy Division, World Bank), with contributions from Brandon S. Tracy (econometrician, consultant), and Noora Arfaa (consultant), both with the Oil, Gas, and Mining Policy Division of the World Bank. The study draws on earlier drafts of chapters 1, 2, and 3 prepared by Christian O. Wolf (Economist, Cambridge University, United Kingdom). The data and material utilized in the calculation of the value creation index and value drivers were collected by Michelle M. Foss, Gurcan Gulen, Miranda Wainberg, Ruzanna Makaryan, and Dmitry Volkov (Center for Energy Economics, Bureau of Economic Geology, University of Texas at Austin—CEE), who also contributed to the definition of the statistical model of value creation and prepared the initial version of the case studies. The comments of peer reviewers Alan H. Gelb (Center for Global Development), Robert W. Bacon and Charles McPherson, both consultants (Oil, Gas, and Mining Policy Division, World Bank), Sunita Kikeri (Corporate Governance Department, World Bank), and Andre Plourde (professor, department of economics, University of Alberta) are gratefully acknowledged. Comments were also provided by PRMSP. Steven B. Kennedy and Fayre Makeig edited the paper.

Abbreviations and Acronyms

\$	United States dollars
BOD	Board of Directors
E&P	exploration and production
EBITRN	earnings before interest, taxes, royalties, and noncommercial expenditure
GAAP	Generally Accepted Accounting Principles
IFRS	International Financial Reporting Standards
JV	joint venture
NOC	national oil company
POC	private oil company
PSC	Production sharing contract
R&M	refining and marketing
RRR	reserve replacement rate
SOE	state-owned enterprise
VAT	value-added taxes
VCI	value creation index
WGI	Worldwide Governance Indicators
WTO	World Trade Organization

Executive Summary

Approximately two billion dollars a day of petroleum are traded worldwide, which makes petroleum the largest single item in the balance of payments and exchanges between nations. Petroleum represents the larger share in total energy use for most net exporters and net importers. While petroleum taxes are a major source of income for more than 90 countries in the world, poor countries net importers are more vulnerable to price increases than most industrialized economies. Unlike most commodities, petroleum is a major factor in international politics and socio-economic development. These characteristics of the petroleum sector largely explain why many producing and importing countries have, at least at some point during the course of history, opted for direct state intervention rather than more liberal governance regimes.

Today national oil companies (NOCs) control approximately 90 percent of the world's oil reserves and 75 percent of production (similar numbers apply to gas), as well as many of the major oil and gas infrastructure systems. This can be directly as producers or as the "gatekeepers" for exploitation by private oil companies (POCs). Petroleum Intelligence Weekly ranks 18 NOCs among the top 25 oil and gas reserves holders and producers. In addition, an estimated 60 percent of the world's undiscovered reserves lie in countries where NOCs have privileged access to reserves. As such, NOCs are of great consequence to their country's economy, to importing countries' energy security, and to the stability of oil and gas markets.

Governments' petroleum sector policies often pursue a variety of development and socioeconomic objectives, including the maximization of the net present value of the economic rent derived from the exploitation of petroleum, inter-temporal equity, the promotion of backward and forward linkages, the promotion of bilateral trade, energy self sufficiency, and security of supplies. NOCs are often used to achieve a wide array of these objectives, as primary tool or in combination with other policy tools. The choice of policy tools—NOC, regulation, or a combination of both—depends on the type of objectives that policy makers wish to achieve and their relative priorities. These in turn depend on the country specific context. Exogenous factors, including oil and gas prices, economic cycles, and the existence of international sanctions, also affect government policies. This helps to explain the diversity of policies pursued by governments over time.

Whatever the objectives and their mix, governments' primary concern should be to maximize economic efficiency and the generation of social welfare. Although there are established criteria to guide policy formulation in cases that involve a certain level of value judgment, in practice deciding whether or not establishing the NOC maximizes social welfare is a matter of political choice. Indeed economic considerations, such as the desire to address market deficiencies or inefficiency or to maximize rent capture, may not be the primary reason for establishing the NOC. Hence, any attempt to compare the relative contribution to social value creation of direct state intervention and regulation would inevitably imply a considerable level of subjectivity. This is not attempted in this paper. Rather we analyze the available evidence on the objectives, governance and performance of 20 NOCs from both net importing and net exporting countries, and draw conclusions about the design of policies and measures that are more likely to lead to social value creation by NOCs. In this paper, social value creation refers to the creation

of benefits or reductions of costs for society in ways that go beyond the maximization of the financial return on investment derived from the exploitation of the resource.

The first step towards measuring NOCs performance is to establish their objective function. But NOCs differ on a number of very important variables, including the level of competition in the market in which they operate, their business profile along the sector value chain, and their degree of commercial orientation and internationalization. One thus needs to be mindful of possible over-generalizations. On the other hand, most NOCs share at least some core characteristics: they are usually tied to the “national purpose” and serve political and economic goals other than maximizing the firm’s profits. Perhaps this is the most relevant single factor that explains their existence and resilience in very different political, social and economic environments. These core characteristics need to be taken into account in defining what constitutes NOC value creation and analyzing NOCs behavior and strategy.

A quantitative measure, the “value creation index”, is proposed to capture the NOC’s capacity to fulfill its mission and objectives (that is, its contribution to value creation). The index, which includes operational, financial and national mission performance indicators, is not designed to measure all aspects of value creation; it focuses on key aspects of short-term value creation by NOCs, and is used to reveal the relative position (and direction of changes over time) of the NOCs in the study sample with respect to the observed value creation measures. This in turn provides an indication of relative policy success.

Although informative, the value creation index does not reveal which factors “drive” value creation. We refer to them as “value drivers”. If we were able to identify these factors, we could determine which policies and tools should be used to affect NOC value creation. To this end, a conceptual model of value creation is proposed that identifies five classes of value drivers: geology and geography, state context, petroleum sector governance and organization, NOC strategy, and NOC corporate governance. An exploratory regression analysis is applied to understand the relationship between value drivers and NOC value creation. The analysis confirms the importance of geology, petroleum sector governance and NOC corporate governance to value creation. However, caution should be applied in interpreting these results. One of the main difficulties that we faced in this attempt to statistically measure the relative importance of value drivers was the uneven quantity and quality of data across the NOC sample. Although some general observations can be drawn from this analysis, overall the result cannot be viewed as offering substantial understanding on how the various drivers affect value creation. More research is warranted.

On the other hand the low explanatory power of the statistical model may indicate the uniqueness of each NOC, underlying the importance to value creation of country specific and NOC specific factors. To test this hypothesis, the experience of 12 NOCs is analyzed in detail to establish whether discernible patterns with respect to value creation can be observed for NOCs with similar strategy and corporate governance arrangements, and whether certain country specific context variables lead to particular NOC corporate governance arrangements and strategies. In particular, our analysis aims to answer the following questions: Are certain corporate governance arrangements more suited than others to promote value creation? Is good geology a pre-condition for NOC value creation? Are there benefits from exposing the NOC to competition from POCs? Does the development of forward and backward linkages hamper NOC value creation? Overall, country specific objectives, constraints, and concerns have a substantial effect

on NOC value creation. Therefore, it is difficult to identify general principles that apply to all countries in all circumstances. Our findings are summarized below.

Internal governance mechanisms are more critical to NOC value creation than the ownership structure. Particularly in the petroleum sector where prices, technology, competition, and management techniques are continuously changing, nimble decision-making processes and budgetary and financial autonomy are crucial to value creation, regardless of the NOC's ownership structure. These features are associated with the level of technical and managerial competence of the NOC. Government interference in the NOC's decision-making processes seems to be more closely related to the degree of economic or strategic relevance of the petroleum sector to the specific country, rather than to the percentage of independent BOD members. This may have something to do with the difficulty in assessing the true level of independence of BOD in companies that exhibit a high concentration of ownership, even when nomination committees are established. Cultural differences across countries help to explain why similar corporate governance arrangements may function in a very dissimilar way.

NOCs that belong to countries with large resource endowments may find it more difficult to create value than their counterparts in countries with smaller resource endowments. The size of the resource endowment matters to value creation, but the manner in which it is exploited matters more. Large resource endowments lead to higher value creation if the resource is extracted efficiently and revenues from its sale are re-invested to support production levels and replace reserves. Given the complex network of often conflicting interests between efficiency of exploitation and state needs, following this approach is often harder for NOCs that belong to countries with large resource endowments, than it is for their peers in less endowed countries. Ultimately, the political, institutional, and societal qualities of a country—more than the actions of its NOC—are critical to determining to what extent the gift of nature will translate into value creation.

Temporary restrictions on access to petroleum activities can be effective policy tools to enhance value creation by the NOC. Among the countries surveyed in this paper, many impose, or have imposed, some form of restriction on the participation of POCs in petroleum exploration and production activities by granting special rights to the NOC. These privileges have generally taken the form of mandated association between the NOC and POCs, with minimum levels of state participation. This formula is often used by countries and NOCs that are new to the petroleum sector with several objectives: (i) fast-tracking the learning curve through the association with experienced industry participants; (ii) reducing information asymmetries between industry participants and the state; (iii) increasing rent capture; (iv) reducing exploration risk; and (v) accelerating the exploration and production of the country's resources while maintaining control over sector activities. Full exclusion of industry participation in petroleum exploration and production activities is rare. Well-designed restrictions on access that take into consideration the characteristic of the resource, domestic capacity, the fiscal regime, and market structure can be very effective tools to address information and capacity asymmetries. Sheltering the NOC from competition allows it to focus on developing the necessary competence and economies of scale. However, this policy has decreasing effects on value creation over time and may discourage the NOC from developing efficient and competitive processes.

The pursuit of national mission objectives does not necessarily hamper the creation of value by the NOC. National mission objectives hamper value creation when their pursuit is in conflict with other key value-added functions of the NOC, such as the

efficient and sustainable exploration and exploitation of petroleum resources. Defining proper national mission objectives for the NOC is thus critical to value creation. This is particularly important in countries where the NOC is the only company authorized to carry out petroleum activities, with limited possibilities for sharing exploration and development risk with other parties, since this approach requires, *inter alia*, a superior level of operational efficiency and the ability to prioritize core-business investments. For example, creating a skilled workforce, developing technology, and supporting the local supply industry allow the NOC to lower the cost of operations while fulfilling its national mission objectives. If the NOC's national mission objectives include the development of industries that make direct use of the oil and gas sector's output (forward linkages), the pursuit of these objectives may hamper value creation since it requires large scale operations and technology that may not be available in the country. When conditions are in place, forward linkages can enhance value creation by capturing the advantages of vertical integration.

Organization of the Paper

This paper has five chapters. **Chapter 1** describes the key features of upstream, mid-stream, and downstream petroleum operations and how these may impact value creation and policy options. **Chapter 2** draws on ample literature and discusses how changes in the geopolitical and global economic environment and in the host governments' political and economic priorities have affected the rationale for and behavior of NOCs. Rather than providing an in-depth analysis of the philosophical reasons for creating a NOC, this chapter seeks to highlight the special nature of NOCs and how it may affect their existence, objectives, regulation, and behavior. **Chapter 3** proposes a value creation index to measure the contribution of NOCs to social value creation. A conceptual model is also proposed to identify the factors that affect value creation. **Chapter 4** presents the result of an exploratory statistical analysis aimed to determine the relative importance of the drivers of value creation. In addition, the experience of a selected sample of NOCs is analyzed in detail, and lessons of general applicability are derived. Finally, **Chapter 5** summarizes the conclusions.

The Petroleum Sector Value Chain

“The weakest link in a chain is the strongest because it can break it.”

(Stanislaw Lec)

The oil and gas industry encompasses a range of different activities and processes that jointly contribute to the transformation of underlying petroleum resources into useable end-products. These different activities are inherently linked with each other (conceptually, contractually, and physically), within or across firms, and national boundaries. Understanding how value is created along the sector value chain is critical for the design of effective policies.

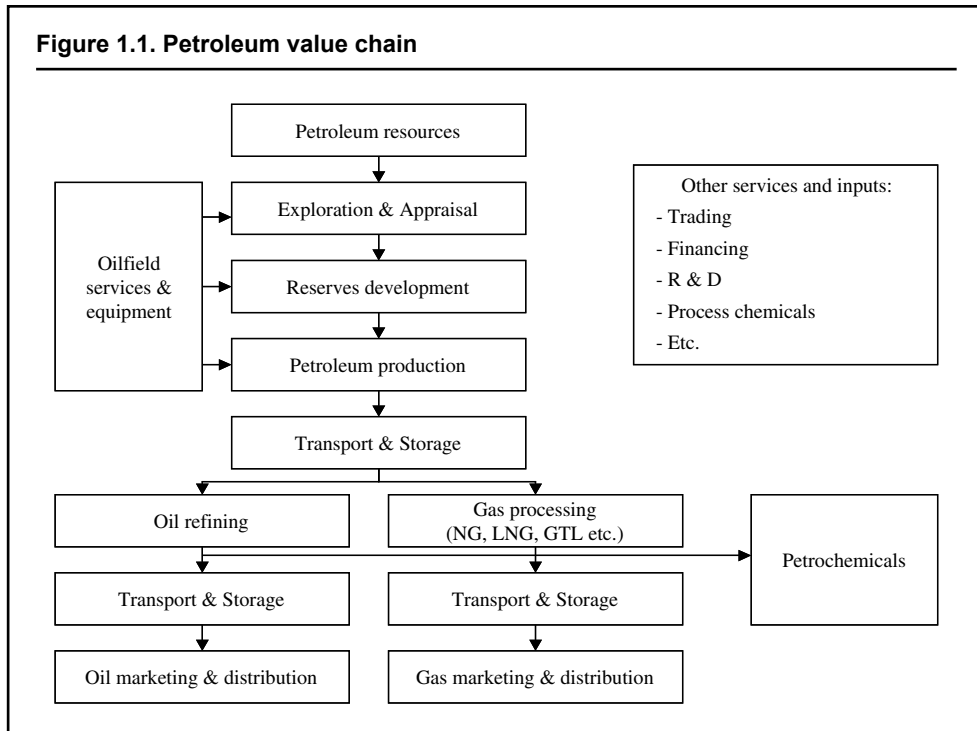
Since the focus of the paper is the creation of social value at the country-level rather than private shareholders value, the industry value chain (national petroleum value system) is examined, and the contribution of individual firms to social value creation is considered.

A company’s ability to create value is affected by the organization and governance of the sector in which it operates, which in turn is the result of policy decisions by the government. Some policies, such as industry participation, licensing and petroleum contracts, taxation, depletion of reserves, and policies designed to increase the economic and developmental impact of the petroleum sector, affect value creation more directly than other, and will be discussed in this chapter. Local content policies are particularly emphasized given their relevance in many petroleum producing countries, and the role that NOCs often play in their implementation.

1.1 Overview of the Value Chain

Value chain analysis, as popularized by Porter (1985), investigates the sequence of activities required to bring a product or service from conception and procurement through production and distribution to the final customer.¹ Such analysis can be done for individual firms, for clusters of firms whose value chains are interlinked—referred to as value systems by Porter and usually involving suppliers, distributors/sellers, and customers—or for selected industries (within or across national borders). In line with our focus on social value creation, we will consider the industry value chain for the petroleum sector, which includes development, production, processing, transportation and marketing of hydrocarbon (Figure 1.1).

The value chain starts with the identification of suitable areas to conduct exploration for oil and/or gas.² After initial exploration, petroleum fields are appraised, developed, and produced. These activities are generally called exploration and production (E&P) or referred to as “upstream” oil and gas. Oilfield services include a number of auxiliary services in the E&P process, such as geological and geophysical surveys and analysis,

Figure 1.1. Petroleum value chain

Source: Wolf, 2009

drilling, equipment supply, and engineering projects. They form an important part of the overall oil and gas industry, but will not be the focus of our overview. Infrastructure, including transport (such as pipelines and access to roads, rail, and ports) and storage, is critical at various stages in the value chain, including the links between production and processing facilities and between processing and final customer. These parts of the value chain are usually referred to as “midstream”. Oil refining and gas processing turn the extracted hydrocarbons into usable products. The processed products are then distributed to wholesale, retail, or direct industrial clients. Refining and marketing (R&M) is also referred to as “downstream”. Certain oil and gas products are the principal input for the petrochemicals industry. This explains the close historical and geographical links between the two.

Individual companies can perform one or more activities along the value chain, implying a degree of vertical integration (“integrated” firms are engaged in successive activities, typically E&P and R&M). They can also seek to expand within a given activity, leading to horizontal consolidation (business scale). At the country level, horizontal integration in the upstream is limited by natural resource endowments and downstream by the size of the domestic market and the country’s ability to export goods and services. Companies’ vertical and horizontal integration choices are affected by country-level industrial policies and the related legal and regulatory frameworks. For example, in some countries, such as South Africa, vertical integration in the petroleum sector is prohibited. Other countries, such as Brazil, limit the market share of industry participants.

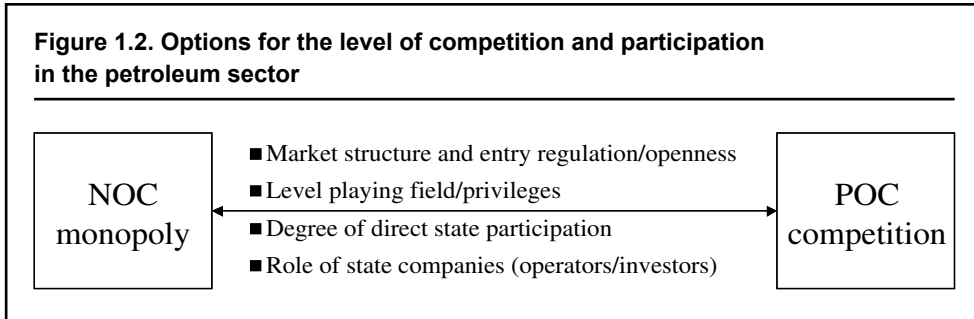
Appendix 1 contains an outline of the technical elements of value creation at each step of the value chain.

To create value along the chain the value of aggregate outputs must exceed the value of aggregate inputs on a sustainable basis. By “aggregate inputs” we mean all economic costs such as production cost, cost of funding, cost of resource depletion, and opportunity cost (Heal 2007). At the most general level, the potential sources of petroleum sector value creation are:

- (i) *Exogenous context and conditions.* Many variables are exogenous to the actors’ decision making, but can materially affect value creation. These factors include, amongst others:
 - the quality and quantity of the resource endowment (including geological properties), which determines the availability, technical complexity, and cost structure of upstream production;
 - the geographic position of the country, and of the resources within the country, and the availability of natural infrastructure (sea ports, rivers etc), which determines the ease of access to domestic and export markets;
 - the structure of the domestic economy, including its dependence on and interactions with the petroleum sector.
- (ii) *The companies participating in the sector.* These include NOCs and POCs.³ Key factors for value creation include:
 - cost efficiency of operations (including exploration, production, refining, and marketing), overhead spending, and investments;
 - technical excellence, which may support higher reserve replacement and field recovery rates, fewer fuel losses, and higher-value product yield (refining);
 - benefits of horizontal concentration (economies of scale) and vertical integration (transaction costs, economies of scope); and
 - strategic choices, such as asset selection, and targeting of domestic versus export markets.
- (iii) *The sector’s organization and institutional properties.* A company’s ability and willingness to perform well are affected by sector organization and governance, which to a large extent are the result of specific policy decisions, including:
 - the mechanism/regime for capital allocation decisions between different stages of the value chain and within individual stages. Possible choices include free and competitive markets, restricted and regulated entry, or a combination of both;
 - licensing policy, depletion policy, pricing policies, and subsidies;
 - the tax system, which the government can use to encourage desired behavior, and to capture a share of the value;⁴
 - the independence, responsibility, and competence of regulatory authorities;
 - legal and regulatory frameworks, including market and trade regulation; and
 - national petroleum and industrial policy, including local content and economic development policies.

1.2 Policy Decisions Affecting Value Creation

Policy decisions largely determine sector organization and governance, which in turn affect a company’s ability and willingness to perform well. A thorough discussion of each policy alternative is beyond the scope of this chapter. In this section, we limit ourselves to four important policy decisions—industry participation, licensing and petroleum contracts, taxation, and depletion policy—and discuss their relationship to value creation.



Source: Wolf (2009).

1.1.1 Industry Participation

Figure 1.2 illustrates the policy options with respect to the level of competition and participation in the petroleum sector. Each policy choice influences the participants' ability and willingness to create social value. At one end of the continuum is a pure monopoly held by a state-owned entity without any outside participation; at the other end is a perfectly competitive market without any entry regulation or direct state intervention; in between are many possible combinations.

In reality, no country has implemented either of the extreme options. Saudi Arabia and Mexico, for example, have a state monopoly on upstream equity ownership, but private oil service contractors face few restrictions, and Saudi Arabia now provides limited opportunities for equity participation in natural gas projects. At the other end of the spectrum, even the most market-oriented countries usually set pre-qualification criteria for participation in auctions, which in some cases may reduce competition and market contestability.

Countries often adopt different policies for the different stages of the value chain. Resource-holding nations are often categorized into those that are fully open, partially open, or closed to outside participation with respect to access to petroleum reserves. Besides the different degree of openness across countries, a country's policy on access to reserves may differ depending on whether oil or gas is considered. In general terms, countries are more likely to allow access to gas reserves in order to attract the technology and capital needed to develop them.

1.1.2 Licensing and Petroleum Contracts

The terms and conditions of petroleum agreements provide the basis for many technical and commercial decisions by petroleum firms (such as where to invest, how much to invest, and whether or not there are incentives for cost-efficiency).⁵ The state can also use its licensing system to shape industry structure. For example, it can decide on the frequency and area coverage of any licensing (whether by auction or negotiated deal), set up economic incentives for participation, or impose conditions such as mandatory involvement of the state.

In essentially all countries outside the United States, the subsoil is either state-owned (irrespective of the ownership of the surface land), or the state retains a veto on its use (Mommer 2002).⁶ Where the subsoil is state-owned, the government can either grant a monopoly right to one party or develop a licensing system to allow the participation of

multiple parties. Exploration rights are usually auctioned or awarded pursuant to solicited or unsolicited offers from interested companies. Bidding often takes the form of commitments to the host country, such as developing infrastructure, spending a minimum amount of money on exploration, training and capacity building, using local contractors, or drilling a minimum number of wells.

In recent years licensing (and taxation) regimes around the world have become increasingly varied, frequently reflecting historical or regional preferences (Tordo 2009). They should always be analyzed based on substantive content rather than formal design or type. Waelde (1995) points out that “the form of the contract is much less of the essence than the actual content, i.e. how the major functions and issues (management and control; risk assignment; revenue sharing) are being regulated.”

1.1.3 Taxation

Taxation is a critical consideration. The petroleum sector is among the most heavily taxed sectors, and taxation impacts on contractual relationships, asset selection, behavioral incentives, the dynamics of supply as well as demand, and most obviously on the financial position of the various parties involved. Ideally taxation should not alter allocative decision-making (and possibly even correct for market failures such as unduly low private costs of environmental pollution). This would support efficient behavior and maximize total welfare. If the fiscal regime is distortive (for example, it creates a disincentive to cost savings or encourages excess investment) net welfare losses will result.

In upstream oil and gas, total government take (the government share of available cash flow from a petroleum project) varies around the world from about 40 percent to well over 90 percent (Johnston 2007). In the years 2002 to 2008, with commodity prices rising significantly, many states have increased the government take from upstream oil and gas. The fiscal terms applicable in a given country can change in a number of different ways: (i) contractually; (ii) when new concessions are awarded on different terms than previously awarded ones; (iii) through competition as oil companies bid the terms or bid the signature bonuses they are willing to pay up front; or (iv) by law.

An important consideration when determining appropriate levels of government take is the potential trade-off between short-term state rent capture and longer-term value creation. Given the uncertainty of petroleum exploration and production, maximizing the net present value of rent capture might discourage longer-term investment, which in turn forms the basis for future rents (Tordo, 2007).

In downstream oil, most industrialized countries levy significant consumption taxes (value added taxes, or VAT) on top of the taxes on crude oil. Looking at a consumption-weighted average of the main refined product in the EU in 2003, only 28 percent of the final sales price was accounted for by the cost of crude oil, whereas 62 percent of the final price was due to taxes (including VAT) and the remaining 10 percent was refining cost and company profit (OPEC 2005).

1.1.4 Depletion Policy

Governments must decide whether or not to explore for petroleum, at what pace to explore, and who should undertake such exploration. If the reserve base is assumed to be known, then maximization of social welfare will be achieved by the appropriate pattern of production (that is, drawing down the inventory) over time (Tordo 2009). The pattern of using up existing reserves is measured by the production rate (annual

production as percentage of proven reserves), which is the basis of depletion policy. In principle, decisions of portfolio composition—whether to hold wealth as petroleum in the ground or as some other asset above ground—could be separated from expenditure decisions; in practice, however, the two issues are linked (Stiglitz 2007). Establishing an appropriate depletion policy involves the following factors:

- *“Good oilfield practice”*: Deviations from good oil-field practice may permanently damage the reservoir;
- *Politics*: Nation states may have entered international commitments on productive capacity and output that limit discretionary decision making;
- *State budget*: Public finances may dictate accelerated production schedules. Better knowledge of the size of petroleum reserves provides an input for the design of sustainable macroeconomic policies and for improving intergenerational equity through the choice of current consumption rates (Tordo 2009);
- *Public pressure on spending*: Increased public income may result in pressures to spend the money, irrespective of the availability of suitable reinvestment opportunities;
- *Domestic economy*: Suitable reinvestment opportunities for monetary income from petroleum operations might encourage accelerated production schedules. On the other hand, a lack of suitable re-investment opportunities, fears of hyper-inflation, adverse changes in foreign exchange rates (“Dutch disease”), or a lack of potential production linkages to the rest of the domestic economy may discourage aggressive depletion policies;
- *Institutional framework/national governance*: Lacking appropriate checks and balances, governments or interest groups might be tempted to direct funds from petroleum production to inappropriate or even illegal purposes. In such cases “the ground just might be the safest place for the asset” (Humphreys et al. 2007b);
- *Resource curse*: Related to both the domestic economy and the institutional framework is the apparent failure of many states to translate a wealth of natural resources into sustainable economic development (the resource curse);
- *Price expectations*: Changes in the prices of oil and gas affect the value of underground assets;
- *Cost expectations*: “[I]n cases where costs of extraction are currently high, and might be lowered over time with the progress of technology, the return to waiting may be higher than on any other investment the government might make.” (Stiglitz, 2007); and
- *Time value of money*: Petroleum in the ground does not earn an automatic interest or income (unless prices or costs change); dependent on the potential investment return on non-petroleum assets, and on the social discount rate, the time value of realized production gains might differ considerably. The earlier the extraction date, the higher the potential gains, *ceteris paribus*.

Depletion management can refer to individual petroleum reservoirs, to connected areas of production, or to the aggregate national level. It can be directly imposed by the government, guided using instruments such as the licensing system, or developed bottom-up through the (largely unregulated) choices of individual project operators (Tordo, 2009). There are wide differences in production rates between individual countries (Eller, Hartley, and Medlock 2007; Victor 2007; Wolf 2009).

1.3 Value Creation Through Integration

The benefits of integration have long been the topic of petroleum value chain analyses. What potential do horizontal and vertical integration have for incremental value generation?

Regarding *horizontal integration*, the benefits of economies of scale in most activities of the value chain are widely acknowledged. Petroleum projects are highly capital intensive, have long lead times, and are inherently risky (Stevens 2005). In E&P in particular, scale helps to provide access to better funding, to diversify investment and development risk, and to serve as long-term insurance to partners, such as host governments. Due to the high financial and operational risks involved, oil and gas companies usually partner with each other in E&P projects, while still competing at the corporate level. Technical expertise and project control are considered key in building a competitive advantage within the industry, and these can be enhanced by economies of scale in R&D investment and broad operating experience.

The ongoing consolidation trend within the private petroleum sector (increasingly also involving NOCs as acquirers of petroleum assets) is testament to the benefits (or at least the perceived benefits) of economies of scale. At the same time, large-scale divestitures are also very common over the period 2002–07, UBS Investment Research shows the value of disposals at the “Global Oil Co” companies to be 75 percent higher than the value of acquisitions. This shows that scale in itself is not always beneficial and that careful selection of assets is required to offset diseconomies of scale (such as management distraction). A focus on certain core areas with shared infrastructure, for example, is one plausible and frequently chosen approach. However, such a strategy may not deliver the best possible diversification of geological risks, which is another driver of sector consolidation, or satisfy the desire for global upstream scale.

At the country level, natural resource limits and issues of appropriate depletion strategy (discussed below in more detail) can prevent companies from building a broader domestic E&P footprint in the upstream petroleum sector. In other segments of the value chain, however, some countries—such as Singapore and the Netherlands in refining, storage, and oil trading—have attracted substantial investment beyond their domestic requirements. Both countries benefited from infrastructure advantages, including large natural ports along busy trading routes.

Vertical integration is another prominent feature of the petroleum industry, although the details of integration have changed over time. It can take two principal forms: (i) financial vertical integration occurs when one holding company owns subsequent stages of the value chain and controls their cash flows; and (ii) operational vertical integration occurs when there is a physical exchange of crude and products between subsequent stages of the value chain (Luciani and Salustri 1998; Bindemann 1999; Stevens 2005).

Before the wave of nationalizations in the 1970s, POCs were both financially and operationally integrated. Key motivations for integration were to secure sources of supply, secure off-take markets, create entry barriers, circumvent taxes, eliminate the profit margins of intermediaries, and practice price discrimination (Bindemann 1999). Integration also facilitated logistical operations, such as storage, and, before the oil price shocks, significantly reduced transaction and information costs (since markets were non-existent or highly inefficient at the time) (Stevens 2005). Following the nationalization of Middle East oil properties and the two oil price shocks, POCs retained integration by ownership but increasingly used intermediate markets, which had become more transparent, liquid, and reliable. Shell was the first company to free its refineries from the requirement of

purchasing oil from within the group. Internal transactions were increasingly conducted at arm's length, giving individual divisions more autonomy. Furthermore, almost all POCs established dedicated oil trading divisions (Cibin and Grant 1996). The increased sophistication and liquidity of oil markets enabled further disintegration, reduced barriers to entry, and allowed a new set of entrants (such as retailers, particularly supermarkets, and dedicated refiners) into the industry (Davies 1999). Today, financial vertical integration is a prerequisite for operational vertical integration, but the reverse is not true—intermediate markets can substitute for operational vertical integration.⁷

Given the prominence and longevity of the major integrated POCs, financial and operational integration are often assumed to be inherently advantageous. But benefits at the corporate level have proven difficult to pin down in empirical studies (Bindemann 1999).

Governments might pursue deliberate industrial policies that guide or encourage diversification along the value chain to: (i) diversify price or demand risks to the economy; (ii) capture a larger share of value-adding processes through taxes or direct participation in industrial activities; or (iii) respond to changing domestic and international demand. The economic literature suggests that vertical integration makes more sense in the case of asset specificity than in the case of commodity markets (Williamson 1985). For example, when owners or producers of very heavy or very sour crudes cannot be assured of sufficient refinery demand on the open market, then there is an incentive for vertical integration of E&P and R&M. Kuwait's strategy of overseas refinery acquisitions can (partially) be seen in this light (Marcel 2006, Stevens 2008). A second example is the presence of abundant and cheap resources that cannot be easily transported, like in the case of Qatar's natural gas. In this case, it is possible to move downstream industrial users to the source of gas, because the savings on feedstock costs more than compensate for higher transport costs (and potentially higher production costs) of the final product. This industrial relocation supports larger production volumes than would otherwise be possible and thus contributes to horizontal concentration at the country level. In Qatar's case, additional benefits include economic diversification and domestic skills development.

1.4 Local Content Policies and Value Creation

Local content policies affect both POCs and NOCs, although not necessarily to the same extent. They were first introduced in the North Sea in the early 1970s and ranged from restrictions on imports to the creation of NOCs. The aim of local content policies has evolved from creating backward linkages (that is, supplying input to the local economy through transfer of technology, the creation of local employment opportunities, and increasing local ownership and control) to creating forward linkages (that is, processing the sector's output prior to export through, for example, the establishment of refineries, petrochemical industry, and the production of fertilizers). More recently, local content has come to include wider economic diversification, thus going beyond the oil and gas sector value chain.⁸

Governments use various instruments to implement their local content policies, including: (i) simple contractual requirements that favor the use of local goods and services or impose training obligations; (ii) regulation and taxation that discriminate in favor of local industries, and other protectionist measures (iii) regulation or contractual obligations that foster the transfer of technology from international to domestic companies; (iv) bidding parameters that include local content among the criteria for winning oil and gas exploration and production licenses and contracts; (v) incentives to

foreign investors to reinvest their profits domestically; (vi) investment in infrastructure and education; (vii) the mandatory incorporation of foreign companies; (viii) local ownership requirements; and (ix) direct government intervention through state owned enterprises (SOEs).

It has been argued that local content policies create distortions, inefficiency, and, in some cases, even corruption. However, this cannot be generalized. Inefficiency introduced by local content policies is strongly influenced by the degree of “technological strangeness.” An economy that is very limited or primitive can hardly be expected to quickly be able to supply services (let alone to build forward linkages). Furthermore, the ability of the rest of the economy to develop a service sector often depends upon the speed at which the oil or gas resources are developed, which is determined by the government’s depletion policy. For example, Norway decided to develop its hydrocarbons more slowly than the United Kingdom, with the explicit objective of allowing a Norwegian service sector to develop. By contrast, the United Kingdom’s speedy development of its North Sea resources attracted American service companies and expertise (Hallwood 1990).

Economic histories of a number of developed and developing countries show that linkages between the primary resource sector and other sectors influenced economic growth. These linkages are defined by the technologies of resource extraction. In some cases, the development of the resource sector stimulates the rise of industries that supply its inputs and that process the staple products prior to export. Thus, an economy gradually becomes diversified. However, the diversification does not take place if the linkages are weak, such as when inputs are supplied from abroad. In this case, production concentrates in the resource sector that has little contact with the rest of the economy, and the country falls into a staple trap (Polterovich and Popov 2005). In transition economies, where a number of economic sectors from the former Soviet period have been destroyed, crowding out by the oil sector may hinder economic recovery. If this is the case, the use of local content policies to encourage economic diversification and the development of strong backward linkages may be appropriate. Local content policies are in essence a tradeoff between short-term efficiency and long-term economic development. While a comprehensive legal and fiscal framework may be required to execute the government’s local content policies, it is essential that this framework be transparent, reliable, and predictable.

Studies of many resource abundant countries show that the staple trap theory, while useful, has limited explanatory power since it does not take into account the role of macroeconomic and political economy variables (Findlay, Lundahl 2001, Abidin 2001, Gylfason 2001). In his study of resource-based industry in eight oil exporting countries, Auty (1989) identifies three critical determinants of performance: (i) the sectoral mix of projects; (ii) the type of enterprise; and (iii) the country’s macroeconomic policies.⁹ Auty argues that the risk of underperforming is minimized when optimum—sized, joint-venture projects feed dynamic markets. Hence, a risk-reducing resource-based industry should be small enough that it does not dominate the domestic economy, and large enough to capture the flexibility of several diversified projects of optimum size. This would also require the careful pacing of infrastructure investments and projects to avoid crowding. The author further found that joint ventures between the government and well-established multinational resource corporations spread investment risk and improve implementation by providing access to technical, managerial, and marketing skills. Finally, a risk-reducing strategy should aim to link the resource to the market. Full capacity utilization and access to market is required for these large investments to

be economically feasible. At the same time, macroeconomic policies that sustain domestic GDP growth and/or a competitive exchange rate are required for these local content policies to succeed (Auty 1989).

Local content often involves multiplier effects and it might be argued that the higher the multiplier, the greater the backward linkages. However, as discussed earlier in this section, not all linkages are good for the national economy. The procurement of goods and services can act as a multiplier for local economic development by contributing to employment, strengthening skills, and developing local suppliers and enterprises. Some countries have done research to assess the multiplier effect of investment in the petroleum sector. The Central Bureau of Statistics Norway calculates an average multiplier of 3 for Norway in 2003. In their economic analyses, the majority of oil companies used a factor of 2.5. But the size of the multiplier varies from country to country, and many countries have difficulties exceeding a multiplier of 1. 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 (Stevens 2008).

Developing local content in the petroleum sector should be based on existing capabilities within manufacturing, fabrication, and services. In other words, successful strategies identify which existing products and services the country can produce profitably. However, many countries have a weak and narrow industrial base. For this reason, local content policies commonly contain some measures that allow for the preferential treatment of domestic companies. To ensure sustainable industrial growth, however, such preferences should be temporary.

Market-based inputs cannot replace public inputs in all cases. There are functions that markets cannot perform, such as establishing company registries, setting norms, enforcing contracts and laws, and providing infrastructure. An inadequate supply of these public inputs affects the productivity of market-based activities. Determining the right level of government intervention is complicated: different activities require different kind of intervention, and there are no clear price signals to guide government choices. Nonetheless, the idea that governments can limit their intervention to the provision of an enabling environment for market-based activities to develop is a simplistic one, since it ignores the role and complexity of public inputs and capabilities. As stated in Hausmann and Rodrik (2006), “industrial policy is hard, but there is no argument against its use”.

Appendix 2 contains a brief illustration of local content policies in a selected group of petroleum producing countries. Although country-specific factors influence the optimal design of local content policies, we can identify general principles that can be applied broadly:

- *Set transparent and measurable targets.* What constitutes local content needs to be clearly defined, and targets should be established for each component of the desired local content policy. Targets should be objectively measurable and reasonable (i.e. within the reach and capability of the country) to avoid creating unrealistic expectations and companies—POCs and NOCs—should be held accountable for missing targets.
- *Account for technological strangeness.* Policy makers need to take into consideration the ability of the rest of the economy to develop service capacity through backward linkages and the speed at which such capacity can be created. The

creation of forward linkages is more complex, requiring scale and technology that are not always within the reach of a country. To maximize opportunities for development of local capacity and their sustainable utilization, the government should carefully assess existing local capacity and manage the pace and scheduling of petroleum sector's activities accordingly.

- *Gradually maximize local value-added.* The use of foreign capacity and investment, especially in less-developed economies, can accelerate the development of local content, reduce risk, and facilitate capacity transfers. Once the local supply and contractor industry is in place, policy could foster joint ventures between foreign and domestic companies. Local ownership requirements are valuable, but they should be carefully paced and should target activities that have the highest potential to add value.
- *Create and enhance local capabilities that can be transferred to other sectors.* This includes the development of skills that are common to all sectors, as well as the creation and support of cluster developments with other industries that have natural synergy with the petroleum sector.
- *Report on the local content performance of operators.* The performance of local—private or state-owned—and foreign companies should be periodically compared to establish benchmarks and targets and identify opportunities for transferring best practice, and reports should be publicly available.
- *Create an enabling environment.* Particularly in less developed economies where market opportunities are often beyond the capability and reach of local suppliers and contractors, a mix of incentives and mandatory requirements could be useful. However, the preferential treatment of domestic companies—private or state-owned—should be temporary so that domestic companies have incentives to be competitive and to develop sustainable industrial growth. It is important for the government to align its agencies, laws, regulations, strategy, and contracts with planned local content objectives. Finally, the government should focus on improving local skills, business know-how, technology, capital market development, wealth capture, and wealth distribution to create the conditions for domestic companies to emerge.

1.5 Conclusion

The petroleum value chain encompasses exploration and production of oil and gas, transportation and storage, refining and marketing of oil, processing and marketing of gas, as well as related activities such as oilfield services and equipment and petrochemicals. Together, these processes transform underlying petroleum resources into useable end-products valued by industrial and private customers. Exploration and production activities carry the highest level of risk, and usually generate most of the value. Along the value chain activities are inherently inter-linked, and such linkages might occur within or across individual firms, and within or across national boundaries.

Broadly, three potential sources of social value creation from petroleum operations can be identified: (i) exogenous context and conditions; (ii) the companies participating in the sector, including their operational and strategic set-up, priorities and capabilities; and (iii) the sector's organization and institutional properties. Among the policy choices that

determine the institutional environment industry participation, licensing and petroleum contracts, taxation, resource depletion, and local content can be expected to have a material impact on overall levels of value creation, and the share of value that can be created by the NOC.

Both POCs and NOCs have often used integration along the value chain to generate incremental value. While the benefits from economies of scale from horizontal integration in most activities of the value chain are widely acknowledged, vertical integration along the value chain at country level has been pursued with mixed success by some countries. Research carried out to date shows that full capacity utilization, access to market, and adequate technical, managerial and marketing skills are necessary for large vertically integrated projects to be economically feasible, which might explain why few NOCs have successfully pursued this strategy.

Our brief overview of the value chain show that the interactions between the sources of value creation are complex and dependent on the specific context (i.e. country and temporal conditions); “blueprint” solutions to successful value creation thus would be difficult to suggest. But experiences from around the world provide useful insights into the drivers of value creation and the conditions for success of different institutional arrangements and operating strategies.

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Notes

1. Porter distinguishes between the different stages of supply, the physical transformation from inputs to outputs, and the critical supply services of the firm such as strategic planning or technology development. Porter argues that the greatest value is frequently added by these latter services, and by the way in which the individual pieces of the chain are combined: "Although value activities are the building blocks of competitive advantage, the value chain is not a collection of independent activities. Value activities are related by linkages within the value chain" (Porter 1985: 48).
2. In this section the description of the petroleum value chain is very much based on conventional oil. Alternative sources petroleum such as oil sands or shale oil require different extraction processes.
3. The usual designation for the large private sector petroleum firms is "International Oil Companies" (IOCs), but there is widespread acknowledgement that this term is confusing because an increasing number of NOCs are also operating outside of their home country; and some oil and gas companies are neither state-owned nor international. "POC" is thus suggested as a more appropriate.
4. This also includes fiscal measures to direct production to domestic or export markets, e.g. custom tariffs and export duties, domestic price caps etc.
5. For a description of petroleum agreements see Johnston 1994, Johnston 2007, and Tordo 2007.
6. In the United States ownership of public lands, and the associated mineral rights, is divided between the federal and state governments. Approximately 30 percent of the land area and all offshore territory are owned by the federal or state governments.
7. Despite the recent liquidity crisis in the financial markets, petroleum markets have worked perfectly well over the past years and decades, but "low-probability high-impact" events could compromise market efficiency.
8. By oil and gas sector value chain we mean the exploration, extraction, processing, refining, transportation and distribution of hydrocarbons, and the development of industries which make direct use of the oil and gas sector's output
9. The countries analyzed in Auty's paper are Bahrain, Cameroon, Indonesia, Malaysia, Nigeria, Saudi Arabia, Trinidad and Tobago, and Venezuela.

The Establishment of a NOC

Advantages and Issues

"We never seem to get it right. Something always seems to be missing between government policy, implementation and public expectation (or public perception of what constitutes the common good). (. . .) As a result, we stagger from one confrontation to the next between policy makers, regulators, actors and customers."

(Edmund Daukoru)

Decisions regarding the creation and management of NOCs can be examined within the general context of government intervention in the economy. The extent of government intervention tends to change over time in response to exogenous (such as geopolitics and the economy) and endogenous (such as state objectives) factors.

This chapter discusses the key arguments—based on both a priori reasoning and empirical experience—in favor of and against the creation of NOCs. Its aim is to elaborate on the special nature of NOCs, and how it may affect their objectives, regulation, and behavior.

2.1 A Brief History of NOCs

The importance of the petroleum industry was widely recognized from the early 20th century, when internal combustion engines and the nascent automotive industry contributed to a prolonged boom in oil demand that more than compensated for the loss of the traditional kerosene lighting market after the invention of the light bulb.¹ The use of naturally occurring oil had been widespread in China and Central Asia for centuries, but up to the mid-19th century oil was by and large only collected when it occurred naturally at the surface. In 1859, the first successful modern oil well was drilled in Titusville, Pennsylvania.

2.1.1 Industry Participation

Initially the oil industry was largely shaped by privately-owned oil companies (POCs) and charismatic entrepreneurs. In the United States, the Standard Oil Company, founded by John D. Rockefeller in 1870 as a refining company in Cleveland, dominated the industry for several decades. By 1880 it had a domestic market share in refining of 95 percent. By that time, Standard Oil had also come to dominate the pipeline, shipping, and drilling business and in 1879 formed the Standard Oil Trust with 30 affiliated companies. Its economic and political power grew to such an extent that, after several years of trials and investigations, the Trust was found to monopolize and restrain trade. In 1911 it was dissolved into 36 independent companies, including the predecessor firms of Exxon, Mobil, Chevron, ARCO, and Amoco. The discovery of oil in Texas in 1901

led to the founding of oil companies such as the Texas Oil Company (later renamed Texaco) and the Gulf Oil Company, which opened the first filling station in the world in Pittsburgh in 1913.

Outside the United States, Russia and the Caspian (particularly the area around Baku, Azerbaijan) were important production areas for oil. Although oil exploration and production was initially a state monopoly, oil properties were auctioned in 1872, triggering a wave of investments in production, refining and transport infrastructure. Famous names associated with the Russian and Caspian oil industry include the Nobel and Rothschild families. By 1900, railroads had been built to transport oil to the West, and Russia briefly surpassed the United States as the world's largest producer. Elsewhere, private European companies took advantage of the protection of their home countries to produce oil in the colonies. Both Shell and Royal Dutch started business in the 1890s in Indonesia. By 1907, the two companies had merged, rapidly expanding into countries such as Venezuela (1910), Egypt (1911), Trinidad and Mexico (1913).

2.1.2 The Emergence of NOCs

The first NOC is believed to have been created in Austria-Hungary in 1908 when private oil producers faced an excess supply of crude. Emperor Franz Joseph approved the building of a topping plant owned and operated by the government, which helped process the crude and further developed end markets for oil products (Heller 1980). As oil became an increasingly important strategic commodity, governments took an interest in the oil industry. Other European states, particularly the colonial powers, started to set up or participate in oil companies to control the domestic markets and pursue upstream operations abroad, usually within their respective colonial domains. In 1914 the government of the United Kingdom invested £2.2 million to obtain a 51 percent ownership stake in Anglo-Persian Oil Company (later to become British Petroleum—BP). This was a “passive” stake without management control and only two appointees on the board of directors. Security of supply was a key motivation for this decision at the eve of World War I, as the latest generation of high-performance naval vessels and warships were oil-powered. As Winston Churchill—at the time the First Lord of the Admiralty—argued: “If we cannot get oil, we cannot get corn, we cannot get cotton and we cannot get a thousand and one commodities necessary for the preservation of the economic energies of Great Britain” (cited in Yergin 1991:160). To achieve security and diversity of oil supply the state could enter into long-term supply contracts as a temporary measure, but ultimately “the Admiralty should become the independent owner and producer of its own supplies of liquid fuel” (ibid).

The Compagnie Française des Pétroles (CFP) was created in 1924 as a private sector company with substantial shareholding and support by the French government. Its key asset was Deutsche Bank's 24 percent share in the Turkish Petroleum Company (later renamed the Iraq Petroleum Company), awarded to France as compensation for German war damages in World War I. The creation of Agip in Italy in 1926 was the first instance of a consuming country aiming to counter-balance the influence of outside petroleum firms (including fully private and state-backed companies) in its domestic downstream market.

At around the same time, Latin America, which had been largely independent since the eviction of the Spanish colonial force in 1821, and where important petroleum discoveries were made during the 1920s, particularly in Mexico and Venezuela, was leading the way in the establishment of NOCs in developing nations. The first to be founded was Argentina's Yacimientos Petrolíferos Fiscales (YPF) in 1922, and others countries soon

Table 2.1. Founding dates of selected NOCs

Year	Country	Company
1914	United Kingdom	BP
1922	Argentina	YPF
1924	France	CFP
1926	Italy	Agip
1938	Mexico	Pemex
1951	Iran	NIOC
1953	Brazil	Petrobras
1956	India	ONGC
1960	Kuwait	KNPC
1962	Saudi Arabia	Petromin
1965	Algeria	Sonatrach
1967	Iraq	INOC
1970	Libya	LNOC
1971	Indonesia	Pertamina
1971	Nigeria	NNOC
1972	Norway	Statoil
1974	Qatar	QGPC
1974	Malaysia	Petronas
1975	Venezuela, RB	PdVSA
1975	Vietnam	Petrovietnam
1975	Canada	Petro-Canada
1975	United Kingdom	BNOC
1976	Angola	Sonangol
2002	Equatorial Guinea	GEPetrol
2006	Chad	SHT

Source: Bentham and Smith 1987; Heller 1980; CEE 2007; company information.

Notes: Table 2.1 excludes communist and former communist countries, most prominently Russia, where the petroleum industry was nationalized in 1917/18, and China, where current NOCs were spun off from executive government in 1982 (CNOOC), 1983 (Sinopec), and 1988 (CNPC) and restructured in 1998. BP (1914) was a state participation of 51 percent in an existing company (Anglo-Persian). State ownership in CFP (1924) was 49 percent. Pertamina's two predecessor firms (PT Permina and Pertamina) had already been established during the 1950s. KPC was founded in 1980 as successor to KNPC; KPC's principal upstream subsidiary, Kuwait Oil Company, was founded in 1934 and fully nationalized in 1974.

followed suit, including Chile (1926), Uruguay (1931), Peru (1934), and Bolivia (1936). Mexico's state petroleum firm *Petróleos Mexicanos* (Pemex) was set up in 1938 to take over the operations of foreign private firms in the country. This was the first large-scale expropriation/nationalization within the petroleum sector. Table 2.1 shows the founding dates of a selected group of NOCs.

During the 1930s a number of significant oil discoveries were made in the Middle East—in Bahrain in 1932, and in Kuwait and Saudi Arabia in 1938. This marked the beginning of a geographic shift in global oil production. International oil companies formed private consortia that controlled virtually all petroleum production in the Middle East, including in Saudi Arabia, where five U.S. companies set up the *Aramco Oil Company*. As a result of rapid economic growth following the end of World War II, the United States became a net importer of crude oil in 1948. At that point, the United States was already the most mature, explored, and drilled country in the world. Its well productivity and marginal costs were far less favorable than in the Middle East, which had highly productive and profitable reservoirs that had become the key assets for Western POCs.² From 1948 to 1972, seven out of every ten barrels of oil added to the world's free reserves were found in the Middle East. This strengthened the bargaining position of the host countries relative to their POC 'tenants', who were perceived by them as "far too profitable, isolated and immobile" (Mommer 2002:100).

2.1.3 OPEC Revolution and Post-Colonial World

The world's major oil exporting countries met in Cairo in 1959, resulting in a "gentleman's agreement" to consult with one another on issues of common interest. One part of the agreement recommended the creation of NOCs to ensure direct state participation within the oil industry. However, in the Middle East this recommendation was not acted upon until a few years later.³ At the time, standard concession contracts included a royalty payment to the resource owner—that is, the host nation—plus an income tax of 50 percent, called "fifty-fifty profit sharing."

The second had only been introduced in 1943 in Venezuela and in 1950 in Saudi Arabia as a result of the shifting power balance towards the producers, but the profit calculation was usually based on posted prices rather than market prices. After the POCs unilaterally cut posted prices twice in 1959 and once again in August 1960, the major resource-holding countries sought ways to better represent their common interests. In September 1960 the Organization of the Petroleum Exporting Countries (OPEC) was established. The five founding member states of Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela were subsequently joined by Qatar (1961), Indonesia and Libya (1962), the United Arab Emirates (1967), Nigeria (1971), Ecuador (1973, left in 1992, rejoined in 2007), Gabon (1975, left in 1995), and Angola (2007). Having become a net importer of oil, Indonesia left OPEC in May 2008.

OPEC initially achieved little tangible results for its member states, mainly due to the fact that POCs insisted on negotiating separately with host governments, which differed in their opinions on acceptable contract terms, degree of oil revenue dependence, and spare production capacities. However, the global economic growth of the 1960s and the impending peak of U.S. domestic oil production substantially strengthened the producer states' bargaining position.⁴ In 1965 three Saudi contracts were the first (outside Venezuela) to be governed by national law and national tax legislation instead of international law and contractual arrangements. In 1968 OPEC issued a "Declaratory Statement of Petroleum Policy in Member Countries" that summarized key recommendations regarding area relinquishment, tax reference points, equity participation, and host country sovereignty. The policy encouraged OPEC members to develop their hydrocarbon resources directly, but if entering into contracts with outside parties, such contracts should at least contain the right to future revisions. At the time OPEC accounted for almost three-quarters of global proven reserves. By the end of the 1960s competition for new concessions had pushed POCs, specifically those in OPEC countries, to offer equity participation of up to 50 percent to host governments or to their NOC in addition to the royalty payment and 50 percent income tax. The new terms ensured that the host governments would receive in excess of 75 percent of the profits of POCs plus significant influence on all entrepreneurial decisions made by their tenants.⁵

Even these concessions were not satisfactory to the oil-producing states, and during the first half of the 1970s a wave of forced equity participations and outright nationalizations occurred. The Fourth Arab-Israeli (Yom Kippur) War in October 1973 and the selective oil embargo of key Arab nations against Western nations, which triggered the first oil price shock, further damaged mutual relations. By 1974 the international oil operations in the Middle East had been de facto nationalized, although the legal arrangements would take time and differ from one country to the other.⁶ The Iranian revolution in 1979 and the Iran-Iraq war from 1980 caused the second oil price shock.

The development of the oil industry in OPEC states was part of a wider, global trend towards national emancipation in a post-colonial world. OPEC, after all, included member states from very different regions of the world (Latin America, Middle East, Africa, and Asia), and the desire for national control over what were previously colonial assets was prevalent in many more countries.⁷

Overall, the emergence of state-controlled companies had a significant impact on the ownership structure of the oil and gas industry. Heller (1980) reports that outside the United States, Canada, and the centrally planned economies, from 1963 to 1975 public sector control in the oil industry rose from 9 percent to 62 percent in production, from 14 percent to 24 percent in refining, and from 11 percent to 21 percent in marketing.

2.1.4 The Reaction of Consumer States

In the oil consuming countries of the Western world, the rise in prices had led to a significant slowdown in demand growth for oil. Furthermore, growth of the world economy slowed. According to estimates, the price increases due to the first oil price shock (1973/74) cost OECD members 2.6 percent of GDP, and those due to the second oil price shock (1978/80) cost them 3.7 percent of GDP (Mommer 2002). One of the key steps to mitigate OPEC's grip on the market was the founding of the International Energy Agency (IEA) in 1974, which was designed to coordinate the policies and energy strategies of the main industrialized, oil-importing nations. The first rules issued by the IEA concerned emergency situations, and mandatory levels of petroleum stocks were introduced. In 1976, the IEA proposed a long-term program that included a reduction in the demand growth for oil, incentives to use alternative energy sources, and an increase in domestic supplies. A liberal licensing system was introduced in many new petroleum provinces outside of OPEC influence (such as the North Sea, Alaska, and the Gulf of Mexico).

In addition to coordinated actions such as the IEA, a second important development was the creation of a new type of NOC in petroleum-producing Western states such as the United Kingdom and Canada. These were intended to ensure control over domestic hydrocarbon development in reaction to the loss of operating control overseas. At the time, the government of the United Kingdom already owned a majority stake in BP. Because BP had an international asset and shareholder base and was largely run like a private-sector company, however, it was not a suitable tool to implement national petroleum policy. Therefore, in 1975 the Labour government set up the British National Oil Company (BNOC), which was originally intended to take a 51 percent stake in all North Sea oil developments. However, due to fears that a 51 percent mandatory participation of the state could significantly weaken the incentives for private sector participation and the anticipation of a large financial burden on the state from meeting half of all North Sea development costs, the scope of rights and objectives of BNOC were reduced (Vickers and Yarrow 1988). By the end of the 1970s, the United States was the only significant producer among the net importing countries without a NOC (Linde 2000).

2.1.5 A New Agenda: Liberalization and Privatization

In the wider economic and social debate, there was an increasingly critical stance towards governments since the late 1970s (at least in the Western world). Many SOEs performed poorly and research in economic theory began to examine more closely the possibility of government failure.⁸ As a result, governments had to acknowledge their failure as efficient producers and their weakness in monitoring the performance of their SOEs (Shleifer 1998; Shleifer and Vishny 1998; Yergin and Stanislaw 2002; Stevens 2004).

In the oil and gas sector, the industrialized and net importing countries took the first steps towards liberalization and privatization. In fact, in refining and marketing most OECD countries already had a policy of liberal market access, which the major POCs used to build extensive downstream portfolios. In 1977 the UK government went further and reduced state ownership in BP from 68 to 51 percent. In 1979, the Thatcher government stripped BNOC of many of its special powers only four years after its establishment, and in 1982 its oil producing assets were spun off and privatized. Like BNOC, many of the consuming countries' NOCs founded in the 1970s proved to be short-lived as the security of supply increasingly became an international concern (Linde 2000). Many of the larger and older NOCs in the consuming countries, such as Repsol, OMV, Eni, Total, and Elf Aquitaine were not privatized until the late 1980s and early 1990s, but

these transactions can be seen as a continuation of policies first implemented in the late 1970s, even though the 1986 oil price drop added to budgetary pressures.

Net oil-exporting states took longer to be convinced of the benefits of liberalization and privatization. After all, oil producing assets in the Middle East had only recently been nationalized, and in Latin America and Africa the end of foreign domination was historically associated with state control over vital resources through the establishment of NOCs (Waelde 1995). But low oil prices in the second half of the 1980s triggered pressures for institutional reform in several countries with dominant NOCs.

In a bid to reduce price volatility, OPEC had introduced its quota system in 1982 and successfully managed to keep prices stable through 1985. In that year, however, the introduction of the so-called “netback pricing” by Saudi Arabia caused a sharp drop in oil prices and marked the shift from a seller’s market to a buyer’s market, a change that would persist up until the turn of the millennium. Non-OPEC producers with less favorable resource endowments and production costs were most vulnerable to the changes in the macroeconomic environment and faced pressure from international creditors—including the World Bank and the International Monetary Fund—to implement stabilization programs. Argentina is often cited as the first major privatization in an oil-exporting country. In 1989, the government declared 32 state-owned companies eligible for privatization, including Yacimientos Petrolíferos Fiscales (YPF), at that time the nation’s largest company. In the same year, the oil sector was liberalized, and monopoly right and price controls were abolished, opening up the industry to private participation. In 1993, 60 percent of YPF was privatized in two separate transactions (Grosse and Yanes 1998). The transformation of YPF into a commercial entity was generally considered a great success and inspired other Latin American countries to liberalize (Venezuela, Bolivia, Ecuador) or even privatize (Brazil) their respective oil sectors and NOCs.

2.1.6 The End of History?

After the collapse of the USSR and other centrally-planned economies, many resource-rich areas that had been closed off to Western POCs, particularly in the Caspian, were now available for investment. As Linde stated, “The liberalization of the oil industry in the former Soviet Union has changed the competitive position of all oil-producing countries” (Linde 2000:8). The liberal agenda of lightly regulated hydrocarbon access advocated by POCs had prevailed over the restrictive policies of the producer NOCs. The NOCs that were set up in the newly created states usually did not have a dominant or monopolist position, but rather took a junior role in POC-led joint ventures (for example, SOCAR in Azerbaijan and Kazakh Oil in Kazakhstan).

The notion that capitalism had not only won over communism, but also over state-interventionism in a wider sense was prevalent at the time and swept through many industries, including oil.⁹ Klein (1999), at the time Chief Economist of Royal Dutch/Shell, expected all NOCs to be privatized by 2040. The first Gulf War in 1990/91 finally convinced many governments that security of supply was no longer an urgent issue on the political agenda. A major military conflict in the Gulf had always been considered a worst-case scenario, but this one had been managed with little disruption to the oil supply and the wider economy. Apparently the IEA strategic oil stocks and the free market and price mechanisms had worked as intended.

Throughout the 1990s, the market saw strong growth in non-OPEC production, particularly from the former Soviet Union. OPEC agreements on output restrictions were usually short-lived, and many countries did not comply with them. In December 1997,

OPEC increased its members' quotas: a number of members wanted to boost their short-term revenues, but Saudi Arabia (which since 1986 had supported a policy of low and stable oil prices to encourage energy users to return to oil) wanted crude prices to fall below \$20 per barrel to discourage further investment in the Caspian and Central Asia. The expansion in supply coincided with the Asian financial crisis and Russia's insolvency, and oil prices subsequently crashed in 1998, with crude oil trading as low as \$10 per barrel.

Prices recovered in April 1999, but by that time most NOCs had already reduced their new investment dramatically or were refused additional funds from their respective governments. POCs began to test new investments for positive net present values at assumed oil prices of \$10–12 per barrel, shelving many projects and setting the scene for a coming shortage of supply a few years later. In 1999/2000, OPEC initiated a period of output restrictions, which benefited from the support of two major non-OPEC producers (Norway and Mexico) and thus proved to be much more successful than earlier attempts to stabilize price. In 2000, the annual average Brent crude price was \$28.5 per barrel, up from \$12.2 per barrel in 1998.

2.1.7 *Developments since 2000*

Since the turn of the millennium, two somewhat opposing trends can be observed with respect to the status and importance of NOCs. On the one hand, the economic and political agenda of market liberalization and privatization have continued to influence decision making around the globe. Since the turn of the millennium several important countries—including China, Brazil, India, Pakistan, Norway, and Japan—have partially privatized their NOCs, and others are considering doing so.¹⁰ Although many key producers ruled out privatization, there were important regulatory reforms in some of these countries (such as Indonesia and Algeria), and initial steps towards allowing foreign participation in others (such as the Saudi Gas Initiative or ongoing political debates in Kuwait and Mexico).

On the other hand, high petroleum prices (particularly between 2003 and 2008)—largely caused by the lack of supply-side investment in the late 1990s, strong Asian demand growth, and heightened geopolitical concerns—have shifted bargaining power firmly in favor of the exporting states. Many immediate budgetary pressures for sector reform have been relieved in exporting countries, and increased interest from investors due to the perceived scarcity of hydrocarbon resources has raised their political profile. The desire to increase the government share of available petroleum rents led to widespread increases in taxation, and in some cases, to the nationalization or quasi-nationalization of petroleum operations (for example, in *República Bolivariana de Venezuela*, Bolivia, and Russia), or the creation of NOCs in emerging oil provinces (such as Chad and Uganda). Furthermore, some net consuming states in the developing world, such as China and India, have supported their NOCs in pursuing acquisitions of overseas petroleum sources, and Russian Gazprom's export dealings appear to be shifting from a purely commercial to an increasingly political arena (Victor 2008). Overall, the political aspect of energy decision making has been reinforced in both exporting and importing countries.

As of today, the volatility in oil prices, the global recession, and the uncertain economic outlook make it difficult to accurately define the outlook for energy demand, petroleum supply additions, international trade policy, or even the geopolitical landscape, all of which are critical to the future economic and political role of NOCs. Several

factors—including the significantly reduced availability of debt financing, and the ongoing volatility in the equity markets—may limit the ability of some NOCs to invest in new upstream capacities as originally planned.

2.2 Arguments in Favor of NOCs

NOCs come in many different forms. They can be monopolies or participate in competitive markets. They can be asset operators or financial holding companies. Their business profile along the petroleum sector value chain and their degree of commercial orientation and internationalization can also vary. As a result, any argument about NOCs inevitably risks being overly generic or simplified. Therefore, to control for the variation among NOCs, most of the arguments put forward in this chapter assume NOCs to have a significant or even dominant role in their domestic petroleum sector. In fact, although “[p]ublic ownership does not imply state monopoly and private ownership does not entail competition” (Vickers and Yarrow 1988:45), both concepts are nevertheless frequently intertwined in practice (Beesley and Littlechild 1983).

A review of the literature offers numerous reasons as to why governments choose to set up NOCs rather than opting for more liberal governance regimes. These have been divided into six categories, namely (i) the historical context of NOC creation; (ii) the importance of the industry; (iii) political benefits of state control; (iv) general sector efficiency levels; (v) rent capture by the state; and (vi) wider socioeconomic issues and priorities.

2.2.1 *Historical Context*

In many countries the establishment of NOCs largely coincided with a wave of asset nationalizations. POCs were perceived to be backed by foreign, imperialistic governments and therefore opposed to national interests (Grayson 1981; Hartshorn 1993). If national sovereignty over natural resources was to be restored, it seemed logical for the government to create a domestic company to replace the former operators (Olorufemi 1991; Stevens 2004) and act as a national symbol of independence. This sense of a national mission, combined with the inherent weakness of the private sector in most developing countries, largely ruled out the option of domestic but privately-owned operators in the oil and gas sector (Linde 2000).¹¹ To some extent the setting up of NOCs could also be explained by an element of mimicry across countries: creating symbols of independence became quite fashionable in the post-colonial world (Jaidah 1980; Stevens 2004).

The proliferation of NOCs after World War II and through the late 1970s was embedded in a wider political view that the state could and should tackle social and economic issues and supported a strong belief in the benevolence of such state action (Yergin and Stanislaw 2002). In later years the mainstream view of the state in economics changed considerably: public ownership was seen to be less efficient, and market failures could instead be addressed using regulation (Shleifer and Vishny 1998).

2.2.2 *The Importance of the Petroleum Sector*

In countries where either production or consumption in the oil and gas sector constitutes a significant share of the domestic economy, there are inevitably strong incentives for comprehensive state involvement or even direct state control to secure political and financial advantages. Petroleum is frequently portrayed as one of the “commanding heights” in the international context, a “strategic” industry that can be used and abused

as an economic or political weapon.¹² Hence, it is “too important to be left to the market” (Robinson 1993:57).¹³

2.2.3 Political Gains from State Control

The political importance of the petroleum sector has been evident throughout its history. Consequently, the political incentives for direct state control are generally very strong. Whether or not state control leads to better decision making and value creation is a different question.

Internationally, petroleum wealth can be used to secure financial, political, or military support, and direct state control over the oil and gas sector enhances the government’s standing and bargaining position. Domestically, state participation in the sector via NOCs provides the government with better control of the petroleum sector along the value chain, including technical and commercial decision making; resource development and depletion policy; product prices and subsidies; employment decisions; and scope of activities.¹⁴ In downstream operations, direct control over the pricing of oil products affects the daily lives of consumers and voters and is therefore a sensitive subject (McPherson 2003). Furthermore, some oil importing countries use their NOCs to address (or at least mitigate) concerns about the security of supply and to balance the power of exporting countries and their NOCs, as well as prominent POCs.

2.2.4 Efficiency and Monitoring of Operations

Proponents say that the presence of a strong NOC benefits overall efficiency levels in the industry and thus improves value creation. The most commonly cited argument in this context is the role of NOCs in reducing informational asymmetries vis-à-vis private operators, which leads to better sector regulation and less opportunities for rent seeking and rent skimming. When a government deals directly with private investors in the petroleum sector, there are significant information asymmetries between the parties: the private operator usually has much better knowledge of the geology (after initial exploration has been conducted), appropriate production schedules, technology and associated costs, and the environmental impact of the project. In order to effectively perform its industry oversight, the government would require a comparable level of expertise and information, which is highly unlikely if the state has no direct operational involvement in the industry (Nore 1980; Stevens 2004). NOCs enabled governments to gain first-hand information on the operational and financial conditions facing all companies and to establish a benchmark against which they could judge the performance of the POCs.¹⁵ In other words, NOCs provided the state with a “window to the oil industry” (Grayson 1981).

2.2.5 Petroleum Rent Maximization

The state’s rent capture from petroleum operations is in principle determined by two main variables: the total amount of rent created in the petroleum industry, and the relative share captured by the state and its agent (NOC). In setting appropriate fiscal systems (the main mechanism for rent extraction), the state must consider the balance between short-term monetary gain and longer-term implications for attracting incremental investment, which in turn determines the future tax base.¹⁶ However, governments often want to secure the highest possible share of the economic rent (or value-added, in the case of downstream operations) and are hesitant to allow private companies to obtain significant returns on investment. Fiscal and contractual frameworks, if well-designed

and implemented, can promote sector development and value creation while efficiently capturing some of that value for the state (Tordo 2007). But an effective fiscal system requires that a country has the administrative capacity and expertise to regulate and oversee private petroleum operators. The absence of such regulatory competencies can be particularly pronounced in developing nations. Therefore, some countries have opted to create a dominant NOC to avoid the need for effective regulation or to allow the bureaucracy time to develop sector familiarity and in-house expertise.

2.2.6 Socioeconomic Issues and Priorities

NOCs can be used to serve socioeconomic goals, such as employment generation for locals, development of commercial and technical capacity, provision of social (such as schools and hospitals) and other infrastructure (such as roads, bridges, and water supply), income redistribution through subsidized prices, and facilitate state borrowing (Nore 1980; Gayson 1981; Horn 1995; McPherson 2003). In countries where welfare systems are underdeveloped or non-existent, employment in NOCs can be a primary social safety net, and oil subsidies can be primary redistribution measures.¹⁷ In many ways NOCs have thus been “tied to the national purpose” (Khan 1987), and the existence of non-commercial objectives and obligations is often cited as a defining characteristic of NOCs compared to their privately-owned peers.

Noncommercial objectives vary widely among NOCs. Some are explicitly mandated by the government, while others are embedded within the corporate culture of the NOC.¹⁸ For some noncommercial objectives, the NOCs are simply convenient sources of funding for government-run programs. Others are actually implemented by the NOCs themselves. Some involve straightforward redistribution of wealth, whereas others aim to develop economic linkages around the oil and gas sector to advance longer-term capacity building and economic diversification. It is worth noting that recent research seems to indicate that NOCs have increasingly been focusing on their core business, and many noncommercial activities today are sponsored indirectly via funds transferred to the state treasuries (Marcel 2006b; WB-CEE 2008).

2.3 Practical Difficulties and Setbacks with NOCs

Despite the host of apparently good reasons to set up a NOC, the performance and commercial efficiency of these state enterprises has in most cases not lived up to expectations and quite often has been disappointing. This issue is related (but not equivalent) to resource curse—that is, the apparent failure of many states to translate a wealth of natural resources into sustainable economic development. Resource curse can affect any resource-holding nation, but some would argue that nations with heavy direct state involvement and limited access to outside competitors are more prone to the phenomenon.¹⁹

2.3.1 Historical Context and Ideology

The historical context of NOC establishment (as outlined earlier in this chapter) makes decision making susceptible to ideology, which can interfere with the maximization of economic efficiency and the generation of social welfare. The memories of foreign domination through international consortia and of the sometimes arduous nationalization process continue to influence perceptions and decision making, particularly in the Middle East. POCs have traditionally sought title to reserves and production, emphasizing the need for property rights; NOCs, on the other hand, have tried to avoid

granting equity rights.²⁰ POCs have also frequently been accused of producing reserves too quickly, focusing on short-term profits and disregarding the longer-term wealth of the host nation; of using deliberately low future price scenarios that underestimate the profitability of any joint projects; and of generally being arrogant (Marcel 2006b). Such strongly held opinions on both sides make cooperation and rational decision making more difficult.

However, in many cases—with the exception of openly nationalist initiatives—the cultural and operational gap between NOCs and POCs seems to have narrowed. Chinese state companies PetroChina and Sinopec have joint ventures with Western POCs to build retail networks and petrochemicals plants in China and run upstream operations around the world. Middle East NOCs such as Saudi Aramco and Kuwait Petroleum Corporation (KPC) have acquired equity interests in private overseas refining and marketing assets (such as Showa Shell in Japan). Even the large-scale takeover of private firms and assets through NOCs, which was considered impossible for cultural and political reasons for a long time, has become a regular feature of the industry.²¹

2.3.2 Economic Cost of Political Control

The importance of the petroleum industry is often cited as an argument in favor of direct state intervention. But this is a political rather than an economic argument, and any political benefits from state control often come at substantial economic costs.

At least in theory, ownership structure does not matter from an economic perspective if complete contracts can be written (Williamson 1985; Grossman and Hart 1986). But as with all SOEs, the ultimate owners²² of the NOCs face a “principal-agent problem”: between the citizens and their government on the one side, and between government and NOC management on the other.²³ This makes the writing of complete management contracts particularly difficult, and might thus be responsible for inefficient behavior (Shleifer 1998).²⁴

Developing countries in the past have also frequently been unable to establish efficient regulatory, contractual, and fiscal frameworks. But as the general understanding and appreciation of these contractual issues has improved in recent years (Johnston 1994; Tordo 2007), from an economic point of view there seems to be no a priori reason to opt for a NOC instead of a competitive market with a well-designed fiscal system.

More generally, the notion of creating value by “cutting out the middle-man” (in this case the private sector) may be misleading: NOCs don’t operate for free either, and any public sector investment in the petroleum sector has a cost of capital associated with it (which in an efficient market is similar to the private operator’s return) as well as an additional opportunity cost due to the fact that public funds tend to have a higher shadow welfare multiplier (Jones et al. 1990; Newbery and Pollit 1997).

2.3.3 Operational Inefficiencies

If NOCs had equal or greater operational efficiency than POCs’, then this would alone constitute a strong argument for their existence. However, NOCs are frequently accused of sub-standard operational efficiency due to inadequate technical and managerial capabilities and misguided human resources policies (Jaidah 1980; Al-Mazeedi 1992; Gochenour 1992; also see many NOC case studies by Rice and Stanford Universities).²⁵

After the POCs lost their prime assets in the wave of nationalizations that took place in the 1970s, years of high oil prices provided an opportunity for POCs to restructure and improve efficiency levels. They invested a large part of their windfall profits from

this benign pricing environment into research and development of new technologies, enabling huge cost savings and productivity gains. The price at which POCs could profitably find, develop, and produce non-OPEC oil—particularly oil from frontier fields—fell significantly from \$25 per barrel in the 1980s to \$10 in 1999, both in 1999 prices (Linde 2000). NOCs, on the other hand, tended to manage and maintain the asset base that was handed to them, and most failed to invest in upgrading facilities or new technologies. It was during this time that many of the NOCs fell behind in technical competency and lost the ability to take on more advanced projects on their own (Stevens 2004). In terms of human resources, NOCs were often overstaffed, paid above-average wages compared to other government entities and state-owned enterprises (Waelde 1995), and were accused of recruiting according to family, tribal, or religious considerations rather than based on qualification and performance (Al-Mazeedi 1992).

2.3.4 Lack of Competition

The important role of competition for the performance of a company is well-documented in both theoretical and empirical work (Boardman and Vining 1989; Galal and others 1994; Nickell 1996). Competition allows improved monitoring through a comparison of managerial performance, encourages innovation of new products and processes, and disciplines companies to fight for market share and against the threat of bankruptcy (Hayek 1948; Beesley and Littlechild 1983; Vickers and Yarrow 1988; Pollit 1995). Lack of competition has been found to be the greatest barrier to economic growth in developing countries (Palmade 2005). Nevertheless, often governments granted monopoly rights—or at least a highly protected business environment—to their NOC. Even where there were potential competitors, especially in the downstream market, NOCs were often able to create significant barriers to entry by manipulating the regulatory environment to their advantage (Stevens 2004). Furthermore, powerful interest groups within public enterprises—including management, employees, and unions—have an incentive to oppose the introduction of competitive forces. By comparison, groups with an interest in competitive pressure—such as potential market entrants and the wider consuming public—often have not been as effective in arguing their case (Vickers and Yarrow 1991). The justification for privileges has often been to offset noncommercial obligations imposed on NOCs, or to promote local content policies.

2.3.5 Subsidies and Noncommercial Objectives

In many importing and exporting countries, NOCs bear the burden of petroleum product subsidies. In net importing countries, subsidies may be one of the NOC's principal noncommercial obligations. These NOCs are particularly hard-hit in times of high commodity prices (Coady et al. 2006; ESMAP 2006; Mati 2008). In a recent study, the 2007 energy subsidies of the 20 largest non-OECD countries (net importers and exporters) are estimated at \$310 billion. Subsidies are often an unsustainable economic burden and exacerbate negative environmental effects (IEA 2008).

Especially in countries with low public investment management capacity and weak social safety nets, the NOC may be tasked to implement investment programs that go beyond normal corporate social responsibility programs. Similar to fuel subsidies, social expenditure programs of NOCs have been criticized as ineffective, inefficient, or as sources for patronage (Hodges 2003; Heller 2009).²⁶

As discussed earlier, many governments assumed that NOCs would be able to successfully deliver on both commercial and noncommercial objectives. This perception

was partly based on the size of the NOCs (often the largest local enterprise) and the significant rents, particularly in the upstream. But many have argued that the pursuit of many, often conflicting objectives imposes costs on NOCs and reduce their incentive to maximize profits.

Noncommercial objectives may well affect the commercial performance and profitability of NOCs. At the same time, they do not necessarily decrease efficiency. Not-for-profit activities can be delivered efficiently, and efficiency should always be measured relative to corporate objectives. But according to most empirical studies, NOCs typically are not very efficient in delivering on noncommercial objectives, and other public sector bodies would be better placed to perform such duties. Where “money is spent haphazardly, without strategic guidance, or without concern for measuring the success of the expenditure” (Marcel 2006b), there will be inefficiencies in the delivery of both commercial and noncommercial objectives.

2.3.6 *Weak Corporate Governance*

According to some researchers NOC’s corporate governance standards score poorly compared to other SOEs or POCs. This may be a consequence of both the NOC managers and the politicians in government not having strong incentives to enforce governance standards. NOC managers may strive to maximize their scope of discretionary decision making, while the government may have political reasons to obscure the exact uses of cash (Stevens 2004). The board of directors (BODs) of NOCs are considered to have less decision making power than their counterparts in other SOEs since their members are frequently government officials or are appointed on political grounds. Some NOCs do not even have a BOD.²⁷ Like with other SOEs, weak governance arrangements of NOCs can lead not only to inefficiency, but also to corruption and cronyism.²⁸

While it is generally agreed that the transparency of NOCs is an important issue, one should distinguish between transparency towards its owners (the state, or more precisely, its citizens) and transparency to outside parties. Some countries have chosen to limit disclosure to the outside world, while providing comprehensive internal NOC disclosure to the relevant authorities (Jaffe and Ellass 2007). From a corporate governance perspective, adequate oversight and control exercised by the owners seems to be of primary importance in reducing information asymmetries and the potential for managerial rent-seeking.

2.3.7 *Funding Strategy and Requirements*

The level of budgetary and financial autonomy of a NOC can have important consequences for its efficiency and market strategy. Financing arrangements can be broadly categorized as follows:

- *Low level of budgetary and financial autonomy:* the NOC transfers all revenue or margin from operations to the state and must present requests for financing in order to fund its investment programs;²⁹
- *Some budgetary and financial autonomy:* the NOC has the right to reinvest part of its profits. Investment and borrowing decisions beyond a certain amount must be authorized by the government body that exercises the ownership rights of the state or other authority representing the state;
- *High level of budgetary and financial autonomy:* the NOC has the right to reinvest all or part of its profits. Investment and borrowing decisions are authorized by its BOD.

In general terms, the lack of autonomy tends to negatively impact the timeliness and effectiveness of investment decisions, and may increase the cost of doing business and political interference in the management and operations of the NOC. On the other hand, too much autonomy may reduce the fiscal revenue of the state, and could diminish incentives for cost reduction and efficiency improvements.³⁰ Similar financing and budget autonomy may produce different results.³¹

In some cases, NOCs do not have sufficient cash flow to provide upfront financing of large and infrastructure-heavy developments.³² More generally, the oil and gas industry is highly capital intensive and the budgetary demands can be daunting for developing nations, especially relative to other government programs such as health, education, and transport.³³ Petroleum sector investment can therefore crowd out social programs to the detriment of national welfare.

2.3.8 Conflict of Interests and Balance of Control

Conflict of interest may affect the efficiency and mandate of NOCs. In many countries, the NOC devises and implements sector policy, and even in countries where a ministry is formally in charge, the NOC often contributes substantially to decision making due to its superior resources and industrial expertise. For example, Marcel (2006b) describes the boundaries between the National Iran Oil Company (NIOC) and the ministry as “famously blurred”. The NOC has frequently been the writer and enforcer of the rules and game participant all at the same time, raising the likelihood that decisions are not in the best interest of the public. NNPC, Pertamina, and Algeria’s Sonatrach once were examples of this “all-in-one” institutional set-up, although all of them have been subject to reform. The most common reform trend has been to transfer some licensing and regulatory powers from the NOC to newly formed executive (or independent) bodies, and to eventually aim for an institutional setup that separates policy making (which is the responsibility of the government) from corporate strategy (NOC) and sector regulation (independent regulatory body) (McPherson 2003; Marcel 2006b). This institutional arrangement is commonly known as the “trinity” or “Norwegian” model.

The promise of overcoming conflicts of interest through independent regulatory bodies is conceptually appealing. Implementing such an arrangement properly requires frameworks that may not exist in some countries, such as strong governance principles, regulatory freedom from political intervention, and strong training and human resources policies to competently staff two sets of institutions. Consequently there are still several prominent NOCs with comprehensive powers over the petroleum sector, including Petronas and Sonangol. According to the protocol of a series of producer countries’ roundtables at Chatham House London (Lahn et al. 2007) there is a consensus today that the regulatory role should be separate from operations, but there is no consensus as to whether this should be achieved through separate departmental responsibilities at the NOC or the ministry or through a truly independent body. This position is corroborated by more recent research on the applicability of the so called “Norwegian” model in different capacity and institutional settings (Thurber, Hults and Heller 2010).

Although NOCs were originally set up as instruments of the state to reduce the information asymmetries between government and foreign operators, they have become “major actors on their own, interposed between the government per se and, mostly foreign, oil companies” (Waelde 1995). As such, NOCs often capitalize on the principal-agent relationship and information asymmetries between the domestic government and itself (Linde 2000; Stevens 2004). But in some cases state control mechanisms intended to

prevent conflicts of interests or corrupt practices may ultimately result in considerable damage to the commercial decision making process of the NOC.³⁴ The final decision can often take ‘a couple of months’.” Achieving the proper balance between the NOC’s entrepreneurial freedom on the one hand and effective monitoring and control on the other is thus difficult.

2.4 Conclusion

To understand NOCs, one has to consider the historical, political, and socioeconomic context in which they were founded and have developed. Direct state intervention could be justified based on: the historical context of the decision; the overall importance of the industry to many nations and the political benefits of state control; the potentially beneficial impact of NOCs on sector-wide economic efficiency; enhanced rent capture by the state; and the ability to pursue wider socioeconomic priorities with the help of the NOCs’ operational and financial clout. Despite these valuable reasons for setting up NOCs, existing research shows that their performance and value creation has quite often been disappointing. Some of the key issues identified for NOCs and a state-led petroleum sector include: the economic cost of political intervention; the operational inefficiencies of NOCs; unsatisfactory delivery on noncommercial objectives; inadequate corporate governance arrangements; inappropriate sector organization; and issues related to funding arrangements and the scarcity of public funds.

The observed shortcomings have historically been associated with NOCs. But few are inevitably tied to them: appropriate institutional arrangements can mitigate or resolve some of these issues, and certain states/NOCs have succeeded in doing so. Nevertheless, the implementation of such mitigating measures has generally proven difficult, and their success has been attributed to a considerable extent to the wider national context. The review of existing literature on the history of NOCs suggests that the country political, economic, and social environment affects the objectives of the NOC, as well as its governance mechanisms over time.

NOCs differ on a number of very important variables, including the level of competition in the market in which they operate, their business profile along the value chain, and their degree of commercial orientation and internationalization. One thus needs to be mindful of possible over-generalizations. On the other hand, most NOCs share at least some core characteristics: for example, they are usually tied to the “national purpose” and serve political and economic goals other than maximizing the firm’s profits. Perhaps this is the most relevant single factor that explains their existence and resilience in very different political, social and economic environments. These core characteristics need to be taken into account in defining what constitutes NOC value creation and analyzing NOCs behavior and strategy.

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Notes

1. The history of the petroleum industry is well documented in a number of publications (e.g., Giddens 1938; Anderson 1987; Linde 1991; Yergin 1991; Linde 2000; Mommer 2002; Mabro 2005; Marcel 2006b), from which this overview is collected. Any historical account of the industry is bound to focus on oil rather than natural gas. Whereas crude oil has been a globally traded commodity from the early days of the industry, gas has been somewhat of a late starter, albeit a very successful one. Furthermore, with the exception of the North American market and the small volumes traded within Europe, natural gas prices remain linked to oil prices.
2. At the beginning of 2000 there were about 500,000 producing wells in the United States with an average production of 14 barrels per day; in the Middle East average production per well was almost 4,000 barrels per day (CSFB 2002).
3. In May 1951, Iran had briefly nationalized the oil operations of the British Anglo-Persian company, but following the coup against Prime Minister Mosaddeq, the nationalization was reversed, and a new British-Iranian agreement was signed in 1954.
4. U.S. production hit an all-time high of 9.6 million barrels per day in 1970.
5. The NOCs usually did not share the exploration risk of the project, as their capital expenditure was financed by the POCs as carried interest, to be repaid from the project revenues, should the project prove to be successful.
6. One example is Saudi Aramco, where in December 1972 long negotiations were completed for the state to take a 25 percent equity stake, effective in 1973. By 1974, this had been increased to 60 percent, and in 1976 arrangements for complete state ownership of Aramco were reached. Payments to the original U.S. parent companies of Aramco were only completed in 1980.
7. For example, Angola's Sonangol in 1976 emerged from a nationalized Portuguese oil company, Angol, which later assumed assets previously owned by private operators such as Gulf Oil, Texaco, and Petrofina.
8. New fields of economic analysis such as the theory of politics (examining the behavior of politicians), theories of public choice (examining the behavior of bureaucrats), and principal-agent theory (examining the interaction between politicians and bureaucrats) identified government failure as a problem that was not less severe than the apparent market failure, which had led to the rise of government in the first place.

9. Francis Fukuyama's book "The End of History and the Last Man" (1992) is one of the most prominent illustrations of this view.

10. This phenomenon might be partly explained by drawn out political decision making, as some of these initiatives were conceived in the pre-2000 era of low oil prices and tight public budgets. Also, up until 2003 most industry participants did not believe that energy prices would remain high—a typical broker forecast was a mean reversion to around \$20 per barrel within three to five years. In many cases of partial privatization, there was no apparent intention to cede management control over time (Wolf and Pollit 2008).

11. Even in Norway, which in the early 1970s had a sufficiently developed private sector and was not laden with post-colonial trauma, private (Norwegian) leadership of the petroleum sector was never an option in the political discourse, although this partly reflected the Scandinavian tradition of state involvement across industries.

12. The term "commanding heights" goes back to Lenin and refers to industries that effectively control and support the others.

13. The original quote that oil is not an ordinary commodity and is too important to be left to the market is often ascribed to Sheikh Ahmed Yamani, Saudi oil minister from 1962–1986.

14. The policies of OPEC members in the oil and gas sector are prominent examples of the blending of political motivation and economic policy. Saudi Arabia has long used its oil trading relationship with the United States to acquire political and diplomatic capital and military assistance (Jaffe and Ellass 2007). Outside of OPEC, Norway is a much-cited example of how the state can use its NOC to control the pace and means of petroleum development. In the early 1970s there was widespread concern among government and civil society over the macroeconomic and cultural consequences of overly rapid oil development, which led to a deliberate "go-slow" policy. This included a restrictive licensing system and a strong NOC (Statoil, founded in 1972), which in the early years had a majority interest in all production licenses and veto power on development decisions (Dam 1974; Al-Kasim 2006; Wolf and Pollit 2009).

15. The belief that the NOC should provide governments an inside view of the industry was instrumental in the creation of Statoil in Norway in 1972. Although some had advocated Statoil to be a holding company only for the state's direct interests in petroleum assets, the Ministry of Petroleum and Energy believed "that only through 'learning the ropes' as an operator would the national company be able to assist the country in ensuring national control" (Al-Kasim 2006). Petronas was established in response to the difficulties faced by Malaysian state officials in obtaining information on new discoveries and developments by POCs, making it difficult to properly inform parliament and to develop suitable national petroleum policies (von der Mehden and Troner 2007).

16. Political control and economic efficiency also affect the size of the rent and its capture. These were discussed in previous sections.

17. For example, Saudi Aramco, which has a reputation for operational and commercial efficiency, still plays an important societal role as a sponsor of technical education and training. Saudi Aramco's mission statement declares investment in Saudi nationals to be "a national obligation and a strategic goal" (Jaffe and Ellass 2007:68). Consequently the NOC spends more than \$1 billion per year on programs to recruit, train, and retain its workforce. Since 1953 it has built more than 130 government schools, and its College Preparatory Center has awarded over 4,800 full scholarships to international universities to Saudi nationals since 1994. Aramco does not usually fire poorly performing employees, but instead keeps them in "shadow offices" "away from important business" (Marcel 2006b:68).

18. Some NOCs, including Algeria's Sonatrach, have in recent years begun voluntary expenditure programs very much comparable to corporate social responsibility initiatives of the private sector. In interviews conducted by Marcel (2006b), Sonatrach managers emphasized the corporate citizenship aspect of programs such as healthcare provision, sport sponsorship, or emergency relief aid.

19. For a detailed analysis of the resource curse see for example, Wijnbergen (1984), Auty (1983), Karl (1997), Leite and Weidmann (1999), Stevens (2003), Humphreys et al. (2007), and Sachs (2007).

20. According to Marcel (2006a), many NOCs consider the compensation paid to the POCs in the 1970s nationalization processes to have been excessive. For many resource-holding states this issue has contributed to the popularity of contractual (including PSCs) over concessionary legal systems.

While contractual and concessionary systems could be designed to provide equivalent economic returns to the government, their psychological connotations clearly differ.

21. The first asset acquisition by a producing NOC was KPC's purchase of some of Gulf Oil's European downstream assets. When KPC acquired 22 percent of BP's shares in 1989, the fear of producer dominance in consuming markets was such that the British government ordered the stake to be reduced to 9.9 percent (Al-Moneef 1998). In 2005 China National Offshore Oil Company (CNOOC) attempted a \$18.5 billion takeover of the U.S. firm Unocal, which was effectively blocked through political opposition in the U.S. Congress. China Petroleum and Chemical Corporation (Sinopec) recently agreed the \$7.2 billion acquisition of Swiss-Canadian Addax Petroleum, which among its assets has a production license in Northern Iraq.

22. In modern democracies the ultimate beneficiaries and owners of SOEs are the citizens, who delegate their rights to politicians and bureaucrats (Cohen 2001).

23. Applied to corporate governance, the term "principal-agent problem" includes many of the problems associated with adequate management that may stem from the distributed ownership structure. In private corporations the shareholders participate and vote on major decisions at the general shareholders' meeting. In SOEs there may be several oversight government entities between the ultimate beneficial owners (that is, the citizens) and the SOE's management. Depending on the organization of the state, an SOE may not have a clear owner, but rather competing owners and stakeholders with widely different objectives (OECD 2005). The various institutional objectives may be legitimate, but competition for influence often dilutes accountability and weakens the incentives for managers and board members to seek optimal performance (OECD 2005). This complex agency chain often creates difficulties for SOEs that are not present in the more straightforward relationship between a private company's management and its shareholders.

24. Critics might rightfully argue that complete management contracts do not exist in either case, but the relative deviation from this ideal scenario does matter in terms of incentives for efficiency and control.

25. Case studies can be downloaded at <http://www.rice.edu/energy/publications/nocs.html> (Rice) and <http://pesd.stanford.edu/research/oil/> (Stanford).

26. For example, an analysis of Sonangol's overseas university scholarships determined that although they covered technical degrees that were pertinent to the oil industry (such as engineering), they were often dispensed to the children of politically-connected families. During the final years of the civil war between 1997 and 2001, overseas scholarships accounted for 18 percent of total government expenditure on education, more than what was spent within the country on technical education and higher education combined (Hodges 2003; Heller 2009).

27. For example, McPherson (2003) reports that the Nigerian NOC, NNPC, did not have a board for 10 years due to the government's desire to exercise more direct political control (see also Nwokeji 2007).

28. For example, in 1999 the Price Waterhouse Coopers special audit report of Indonesia's NOC, Pertamina, found numerous irregularities, including excessive mark-ups on contracts, sales of natural gas below market price, and questionable fees to trading companies partially owned by the President's family. Following the change in regime and the oil and gas sector reform law of 2001, Pertamina cancelled or re-tendered more than 150 contracts with associates of former President Suharto; the associates were ordered to sell their stakes in petroleum projects (Hertzmark 2007).

29. Some government uses its NOC to collect revenues and then allocates investment capital through its central budget (Randall 1987; Karshenas 1990; Cochnour 1992; McPerson 2003).

30. For example, it is very common for NOCs to sell the state's share of production on behalf of the government, given that NOCs have, in principle, both the market knowledge and existing sales channels. But if sales and transfer prices are not market-based or do not reflect marketing costs, then transparency and efficiency might be compromised. Before the 2001 sector reform in Indonesia, Pertamina marketed the government's share of PSC production volumes. The NOC retained 5 percent of the sale value as marketing fee, which typically accounted for half of Pertamina's profits (World Bank 2000a). After the 2001 reform, receipts from the sale of the state share of PSC production go directly to the Central Bank rather than through Pertamina's accounts. The objective of the reform was to make the flow of funds more transparent, and to improve incentives for efficiency in Pertamina (Hertzmark 2007). In Norway the state has substantial direct equity interests

in Norwegian production, which historically has been processed, transported and marketed by the Statoil. Statoil is mandated to sell state volumes alongside its own production so as to maximize their combined value. Statoil must ensure the equitable distribution of value between the State and itself, and costs and revenues related to these sales must be transparent and measurable (Statoil 2001). All prices are realized prices; the state does not pay any specific consideration to Statoil other than reimbursement of a proportionate share of actually incurred marketing expenses.

31. For example, both Pemex (Mexico) and Saudi Aramco (Saudi Arabia) have a relatively low level of financing and budgetary autonomy. Corporate tax rates imposed by the state on Pemex have historically been based on government needs, leaving the NOC with after-tax resources that are inadequate for capital replacement, let alone investment in new projects. Over the past five years, Pemex has paid out slightly over 60 percent of its total revenues in royalties and taxes and has financed almost 40 percent of Mexico's entire federal budget. Evidence from investment data and available research show that the company focuses on short-term production maintenance to maximize short-term revenue (Moody's 2003; Stojanovski 2008). At Saudi Aramco, normal operational expenses and investments are financed out of retained earnings, but additional funds for major projects need to be allocated through the national budget via the Ministry of Finance (Jaffe and Ellass 2007). This arrangement seems to work reasonably well in the Saudi case, as there is little evidence of long-term investment being suppressed.

32. Several factors can restrict the availability of private sector financing to NOCs. For one, borrowing from private sources usually requires government approval or the provision of government guarantees. Furthermore, the NOC may be constrained by the level of existing foreign debt of the government. Finally, if oil production is used as loan collateral, the extent and availability of the resource base will affect the level of possible financing.

33. For example, in Nigeria in 1999, budgetary allocations for health, education, and transport were less than 20 billion Naira each while the state share in NNPC's joint ventures with foreign oil companies required a total investment of close to 350 billion Naira (McPherson 2003).

34. Pemex, for example, is stringently controlled in its operations and business decisions by various ministries, including the Ministry of Public Functions (SFP). Not only does SFP appoint Pemex's external auditors and oversee its procurement decisions, it also determines its organizational charts, salaries, and employment positions. Any newly created jobs—whether they are managerial or low-level union jobs—require the agency's regulatory approval. Stojanovski (2008) observes that “[w]hile the stringent oversight (. . .) may, in some ways, be fitting for a country with a vast bureaucracy and significant potential for political corruption, it also clearly clips Pemex's autonomy and restricts the flexibility and risk-taking that are essential to running a business.” At KPC, any purchase over 5,000 KD (approximately \$17,000) requires a public tendering process, which can take up to one year. This figure was set in 1964 and has not been adjusted since. Additionally, any expenditure greater than 100,000 KD requires pre-approval by the State Audit Bureau (SAB). The law requires the SAB to respond within one week, but according to Stevens (2008a), “in practice on day 6 or 7 the SAB comes back with some ‘query which effectively stops the clock’ (PESD Interviews 2007).

The Performance and Value Creation of NOCs

A Conceptual Model

“Aerodynamically the bumblebee shouldn’t be able to fly, but the bumblebee doesn’t know that so it goes on flying anyway.”

(Mary Kay Ash)

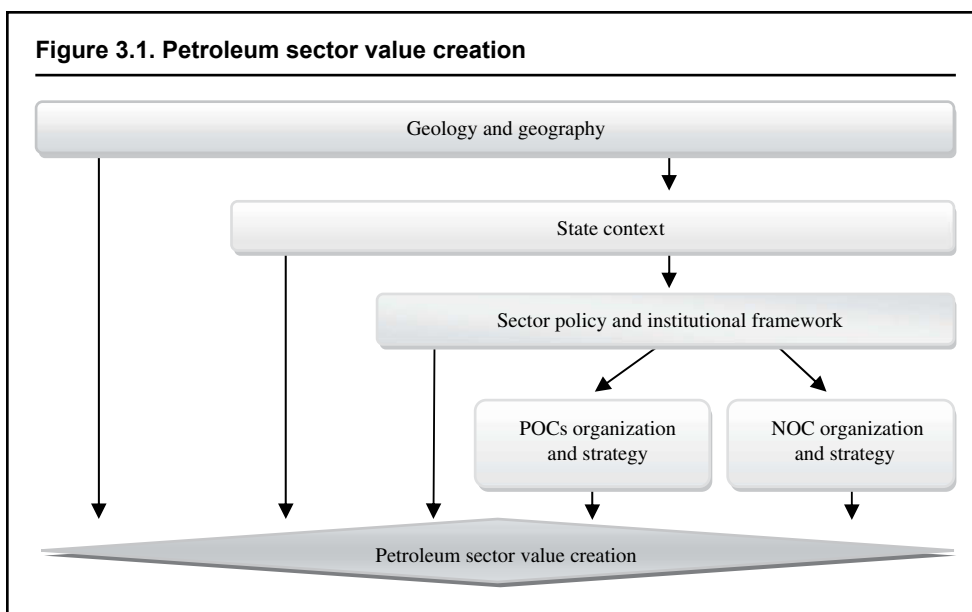
Most of the analyses carried out to date point to the existence of efficiency gaps between NOCs and POCs. In general, NOCs exhibit lower labor and capital efficiency, generate lower revenue, are less profitable, and produce a significantly lower annual percentage of their upstream reserves than POCs.¹ Such efficiency gaps have been partly justified by the complexity of objectives pursued by NOCs compared to the simple maximization of shareholders’ return on capital pursued by POCs. The results, although indicative of a general trend, shed little light on the performance of NOCs, since they attempt to measure performance with reference to an objective function—the maximization of shareholders’ return on capital—that fails to capture the broad mandate and mission of NOCs.

Previous chapters have shown that NOCs differ greatly in their institutional environments, their corporate objectives and operations, and their domestic and international socio-economic linkages, which makes a comparative assessment of NOCs’ value creation far from trivial. This chapter sets out a possible analytical framework for assessing NOCs’ wider contribution to social value creation.

3.1 A Conceptual Model of Value Creation

The factors that affect value creation by NOCs can be grouped into two categories: (i) variables describing initial conditions and context (such as the economic situation, political history and ideology, international obligations, and natural resource endowment); and (ii) variables describing human and organizational agency (such as sector and corporate governance choices, and companies strategies).² The model draws from an earlier version developed by Wolf (2009). Together, the context and agency variables constitute the *drivers of value creation*. A schematic representation of these factors and their interaction is shown in figure 3.1.

The proposed simplified conceptual model assumes that three key institutions generate the vast majority of direct value in any national petroleum sector: the NOC, the POCs, and the sector organization and governance.³ NOCs and POCs (the companies) have certain levels of economic efficiency and make strategic and operational choices, which translate into commercial and noncommercial performance and value creation. But the companies’ ability and willingness to perform well are embedded within, and affected by, matters of



Source: Authors.

sector organization and governance, including the fiscal regime (which often delivers the greatest share of state monetary benefits), industry structure (that is, monopoly versus competition), regulatory responsibilities and capacity, and pricing mechanisms.

Any national petroleum sector has a set of implicit or explicit rules and procedures. Additionally, as the resource owner, the state has to decide whether to allow NOCs, POCs (national or international), or a combination of the two to operate and invest in the sector. The state's decisions—regarding sector governance and sector participation are fundamentally interconnected and jointly affect value creation. The model describes NOC value creation as the outcome of a number of interlinking variables and processes. The role and objectives of a NOC are assumed to be influenced by the goals and objectives of the state with regard to energy and petroleum policy, which in turn is determined by the nation's historical, political, financial, and economic context, itself affected by the country's resource endowment and geography. The NOC's objectives influence both its corporate governance structure (which is also influenced by the country's institutional and governance arrangements) and its strategy and behavior in the marketplace. These two factors are suggested as the most immediate drivers of NOC performance and value creation.

Any model is a simplification of reality. Therefore some possible variables and many possible linkages between variables have not explicitly been acknowledged. For example, the model does not assume that value created within the petroleum sector in turn affects the country's financial, economic, political, and geological context.

3.2 Measuring the Performance of NOCs: The Value Creation Index

The performance of a NOC should be measured with reference to its objective function. As discussed in chapter 2, mission and objectives vary widely among NOCs, depending on its shareholder's policy objectives. But in general they often include one or more of the

following: (i) to protect national hydrocarbon wealth, which requires the NOC to maximize the recovery factor on fields and optimize resources in line with the country's depletion policy; (ii) to promote economic development, which requires the NOC to maximize its financial and productive linkages, both forward and backward; and (iii) to promote the political interests of the state abroad (Stevens 2008). In other words, the NOC's objective function is the creation of value for society.

In this context performance simply refers to economic behavior by the NOC that is conducive to overall value creation. NOCs directly create value, either through their role as operators, or through their national mission (Stevens 2008). They can also create value indirectly, for example, as an advisor to other elements of the government and as a regulator (although this may give rise to conflict of interest). The NOC's capacity to fulfill its missions and objectives determines its contribution to value creation.

To measure NOC value creation this section proposes a composite indicator: the value creation index (VCI).⁴ The index is not meant to capture all aspects of NOC value creation, but to provide a useful measure of key aspects of value creation for further analysis. In particular, the index is designed to measure short term value creation by the NOC. As such, long-term sustainability considerations and long-term growth potential are not captured by the index (for example, we measure the NOC's ability to replace its reserves, but not the future flow of revenues from the extraction of existing reserves).

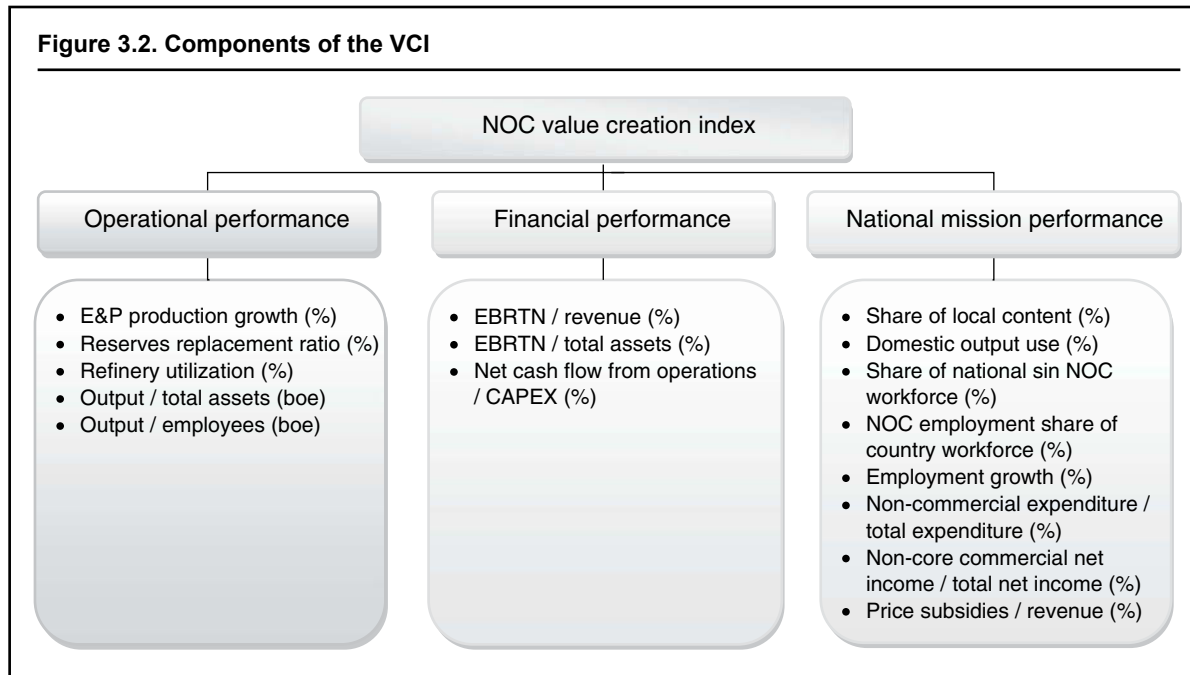
The proposed index focuses on performance indicators that contribute directly to value creation (that is, output indicators). There are other interesting and essential aspects of good NOC performance, such as human resources and skill base, technological competence, and industrial partnerships. However, these support and enable the creation of value and are drivers of value creation rather than indicators of value creation. Since we aim to better understand the relationships between value drivers and value creation, the value creation index should not overlap with these drivers. Stevens (2008) identifies three categories that theoretically capture NOC value creation: operational performance, financial performance, and national mission performance. If each of these categories could be observed and measured directly, the summation of the observed values would provide the desired measure of value creation. But categorical measures do not exist. Therefore we estimate them by using proxy variables that capture aspects of value creation that we believe to be important for each category.⁵ It is worth noting that the selection of proxy variables is affected by data availability for a sufficient number of NOCs. Figure 3.2 shows the categories and proxy variables selected for the creation of the index.

3.2.1 *Proxy Measures Used in VCI*

The rationale behind the selection of the proxy measures used for each component in the VCI—operation performance variables, financial performance variables, and national mission variables—is discussed below.

A. OPERATIONAL PERFORMANCE VARIABLES. Production growth and the reserve replacement rate (RRR), both net of acquisitions and disposals, are standard indicators of upstream effectiveness. While the exploration success rate might be considered as an additional indicator of technical and geophysical expertise, it is already partially captured by the RRR.

Refinery capacity utilization is chosen to measure downstream performance. Growth in capacity utilization is considered a proxy measure of a NOC's ability to meet local demand, and to add value. NOCs without refining assets are not penalized in the data aggregation process.



Source: Adapted from Wolf, 2009.

The ratios of output to total assets and output to employees reflect capital and labor efficiency, respectively. For the purpose of this index, output is defined as the sum of upstream production and refined products (where applicable), both expressed in millions of barrels of oil equivalent (MMBOE).

B. FINANCIAL PERFORMANCE VARIABLES. As this paper examines social value creation by NOCs, after-tax measures are not appropriate because taxes are not a loss of value as viewed by the government. Furthermore, taxes are not usually within the NOC's sphere of influence due to its inability to relocate domestic operations.⁶ Similar considerations apply to a NOC's noncommercial expenditure. Ultimately, the earnings before interest, royalties (and other production taxes), income taxes, noncommercial expenditure, and non-core commercial activities ("EBITRN") should allow us to benchmark the financial performance and value creation of NOCs, irrespective of how they transfer that value to the government, whether through taxes, social expenditure, or profits and dividends.⁷

Noncommercial and non-core activities are excluded from the financial performance measure, since they are considered in the national mission performance. However, data on noncommercial, non-core activities, and price subsidies are not systematically disclosed by NOCs. Without appropriate data, financial performance and national mission performance may be under or overestimated as the case may be.

The proxy indicators chosen to measure profitability, financial efficiency, and solvability are EBITRN/revenue, EBITRN/total assets, and net cash flow from operations/capital expenditure (NCFO/CAPEX), respectively. For the purpose of calculating this proxy indicator, NCFO is defined as cash flow from operations minus the government's portion of dividends.

When using financial accounting data the following need to be taken into consideration:

- the accounting literature has shown that companies can manipulate their disclosure, even in developed capital markets and jurisdictions;
- differences in accounting standards between countries (and within countries over time) can reduce the comparability of data;
- irrespective of accounting standards, the detail and quality of the accounts and the auditing process might vary significantly between NOCs;
- the definitions of individual, non-GAAP financial items may vary between NOCs (for example, capital expenditure might be reported including or excluding acquisitions, based solely on additions to property, plant and equipment, or on a wider range of assets); and
- specific petroleum-sector accounting issues need to be considered, such as different approaches to treating exploration expenditure (that is, "full cost" vs. "successful effort").

C. NATIONAL MISSION PERFORMANCE VARIABLES. The following are often cited as objectives in NOC mission statements: fostering the transfer of technology, creating employment opportunities, increasing local ownership and control, promoting economic growth and diversification, contributing to energy self sufficiency, and security of supplies. As discussed in chapter 1, similar objectives appear in countries' local content policies, thus affecting both NOCs and POCs. But NOCs are often given a primary role in promoting local content policies. Nonetheless, they have very little control over their countries' policy choices. For the purpose of this paper, we assume that local content policies are inherently effective and efficient. Hence, NOCs that implement them create value for society.⁸

Measuring the performance of NOCs with respect to the achievement of their national mission objectives is made difficult by the dearth of detailed reporting, as well as the lack of standard disclosure policies in this area. With this limitation in mind, the following proxy measures of key aspects of national mission performance are proposed:

- The *share of local content*—measured by the percentage of expenditure on local goods and services to total expenditure on goods and services—captures the contribution of a NOC to the domestic economy and transfer of technology through creation of backward linkages.
- *Domestic output use* measures a NOC's contribution to energy self sufficiency and security of supplies, as well as domestic value-added processing of crude oil (either in refineries or in industries further downstream). Domestic supply often comes at a financial cost, as exports would maximize revenues, but at the same time it indicates stronger forward linkages to the domestic economy. Domestic output use is measured by the ratio of petroleum product supply to the domestic market to total domestic consumption.
- The contribution of a NOC to local employment and the creation of a skilled local work force is measured by three proxy indicators:
 - the *share of nationals in the NOC workforce*, measured by the ratio of the number of local employees to total NOC employees, indicates local skills levels. However, for some NOCs, the share of domestic labor may simply represent the ability of the NOC (and pressures on the NOC) to employ nationals (Stevens 2008);
 - the *NOC share of its country's employment*. Salaries for employees of NOCs are often quite high compared to those paid by other publicly- or privately-owned companies operating in different sectors of the economy. If a NOC accounts for a large share of its country's employment, disposable incomes of NOC employees could have noticeable multiplier effects on the national economy;
 - *NOC employment growth* relative to country labor force growth, which measures the contribution of a NOC to national employment;
- The contribution of a NOC to its country's economic growth and diversification is measured by two proxy indicators:
 - the *NOC share of noncommercial expenditure to total expenditure* captures the relevance of a NOC's corporate social responsibility expenditure, which can include malaria awareness campaigns, the construction of schools, clinics, public roads, and similar projects. In countries with low public investment management capacity, the NOC is often viewed as the most competent managerial organization. As such, the NOC is may be asked to manage projects with little or no relationship to oil or gas. In effect, these NOCs become contractors on behalf of the government.⁹
 - the *NOC's share of non-core commercial net income to total net income* measures the contribution of a NOC to the diversification of its country's economy. For the purpose of this index, non-core commercial activities may include airlines, banking services, commercial warehousing, oil logistic services, processing of seismic data, and handling and shipping services. This is particularly important in countries with strong demand and limited

production linkages, especially when a NOC is able to efficiently perform in sectors that have high multiplier effects.

- The contribution of a NOC to poverty reduction is measured by the ratio of *subsidies to total revenues*. While subsidizing oil and gas prices may not be an effective way to protect the poor, the policy choice is beyond the control of the NOC. Therefore, for our purposes, it is considered a transfer of benefits from the NOC to society.

3.2.2 Determination of VCI

For any given NOC, the VCI is calculated annually as the average of three sub-groups of the sub-components detailed in figure 3.2:

$$I = \frac{1}{m} \sum_{i=1}^m \left(\frac{1}{n} \sum_{j=1}^n N_j \right)_i \quad (1)$$

where I is the composite index, N_j is a normalized variable and j indicates the number of sub-components in each sub-group i .

Normalization is necessary to aggregate the different individual indicators, which are measured on different units and have different ranges. We use the distance from the best and worst performers, where positioning is in relation to the sample annual maximum and minimum, and the index takes values between 0 (laggard) and 1 (leader):

$$N_j = \frac{X_j - X_j^{\min}}{X_j^{\max} - X_j^{\min}} \quad (2)$$

Where N_j is the normalized value, X_j is the original value, and X_j^{\min} and X_j^{\max} are the minimum and maximum values of the annual sample data.

3.3 The Value Drivers

The value creation model assumes that the state's historical, political, social, and economic environment—the state context—largely determines the objectives of its petroleum sector policy. The state's administrative capacity, effectiveness, quality of public policy, and accountability, and level of sector-specific knowledge affect its options with respect to sector organization and governance arrangements. As owner of the resource, the state can decide how, at what pace, and by whom they should be developed, thus defining the role of the market and the level of direct intervention through the NOC. State goals and objectives and sector policy and organization affect the strategy and corporate governance arrangements of the NOC. Finally, we expect that a country's resource endowment, distance to market, and quality of infrastructure—that is, its geology and geography—affect the state's objectives and policy choices, as well as the level of competition and performance of market participants (both NOCs and POCs). These value drivers can be grouped into five categories: *geology, state context, sector organization and governance, NOC governance, and NOC strategy*.

Ideally, one measure would exist for each of the theoretically-defined value drivers. Since these measures do not exist, we estimate them by using proxy variables that capture aspects that we believe to be important for each category. Table 3.1 lists the five value drivers and the proxy variables used to measure them.

Table 3.1. Value drivers and their proxy measures

Driver	Components
Geology	<ul style="list-style-type: none"> • resource endowment (mmbob)
State Context	<ul style="list-style-type: none"> • WB indexes on voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, corruption control • HC revenues as % of government revenues • HC revenues as % of GDP • WTO membership (yes-1/no-0) • OPEC membership (yes-1/no-0) • Net oil exports as % of GDP • Government budget surplus as % of GDP • Presence of stabilization mechanisms, such as petroleum funds (yes-1/no-0)
Petroleum Sector Organization and Governance	<ul style="list-style-type: none"> • Publicly disclosed national policy addressing hydrocarbon sector issues (yes-1/no-0) • Presence of country specific clear objectives and management separation (ordinal ranking with six categories) • Non-NOC percentage of oil and gas production • Non-NOC percentage of refined products production • Presence of clearly defined, publicly stated objectives ranked by priority and publicly measured for the NOC (ordinal ranking with five categories)
NOC Strategy and Behavior	<ul style="list-style-type: none"> • NOC upstream capital expenditures as % of total capital expenditures • NOC refining capital expenditures as % of total capital expenditures • NOC upstream equity production as % of total NOC refining throughput • NOC international revenues as % of total NOC revenues • Joint ventures and other partnerships, (ordinal ranking with four categories)
NOC corporate governance structure	<ul style="list-style-type: none"> • Percentage non-government ownership of NOC • Percentage of members of NOC Board of Directors that are independent • Appointment authority for chairman of BOD (ordinal ranking with three categories) • Independence of NOC capital and budget processes (ordinal ranking with five categories) • NOC financial transparency (ordinal ranking with five categories) • NOC upstream reserves transparency (ordinal ranking with five categories)

Source: Authors

To create a driver variable, each of its underlying proxy variables is transformed into a normalized variable and the driver variable is the result of the average of the normalized proxy variables.

3.3.1 Selection of Proxy Variables

A. GEOLOGY. A question underlying this research is whether NOC operations and performance vary with a country's resource endowments. Some NOCs are based in countries that are net oil and gas exporters, while others mainly serve their home countries' energy security by reducing import requirements. In several cases, domestic production does not satisfy consumption even though resource endowments may be substantial. In other cases, production levels are well above local consumptions needs, whether because of exceptional endowment (as is the case for many Middle Eastern producers) or because of the level of local economic development (as for many African producers). The abundance of petroleum resources may also affect the government's depletion policy, the commercial conditions for exploitation, and the NOC's resource extraction strategy.

The size of a country's reserves base is also used as a proxy for prospectivity and of the availability of sector related infrastructure. For example, a country with large proven reserves and associated production will be more likely to have relevant sector infrastructure (although its quality would be difficult to capture by a proxy measure).

B. STATE CONTEXT. The state context driver comprises 13 proxy variables that aim to capture the institutional and economic environment in the home country of the NOC.

We expect that stable, predictable, and efficient public policies contribute positively to the creation of value by NOCs and POCs. We also expect that the lower the stage of socioeconomic development, the more important the national mission becomes. We use the World Bank Worldwide Governance Indicators (WGI) to measure a country's political stability, institutional strength, regulatory quality, control of corruption, democracy and accountability, and rule of law. While many possible measures exist for these variables, the use of composite indicators is widely recognized.

We hypothesize that national dependency on the petroleum sector affects the government's macro-fiscal and sectoral policy focus and the objectives and goals that are given to the NOC. We use four proxy measures of dependency: petroleum revenue as a percentage of total government revenue, petroleum revenue as a percentage of gross domestic product (GDP), net oil exports as a percentage of GDP, and government budget surplus or deficit as a percentage of GDP.

Three dummy variables—World Trade Organization (WTO) membership, Organization of Petroleum Exporting Countries (OPEC) membership, and existence of revenue stabilization mechanisms—aim to capture a country's trade openness (which in turn affects the level and quality of competition, transfer of technology, and market opportunities), the presence of constraints on production levels, and the quality of fiscal policy, respectively.

C. PETROLEUM SECTOR ORGANIZATION AND GOVERNANCE. As the resource owner, the state has a wide range of options with respect to the implicit or explicit rules and procedures that govern the exploitation of the country's petroleum resources, including the objective of sector policy, the role of market participants, the distribution of institutional responsibilities, and the conditions for exploitation. A country's fiscal regime, regulatory compliance, regulatory uncertainty, and quality of environmental regulations all affect POCs' decisions to invest. The NOC has no choice as to whether or not to invest in its home country. Hence its ability to create value partially depends on how favorable its country's conditions are to investment.

Transparency with respect to the NOC's institutional responsibilities and mission and objectives will ultimately improve the efficiency of the NOC. This is particularly true when the government pursues multiple policy objectives through the NOC. Knowing the relative importance of these objectives will allow the NOC to devise appropriate strategies, reduce administrative cost, and may reduce the perception of risk. Three proxy variables are used to assess the country's willingness to allow the NOC to operate within transparent public policies: the existence of a publicly-disclosed national policy addressing hydrocarbon sector issues; the existence of clear country-specific objectives and management separation; and the existence of clearly defined, publicly stated, and measurable objectives for the NOC.

We hypothesize that the presence of POCs or other countries' NOCs affects the performance of the domestic NOC by promoting efficiency and defraying exploration and development risk. Two proxy variables capture the openness of the petroleum production and refining markets in the NOC's country: non-NOC percentage of oil and gas production; and non-NOC percentage of refined products.

D. NOC STRATEGY AND BEHAVIOR. Like other oil companies, NOCs must make investments in capital to preserve future production capabilities. A proxy for the kind of strategic behavior that is expected to create value is the NOC's capital expenditures

as a percentage of total capital expenditures (upstream considered separately from refining capital).¹⁰

NOCs that are net importers of petroleum products may be more exposed to changes in economic cycles, especially when they carry the burden of subsidizing prices for domestic consumption. A measure of the NOC's self-sufficiency is upstream equity production as a percentage of total refining throughput measures NOC's self sufficiency. This is also an indicator for the country's security of supplies, which is often part of the national mission of the NOC.

The ratio of international revenues to total revenue captures the NOC's ability to create value through access to the international markets. Another proxy for international participation is the existence of joint ventures and other partnerships, which captures the NOC's access to international best practices and technology.

E. NOC CORPORATE GOVERNANCE. The NOC's corporate governance structure affects the strategic options available to an NOC and therefore affects its capacity to create value. For example, the technology, competition, and management techniques in the oil industry are continually changing; successful companies are those that can anticipate changes, or rapidly adjust their strategy to accommodate them. This requires nimble decision-making processes that might not be compatible with the reality of a state-owned enterprise.

We hypothesize that partially privatized NOCs may be more able to create value since they are subject to market scrutiny and are less exposed to political influence. We use the percentage of non-government ownership of the NOC and its ownership structure and organization to measure this dimension. Also, independent boards of directors are thought to be more effective in sheltering the NOC from political interference (regardless of whether or not the NOC is partially privatized), allowing it to focus on achieving its goals. The proxies for the independence of the board are the percentage of independent board members and who holds the authority to appoint the NOC's chief executive officer.

There are many arrangements for allowing the NOC to administer the resources of the state: some NOCs are given a total vesting of petroleum rights, others are given a partial vesting, while others are given the nonexclusive right to develop and exploit resources directly or in association with third parties. These arrangements affect the capital structure of the NOC, its mandate, and its organizational and financial autonomy. The ability of the NOC to finance its operations is crucial to value creation. If the NOC is given too little financial and budgetary autonomy from the state, it will likely hamper the NOC's efficiency and may increase the cost of doing business. On the other hand, too much financial and budgetary autonomy may be a disincentive to improve efficiency. Financial transparency and regular audits allow the state to secure its interests (that is, avoid rent absorption) without excessively reducing the autonomy of the NOC. The independence of NOC capital and budget process, its financial transparency, and the transparency of its upstream reserves values are used as proxies for autonomy and transparency.

3.4 Conclusion

This chapter presents a model of value creation in the petroleum sector, and of NOCs' contribution to value creation in particular, which is used in chapter 4 as a reference framework for case study analysis and for exploratory statistical analysis.

Two categories of variables are hypothesized to affect value creation: (i) variables describing initial conditions and context (such as the economic situation, political history and ideology, international obligations, and natural resource endowment); and (ii) variables describing human and organizational agency (such as NOC objectives, sector and corporate governance choices, and NOC strategy). Together, the context and agency variables constitute the *drivers of value creation*: multidimensional variables that affect value creation by the NOC. These can be grouped into five categories: state context, sector organization and governance, NOC strategy, NOC corporate governance, and geology. We expect that the state's historical, political, social, and economic environment—the state context—largely determines the objectives of its petroleum sector policy. We also expect that the petroleum sector organization and governance arrangements in a country are affected by the state's administrative capacity, effectiveness, and governance. State goals and objectives and sector policy and organization affect the strategy and corporate governance arrangements of the NOC. Finally, we expect that a country's resource endowment, distance to market, and quality of infrastructure—that is, its geology and geography—affect the state's objectives and policy choices, as well as the level of competition and performance of market participants (both NOCs and POCs).

The performance of a NOC should be measured with reference to its objective function, which in turn depends on its shareholder's policy objectives. Although mission and objectives vary widely among NOCs, in general they often include one or more of the following: (i) to protect national hydrocarbon wealth; (ii) to promote economic development; and (iii) to promote the political interests of the state abroad. A composite indicator—the value creation index—is proposed to measure NOCs performance. The index, which measures key aspects of short-term operational, financial, and national mission performance, is not intended to capture all aspects of NOC value creation. But it provides a simple yardstick to monitor NOC performance over time and facilitates comparisons among NOCs.

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Notes

1. Appendix 3 contains an overview of the most salient advances in the research on NOCs.
2. For some variables this classification is dependent on the time horizon of the analysis. Over the mid- to long-term, for example, international obligations can be revoked or renegotiated, but for any short-term decision they are essentially exogenous.
3. We define institutions to include the system of formal laws, regulations, and procedures (including, but not limited to, legal entities and their governing rules), as well as informal conventions, customs, and norms that influence socioeconomic behavior.
4. Composite indicators are synthetic indices of individual indicators, where an indicator can be defined as a "quantitative or qualitative measure derived from a series of observed facts that can reveal relative position in a given area and, when measured over time, can point out the direction of change" (Freudenberg 2003).

5. Since the scale of the VCI is not relevant to the proposed model, the relative importance of each category, and of proxy variables within a category, is not a concern (as long as each sub-component is orthogonal to the others and measured in such a way that it facilitates aggregation, for example, by normalizing on a common, increasing scale).

6. POCs usually have considerable flexibility with respect to portfolio management and related tax implications. In this sense, benchmarking the performance of POCs on the basis of after-tax profits reflects the companies' ability to devise efficient tax management strategies.

7. For the purpose of our calculations "noncommercial expenditure" includes social and capacity building programs, culture, sports, environmental projects that are not directly related to petroleum operations, country infrastructure projects, and similar non-productive expenditure; and "non-core commercial activities" include activities, such as airlines, banking services, commercial warehousing, oil logistics, seismic acquisition, data storage, handling and shipping services, and other for profit activities that are sold by the NOC to affiliates or third parties.

8. Measuring the effectiveness and efficiency of local content policies is beyond the scope of this paper.

9. Stevens (2008) cites the example of Saudi Aramco, which was recently requested to take on the management of King Abdullah University of Science and Technology at Thuwal, north of Jeddah.

10. The ratio of upstream production operated by the NOC to total production is an indirect measure of its technical capacity and business strategy (operator versus financial investor). Another measure, the percentage of NOC refining production operated by NOC, is meant to capture the NOC's vertical integration, which allows for greater value creation, except when the NOC is burdened with the obligation to sell petroleum product at below market price. However, these indicators were excluded from the list of proxy variables since very rarely they are included in standard reports by NOCs.

Case Studies and Lessons Learned

"We succeed in enterprises which demand the positive qualities we possess, but we excel in those which can also make use of our defects."

(Alexis de Tocqueville)

This chapter investigates value creation through the experience of a selected group of NOCs with the objective to derive lessons of wider applicability. Using the analytical framework developed in chapter 3, an exploratory statistical analysis of twenty NOCs is attempted to determine the relevance of the value drivers identified in the value creation model. In addition, the experience of a smaller sample of NOCs is analyzed in detail to establish whether there are discernible patterns with respect to value creation for NOCs with similar strategy and governance structure, and whether certain country context variables lead to particular corporate governance arrangements and NOC strategies.

4.1 Exploratory Analysis of Value Drivers

This section discusses a preliminary attempt to statistically measure NOC value creation using the conceptual model presented in chapter 3. In particular, we hypothesize an explanatory relationship between the VCI and value drivers, and test our hypothesis using data collected on the NOCs listed in table 4.1 for the period 2004 to 2008. Table 4.2 shows the VCIs for the NOCs in our sample, sorted from the highest to the lowest five-year average. The complete dataset is contained in National Oil Companies and Value Creation: Data Annex, which can be downloaded from <http://www.worldbank.org/NOC>.

As noted in chapter 3, the VCI is not designed to measure all aspects of value creation; it focuses on key aspects of short-term value creation by NOCs. Following the methodology presented in chapter 3, the VCI is the result of the average of three group averages, with each group average consisting of normalized proxy variables. This construction results in a unit-less scale. The VCI is a relative measure in the sense that the assigned score results from a within-sample normalization. While relative in this sense, the VCI does capture cardinal performance among the NOCs in the sample, albeit in a unit-less fashion.¹ Given the foregoing, the VCI scale is not relevant and may not be indicative of the total value created by each NOC. But the index can reveal the relative position of the NOCs in the sample with respect to the observed value creation measures, and the direction of changes over time .

4.1.1 Selection of Proxy Variables

We hypothesize that the five categories of value creation drivers described in chapter 3 section 3.3 stochastically contribute to explaining the VCI. This model can be written as:

$$y_i = \alpha + \sum_1^5 \beta_i x_i + \varepsilon_i$$

Table 4.1. NOC sample for statistical analysis

▪ CNOOC (<i>China National Offshore Oil Company</i>), China
▪ Ecopetrol (<i>Ecopetrol S.A.</i>), Colombia
▪ ENI (<i>Ente Nazionale Idrocarburi S.p.A.</i>), Italy
▪ Gazprom (<i>Open Joint Stock Company Gazprom</i>), Russia
▪ GDF (<i>Gaz de France S.A.</i>), France
▪ KMG E&P (<i>JSC KazMunaiGas Exploration Production</i>), Kazakhstan
▪ OGDCL (<i>Oil & Gas Development Corporation Ltd.</i>), Pakistan
▪ ONGC (<i>Oil and Natural Gas Corporation Ltd.</i>), India
▪ PDVSA (<i>Petróleos de Venezuela S.A.</i>), Venezuela, RB
▪ Pemex (<i>Petróleos Mexicanos</i>), Mexico
▪ Petro SA (<i>The Petroleum, Oil and Gas Corporation of South Africa (Pty) Limited</i>), South Africa
▪ Petrobras (<i>Petróleo Brasileiro S.A.</i>), Brazil
▪ Petrochina (<i>Petrochina Company Limited</i>), China
▪ Petronas (<i>Petroleum Nasional Berhad</i>), Malaysia
▪ PTT (<i>PTT Public Company Limited</i>), Thailand
▪ QP (<i>Qatar Petroleum</i>), Qatar
▪ Rosneft (<i>Oil Company Rosneft</i>), Russia
▪ Sinopec (<i>China Petroleum & Chemical Corporation</i>), China
▪ Sonatrach (<i>Sonatrach S.A.</i>), Algeria
▪ Statoil (<i>StatoilHydro ASA</i>), Norway

Source: Authors.

Table 4.2. VCI for the sample NOCs

NOC	2004	2005	2006	2007	2008	5-Yr Avg
Sonatrach	0.72	0.69	0.67	0.67	0.65	0.68
QP	0.70	0.56	0.56	0.63	0.62	0.61
PdVSA	0.65	0.55	0.66	0.57	0.51	0.59
Rosneft	0.41	0.48	0.43	0.56	0.56	0.49
ONGC	0.50	0.43	0.48	0.53	0.48	0.48
OGDCL	0.52	0.43	0.51	0.47	0.49	0.48
CNOOC	0.52	0.46	0.45	0.47	0.46	0.47
Ecopetrol	0.46	0.39	0.44	0.48	0.45	0.44
Petronas	0.51	0.41	0.42	0.46	0.38	0.44
KMG	0.40	0.30	0.40	0.55	0.53	0.43
Petrobras	0.49	0.41	0.40	0.39	0.35	0.41
Statoil	0.37	0.34	0.45	0.43	0.39	0.40
Pemex	0.39	0.32	0.39	0.45	0.40	0.39
Petrochina	0.46	0.38	0.33	0.35	0.33	0.37
Gazprom	0.39	0.33	0.39	0.35	0.37	0.37
PTT	0.38	0.24	0.30	0.29	0.41	0.32
ENI	0.35	0.27	0.29	0.23	0.27	0.28
GDF	0.31	0.27	0.23	0.26	0.26	0.27
Sinopec	0.30	0.20	0.20	0.30	0.23	0.24
PetroSA	0.09	0.26	0.22	0.23	0.22	0.20
Sample average	0.45	0.39	0.41	0.43	0.42	0.42

Source: Authors.

where y_i is the VCI, the x_i are the value driver group indices, the β_i are the coefficients for each value driver group index, α is an intercept, and ε_i is a well-behaved stochastic disturbance associated with each observation.

In addition to the five value drivers, each NOC in the sample is expected to act in an individual fashion as it creates value. This individual behavior can be expected to fall outside the bounds of the proposed model. Panel data analysis can partially address this issue as long as multiple observations for each NOC are available. By including a fixed-effects variable for each NOC to capture these NOC-specific effects, the model can now be written as:

$$y_{it} = \alpha + \sum_1^5 \beta_i x_{it} + v_i + \tau_t + \varepsilon_{it}$$

where the t subscript indicates the t -th observation for each NOC, v_i captures the individual effect of each NOC, and τ_t captures the time effect of each year. The VCI and the value drivers are calculated annually for a five-year period starting with 2004 for the 20 NOCs in our sample. Data limitations and issues are discussed in appendix 4. Explicitly, the model to be estimated using robust standard errors is:

$$vci_{it} = \alpha + \beta_1 \text{geology}_{it} + \beta_2 \text{state}_{it} + \beta_3 \text{petsec}_{it} + \beta_4 \text{nocsb}_{it} + \beta_5 \text{nocgov}_{it} + v_i + \tau_t + \varepsilon_{it}$$

The model estimations are shown in table 4.3. Before attempting to interpret the result of the model, it is worth noting that there is a near-perfect correlation between the fixed effects and the dependent variable, which indicates that much explanatory power stems from the individual NOC's behavior, rather than from the model parameters. There are a number of possible explanations, including: (i) concerns related to data quality and availability; and (ii) the possible misspecification of the drivers, given the wide use of proxy variables to supplement for the lack of primary data. Furthermore, the relationship between VCI and drivers hypothesized in our exploratory model may be too simplistic. A more complex representation may be needed to capture the relationship between context and agency variables, and their relevance to value creation. However, the current dataset greatly limits our ability to test more complex model specification.

4.1.2 Indications from the Statistical Analysis

The *geology value driver* has a significant and negative influence on value creation. Larger petroleum endowments should lead to more value creation if resources are extracted efficiently and revenues from its sale are re-invested to support production levels and replace reserves. The negative coefficient suggests that NOCs that enjoy large resource endowments may also have less incentive to produce them efficiently

Table 4.3. Results of model estimation

Dependent Variable	Coefficient	P value
Geology	−2.511	(0.000)***
State context (state)	0.221	(0.609)
Petroleum sector governance (petsec)	−0.446	(0.058)*
NOC strategy and behavior (nocsb)	−0.070	(0.510)
NOC Governance (nocgov)	0.277	(0.010)***
Constant	0.953	(0.000)***
Observations	100	
Number of group (NOC)	20	

Robust p values in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Source: Authors.

and to maximize the net present value from their extraction, especially when partnerships and alliances with POCs are not the prevalent business strategy. The negative sign could also reflect a time lag between the addition of reserves and their exploitation which is not captured by our model. Indeed, reserves additions, especially for NOCs that have large reserves endowments, are usually not put into production in the same year as they occur. Since the VCI measures short-term contributions to value creation, future production from reserves addition is not captured. Therefore, all other elements of the VCI being equal, an increase in reserves (positive variation of the geology driver) would not be reflected by an increase in production (positive variation of the VCI).

The *petroleum sector value driver* is significant. But contrary to expectations, its coefficient is negative. We expected that more favorable investment environments would improve NOC value creation directly, through better investment conditions, and indirectly through risk sharing with POCs. Furthermore competition from POCs should improve NOC value creation by inducing them to become more efficient. But this effect is indirect and depends on whether or not the government uses efficiency benchmarks to measure and reward the performance of its NOC. Although the model is not designed to capture the time lag between changes in sector governance measures and their effect on value creation, a negative relationship does not seem to be justified. The negative coefficient could be an indication of misspecification of the driver—namely, the choice of proxies or their measures—or the result of data limitations. Further investigation would be necessary to refine the proxy measures for this driver, or to gain a better understanding of the relationship between this driver and value creation.

The *NOC governance value driver* is positive and significant. This would indicate the benefit of market discipline to value creation through financial transparency and private participation in the NOC's share capital. This is in line with existing studies on the effect of commercialization on NOC's performance (Aivazian et al, 2005). In addition, independent board of directors (BODs) are expected to help to shelter the NOC from political interference and expedite decision-making processes. These in turn should improve the NOC's project efficiency, its ability to fulfill obligations in partnerships, its capacity to raise capital in the open market, and its ability to make efficient use of assets and employees.

The *state context* and the *NOC strategy and behavior drivers* are not significant; no conclusion can be drawn on the relevance of these two drivers to value creation.

Overall, the results of the exploratory model parameters cannot be viewed as offering substantial understanding of NOC value creation. However, understanding the constraints and possible limitations of the present data set and model will contribute to enhancing future research.

4.2 Case Studies

This section analyzes the history and performance of twelve NOCs with the objective to derive lessons of wider applicability. The case study sample includes NOCs that span the range of experience with respect to the drivers of value creation. Some belong to countries that are blessed with large resource endowments (*República Bolivariana de Venezuela* and Kazakhstan), while others have limited domestic resources (such as Ecopetrol, PetroSA, and PTT). Some are key contributors to their countries' economies (PDVSA, Pemex, Petronas, and Sonatrach). Some are vertically integrated (Ecopetrol, PDVSA, Pemex, Petrobras, Petronas, ONGC, Petrochina, Sonatrach, and Statoil), while

others focus on one or two steps of the sector value chain (KMG EP, PTT, and PetroSA). Most are mainly commercial entities, while others have regulatory functions (PDVSA and Petronas). Some have a domestic focus (Ecopetrol, KMG EP, Petrobras, Petrochina, Pemex, Sonatrach, and Statoil), while others derive a substantial part of their revenues from international operations (ONGC, PDVSA, Petro SA, and particularly Petronas and PTT). Some are quoted on domestic and international stock exchanges (Ecopetrol, KMG, Petrobras, Petrochina, and Statoil), some are only quoted domestically (ONGC, PTT), and others are not quoted at all (PDVSA, Pemex, Petronas, Petro SA, Sonatrach).² Ten of the NOCs in the case study group (and fifteen of the NOCs included in the statistical analysis) are included in the Petroleum Intelligence Weekly (PIW) Top 50 ranking of petroleum companies.³

Table 4.4 provides a quick overview of: (i) the VCIs and drivers of value creation for each NOC in the case study sample; (ii) the factors that have affected value creation; and (iii) the main conclusions from the case studies. Detailed case studies and VCI calculations can be found in the data annexes to this paper—volumes II and III—downloadable from www.worldbank.org/noc.

4.3 The Corporate Governance of NOCs

The importance of governance in improving the level and sustainability of state-owned enterprises (SOEs) performance has been the object of several research papers (see appendix 3).⁴ Some authors see good governance as a prerequisite for effective privatization. This is supported by the recent trend in SOEs reforms, where better corporate governance has become a priority, including in countries in which the public sector accounts for a sizable proportion of the economy. But existing research suggests that the corporate governance of NOCs typically compares unfavorably to private sector standards or other SOEs, whether it is regarding transparency, accountability, internal financial controls, commercial oversight, or management structures. Opaque and inefficient corporate governance mechanisms hinder NOCs' ability to create value, and in some cases facilitate the development of corrupted practices.

Drawing from the experience of a selected sample of NOCs, this section investigates whether there are systemic differences between the corporate governance arrangements of NOCs, and generally accepted corporate governance standards for SOEs or POCs, and whether these differences may be ascribed to specific factors that are unique to NOCs.⁵

4.3.1 Context Variables and NOC Corporate Governance

From a corporate governance perspective, adequate oversight and control exercised by the owners seems to be of primary importance in order to reduce information asymmetries and the potential for managerial rent-seeking. Although generally accepted principles of good corporate governance exist, the design of oversight and control systems may be affected by the mandate of the NOC, which in turn depends on a number of context variables, such as a country's public sector governance, its oil dependency, and the size of its resource endowment, and affects the NOC's strategy. Were this to be the case, NOCs with similar mandates and similar context variables would be similarly organized. To test this hypothesis, this subsection analyzes the external and internal corporate governance arrangements of a group of NOCs that reflect a wide range of possible combinations of these variables (table 4.5).

Table 4.4. Case studies: overview

Company	VCI and value drivers						Key factors	Main conclusions
Ecopetrol, Colombia	VCI:						The major institutional and regulatory reforms launched by the government in 2003 were intended to address the decline in production levels and reserve basis, which was affecting the country's fiscal sustainability and its security of supplies.	High levels of commitment and cooperation between the NOC and its government and fast execution have proven critical to the successful implementation of far-reaching sector and corporate governance reforms.
Establishment: 1951	2004	2005	2006	2007	2008	5-Yr Avg		
Mission Statement: To discover new energy sources and to transform them into value for clients and shareholders by protecting the environment and ensuring process safety and people's integrity.	0.46	0.39	0.44	0.48	0.45	0.44	The reform of the fiscal regime and the elimination of Ecopetrol's mandatory participation requirement created the conditions for increased exploration expenditure, which will hopefully result in future reserves growth.	
	Geology: At the end of 2008 proven oil and gas reserves were estimated at 1.7 billion barrels and 4.4 trillion cubic feet respectively. The Middle Magdalena Valley is the most explored basin in Colombia and is still one of the most prolific. But large parts of the country are under-explored and have many of the geological features of its oil-rich neighbor Venezuela, RB.						The promotion of competition and the partial privatization of Ecopetrol appear to have created additional incentives for the NOC to improve its performance.	
	State context: Despite its history of widespread violent conflicts, the country has made significant efforts on issues such as expanding international trade, strengthening rule of law, protecting human rights, promoting governance, and reducing poverty. In 2008 the petroleum revenue was approximately ten percent of total government revenue.							
	Petroleum sector governance: In 2003, the government opted for the strict separation of policy, regulatory, and commercial responsibilities, and transformed its NOC from a government department to a mixed-share company.							
	Corporate governance: Ten percent of Ecopetrol's equity is publicly traded in Colombia and the US. Two-thirds of the BOD members are independent directors, and the NOC's internal and external governance structure compares well with other NOCs in our study sample (see section 4.2).							
	Strategy and behavior: Ecopetrol is a vertically integrated company. It dominates oil and gas production, refining, oil and gas transportation and petrochemicals in the country. Ecopetrol's reserve base is relatively mature. Years of underinvestment in exploration have hindered the NOC's ability to replace its reserves. Recent international expansion aims at diversifying the NOC's portfolio and improving its technical skills. The NOC's workforce comprises mainly nationals. The NOC does not have non-commercial or non-core commercial activities, but has made substantial investment in developing backward linkages.							

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Table 4.4. Case studies: overview (continued)

Company	VCI and value drivers						Key factors	Main conclusions
Kazmunaigaz EP, Kazakhstan Establishment: 2004. Mission Statement: To build on its position as a leading oil and gas company in Kazakhstan by increasing its production and replacing its reserves both through acquisitions in the short-to-medium term, and through exploration in the longer term.	VCI:						By the early 2000s, the oil and gas industry was the major driver of the country's economy accounting for about 62 percent of export earnings and close to 40 percent of the government's budget revenue. Consequently the government made two key policy decisions: (i) to create the National Fund of Kazakhstan; and (ii) to created a strong NOC. Since the NOC's initial portfolio of assets contained mature fields, the government granted it a series of commercial privileges by law, aimed at providing the NOC with a clear competitive advantage. These include: the right of first refusal on any onshore oil and gas rights, interests or assets offered for sale in Kazakhstan; preferential access rights to KMG oil and gas transportation assets; and access to unlicensed acreage in Kazakhstan without the need for the government to run a competitive tender process. In addition, all new PSAs post 2004 must include at least 50 percent participation of KMG EP, carried through exploration. A modern corporate governance structure was set up, to afford the NOC the management flexibility needed to fulfill its mission. The NOC does not have large non-commercial obligations, nor it is required to undertake non-core commercial activities beyond those acquired at the time of its creation.	As long as Kazakhstan's investment conditions remain attractive to private investors, protectionist policies may be one of the most effective ways for the government to help the NOC achieve the size and economies of scale necessary to become a fully fledged oil and gas corporation.
	2004	2005	2006	2007	2008	5-Yr Avg		
	0.40	0.30	0.40	0.55	0.53	0.43		
Geology: At the end of 2008 proven oil and reserves were estimated at 30 billion barrels and 85 trillion cubic feet respectively. Kazakhstan has a relatively immature but large oil and gas resource base. State context: Oil revenue accounts for approximately 40 percent of total government revenue. Exchange rate volatility driven by fluctuations in oil prices, pressing development needs, and limited implementation and absorptive capacities are among Kazakhstan's key policy challenges. But over the past several years important reforms have been undertaken through the adoption of international standards for the productive, financial and public sectors and to diversify the economy away from oil and minerals. Kazakhstan's Governance Indicators have been improving over the period 2004–08. Although within regional average, the control of corruption and voice and accountability indicators rank in the 10th to 25th percentile. Petroleum sector governance: Policy and regulatory functions in the hydrocarbon sector are carried out by the Ministry of Energy and Mineral Resources. KMG EP and its holding, KMG, are purely commercial entities. Private company participation is permitted in the sector. Corporate governance: KMG EP is 63 percent owned by parent company KMG (itself wholly owned by the government of Kazakhstan through the Ministry of Energy and Mineral Resources via the holding company Samruk-Kazyna). Of the NOC's BOD members, 38 percent are independent. NOC strategy and behavior: KMG EP is the second largest Kazakh oil producing company. It was founded as upstream and Kazakhstan-focused commercial company, with oil and gas reserves that were largely mature. In addition it has supplemented its asset base with ongoing domestic acquisitions. KMG EP is requested to contribute to national and regional projects, and discloses associated costs on its website.								

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Table 4.4. Case studies: overview (continued)

Company	VCI and value drivers						Key factors	Main conclusions
ONGC, India	VCI:						ONGC's strategy to enhance domestic production and to find equity oil abroad helped to stabilize its oil and gas reserves and production	ONGC's core expertise in production activities may be the natural response to its shareholder's short-term drive to increasing production levels, but it may pose threats to the NOC's sustainability going forward.
Establishment: 1994.	2004	2005	2006	2007	2008	5-Yr Avg		
Mission Statement: The NOC has no publicly stated mission. The following was taken from the 2006 annual report, which includes a vision from the President of India. "To be a leader in: (i) the exploration and management of petroleum resources; (ii) the diversification of energy sources; and (iii) technology in Underground Coal Gasification. Finding new ways of tapping energy wherever it is, to meet the ever growing demand of the country."	0.50	0.43	0.48	0.53	0.48	0.48		
Geology: At the end of 2008 India's proven oil and gas reserves were estimated at 5.8 billion barrels and 38.5 trillion cubic feet respectively. Approximately 20 percent of the known geological basins are moderately to well explored. The rest is in different stages of exploration.								
State context: With high economic growth rates, India is a significant consumer of energy resources. But it lacks sufficient domestic resources, and is a net importer of oil and natural gas. A central element of India's foreign affairs agenda is 'energy diplomacy', which relates to the need to secure energy supplies to meet rapidly growing industrial and consumer demand. The petroleum sector is dominated by state-owned enterprises, and reforms to reduce state control have been slow. With the exception of political stability, India's Governance Indicators are above the regional average and have been fairly stable over the period 2004–08. But regulatory quality and control of corruption remain key concerns.								
Petroleum sector governance: The Directorate General of Hydrocarbons, under the administrative control of the Ministry of Petroleum and Natural Gas, regulates the exploration and exploitation of oil and gas resources and administers bidding rounds. In 1999 the Directorate introduced the New Exploration Licensing Policy (NELP), which eliminated the obligation for one private oil company to partner with the NOCs. Since then, the NOCs have had to compete for acreage with private companies.								
Corporate Governance: It is the larger of India's two NOCs. The government controls 84.2 percent of ONGC. The BOD comprises two executive directors and eight non-executive directors, only two of which are independent. The President of India appoints the BOD members.								
NOC strategy and behavior: International production accounts for about 14 percent of total production. Operates alone in 43 percent of its international projects and is a joint operator in an additional 12 percent. Currently has international production in the Sudan; Vietnam; Syria; Russia; Colombia; Venezuela, RB; and Brazil and exploration projects in Myanmar, Egypt, and Iran. It is the smallest refiner in India. Besides substantial price subsidies (the highest in our study sample), ONGC does not have special social and economic development projects.								
The NOC's core expertise is in the production of shallow water and onshore fields, which is a mismatch with India's exploration and production opportunities that are believed to be in deepwater.							The NOC is a newcomer in the international oil and gas arena and faces considerable learning curve costs and risk.	Diversification further down the oil and gas value chain and price subsidies risk distracting NOC's management, and detract resources from oil and gas exploration.
ONGC bears the largest petroleum product subsidies burden among NOCs in our sample.								
ONGC does not seem to attract as large a proportion of foreign direct investment as its competitors in India. This may reflect of views about corporate governance, strategy, behavior, or other management attributes.								Acquisition of deepwater technologies and strategic alliances with international POCs will be necessary for sustainable value creation.

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Table 4.4. Case studies: overview (continued)

Company	VCI and value drivers						Key factors	Main conclusions												
PDVSA, Venezuela, RB	VCI:						Venezuela, RB saw a considerable decline in oil production, especially since the government imposed restrictions on private participation in oil production activities. The NOC's reserves replacement rate has been sharply declining since 2006.	The large reserves base and the sustained level of oil prices until August 2008 allowed the NOC to support a drastic change in priorities and objectives. However, the reforms introduced by the government have shifted a larger share of exploration and production risk to the NOC by reducing foreign investments and the NOC's ability to partner with POCs.												
Establishment: 1975.	<table><tr><th>2004</th><th>2005</th><th>2006</th><th>2007</th><th>2008</th><th>5-Yr Avg</th></tr><tr><td>0.65</td><td>0.55</td><td>0.66</td><td>0.57</td><td>0.51</td><td>0.59</td></tr></table>						2004	2005	2006	2007	2008	5-Yr Avg	0.65	0.55	0.66	0.57	0.51	0.59	The NOC's investment in upstream and downstream petroleum sectors declined over the period of the study, perhaps affected by increasing use of cash flow for non-core activities and worsening of the debt to equity ratio. But the underinvestment in complex fields has reduced the NOC total production costs. This resulted in short-term improvements in financial performance, but long-term risk.	Excessive reliance on the NOC to achieve national mission objectives creates competing demands on the NOC. Given the NOC's limited amount of financial and technical resources, these measures may result in erratic operational and financial performance, which may threaten the sustainability of the NOC's national mission performance.
2004	2005	2006	2007	2008	5-Yr Avg															
0.65	0.55	0.66	0.57	0.51	0.59															
Mission Statement: To ensure the efficient, profitable, and dependable exploration, production, refining, transport and sale of petroleum and petroleum products; to promote technological independence; to foster the harmonic development of the country; to guarantee sovereignty of national resources; to protect the environment; and to serve and benefit the Venezuelan people.	<p>Geology: Venezuela, RB has one of the largest hydrocarbon endowments in the world. At the end of 2008 Venezuela RB's oil and gas proven reserves were estimated at 172 billion barrels and 176 trillion cubic feet respectively. The Orinoco Belt contains one of the largest recoverable oil accumulations in the world.</p> <p>State context: The country's dependence on oil revenue has grown considerably since 2004. In 2008 oil revenue represented 33 percent of GDP. Since 1975 the industry and trade of hydrocarbons for the state. Venezuela, RB scores poorly in terms of World Governance Indicators, especially with respect to the rule of Law. Following the wave of expropriations in 2006, uncertainty with respect to contractual and property rights has affected Venezuela RB's attractiveness to FDI.</p> <p>Petroleum sector governance: Current law requires PDVSA to have at least 60 percent participating interest in each joint venture with POCs. Ministry of Energy formulates policies and acts as the regulator. The NOC has some regulatory responsibility.</p> <p>Corporate Governance: Public limited company, wholly owned by the state. The BOD comprises 10 members, of which two are not government officials or NOC executives. The BOD is appointed by the President of Venezuela, RB. The NOC has limited financial and budget autonomy. Since 2005 the NOC has used internal auditors. The NOC publishes annual reports, which are no longer submitted to the US Securities and Exchange Commission.</p> <p>NOC strategy and behavior: The NOC is vertically integrated along the petroleum sector value chain. International investments are minor but strategic and are mostly limited to the regional market. E&P activities are limited to Venezuela, RB. The NOC has some petrochemical production and power generation. Its national mission objectives have been substantially stepped up in recent years. Non-commercial obligations include the provision of social services, social safety networks, and subsidized petroleum products.</p>						Substantial petroleum price subsidies have dampened the NOC's financial performance while inflating demand.	Weak corporate governance and internal management processes appear to constrain the NOC's human resource capital and skills, exacerbating the impact of underinvestment.												

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Table 4.4. Case studies: overview (continued)

Company	VCI and value drivers						Key factors	Main conclusions												
PEMEX, Mexico Establishment: 1938. Mission Statement: To maintain oil production at 3.1mmbd until 2012; to achieve 100 percent reserve replacement ratio by 2012/2013; to achieve R/P ratio of 10 years; to maintain gas production increases above demand growth; to reduce gasoline imports; to enact crucial operational upgrades in refining and petrochemicals; and to reduce investment leverage.	VCI: <table border="1"><thead><tr><th>2004</th><th>2005</th><th>2006</th><th>2007</th><th>2008</th><th>5-Yr Avg</th></tr></thead><tbody><tr><td>0.39</td><td>0.32</td><td>0.39</td><td>0.45</td><td>0.40</td><td>0.39</td></tr></tbody></table> <p>Geology: At the end of 2008 Mexico's proven oil and gas reserves stood at 11.8 billion barrels and 17.6 trillion cubic feet respectively. Around 55 per cent of Mexico's oil reserves are in deep waters, where over half of the country's potential reserves are expected to lie.</p> <p>State context: Oil revenue represents approximately 40 percent of total government revenue. Pemex's dominance as the largest single contributor is a key motivator for government intervention in the petroleum sector. Mexico's World Governance Indicators have been deteriorating over the period 2004–08, except for control of corruption that shows a slight improvement.</p> <p>Petroleum sector governance: The NOC has the monopoly in the petroleum sector. It has no regulatory powers. Various government entities carry out supervision and regulatory functions. The Department of Energy (Secretaría de Energía, or SENER) exercises the ownership rights of the state; Pemex's budget is authorized annually by the Department of Finance and Public Credit (Secretaría de Hacienda y Crédito Público, or SHCP), and approved by Congress. The Comisión Reguladora de Energía (CRE) regulates the natural gas sector. The newly established national hydrocarbon commission (CNH) advises the President on energy policy and interacts with the other federal entities and with Pemex.</p> <p>Corporate governance: Established by the Mexican Congress as a Public Limited Company wholly owned by the state. The BOD consists of 15 members. The President of Mexico appoints 6 government officials and 4 professional directors to the BOD. The Petroleum Workers Union appoints the remaining 5 directors. The President of Mexico also appoints the Director General of Pemex. SENER exercises the ownership rights of the government.</p> <p>NOC strategy and behavior: No international upstream operations. The NOC is an integrated oil and gas producer, refiner, and distributor and is diversified in the petrochemical business. Currently, approximately 74 percent of oil production comes from offshore, most from a single large oilfield, Cantarell. Production has been steadily declining since 2004. Pemex is no longer a major source of employment or of substantial direct, non-commercial investment. Price subsidies, although provided, are well below the average of the NOCs in our sample. Pemex's downstream investment programs have closed the gap on meeting Mexico's petroleum products demand, but the company still does not meet 100 percent of internal requirements. Above all Pemex is the largest single contributor of government revenue, and its financial management has historically been tightly intertwined and heavily affected by its owner's budgetary needs.</p>	2004	2005	2006	2007	2008	5-Yr Avg	0.39	0.32	0.39	0.45	0.40	0.39	<p>The NOC is an efficient producer of existing reserves but lacks the capital and technology to replace those reserves.</p> <p>Fiscal contribution to the state is vital for Mexico's economic stability, but strongly constrains the NOC's ability to invest in maintaining production levels from declining fields, exploring for new fields, and investing in technologies and human capital.</p> <p>Company's fiscal obligations have forced it into debt markets, resulting in a highly leveraged balance sheet relative to capex needs, which leaves little room for further debt expansion.</p> <p>Recent governance reforms have improved transparency and attempted to create at least some room for the BOD to participate in operations and decision making. Further innovation in its management structure may be necessary to lead to sustainable value creation.</p>						<p>Pemex's monopolistic position provided the framework for building a significant asset base and production expertise. It also precluded the participation of private investors, however, which has deprived the NOC of access to world-class technologies and managerial expertise. The impossibility of partnering with other companies has left Pemex to shoulder the drill bit risk entirely.</p> <p>The 2008 reforms represent an effort to invigorate and expand private and foreign direct investment flows into priority upstream projects, but the lack of clarity and slow pace of implementation may drastically reduce its intended effects.</p>
2004	2005	2006	2007	2008	5-Yr Avg															
0.39	0.32	0.39	0.45	0.40	0.39															

(continued on next page)

Table 4.4. Case studies: overview (continued)

Company	VCI and value drivers						Key factors	Main conclusions
Petrobras, Brazil	VCI:							
Establishment: 1953.								
Mission Statement:								
To operate in a safe and profitable manner in Brazil and abroad, with social and environmental responsibility, providing products and services that meet clients' needs and that contribute to the development of Brazil and the countries in which it operates.								
	2004	2005	2006	2007	2008	5-Yr Avg		
	0.49	0.41	0.40	0.39	0.35	0.41		
	Geology: At the end of 2008 Brazil's oil and gas proven reserves stood, respectively, at 12.8 billion barrels and 12.8 trillion cubic feet. The country still has a large number of sub-mature and frontier areas, including the recently discovered sub-salt province.							
	State context: Petroleum revenue represents a relatively small part of total government revenue. After the sector reform in 1997 the government has been careful to create a legal and regulatory framework that ensures the participation of domestic and foreign investors. However, since the large pre-salt discoveries in 2007, this policy has been partially reversed. Except for the rule of law and voice and accountability, Brazil's Governance Indicators have been deteriorating over the period 2004–08.							
	Petroleum sector governance: The NOC had a monopoly on virtually all petroleum sector activities until the 1997 reform. Conselho Nacional de Política Energetica is part of the government's executive branch and advises the President in the formulation of national energy policy. The Ministry of Mines and Energy chairs the CNPE and is a member of Petrobras' BOD. The MME is responsible for implementing CNPE recommendations and overseeing the development planning for the hydrocarbon sector. The National Petroleum Agency is the upstream regulator.							
	Corporate governance: The government owns 40 percent of Petrobras' outstanding capital stock and 56 percent of its voting shares, giving it majority control of the company. The NOC is quoted on the Brazilian Bovespa, New York, Buenos Aires, and Madrid Stock Exchanges. The nine members of the BOD are appointed at the ordinary general meeting of the shareholders. Various government ministries are represented on Petrobras' BOD, including the Minister of Treasury, who is the chairman. One board member represents the minority shareholders of common stock, and another represents the holders of preferred stock. In compliance with Brazilian Corporate Law, the BOD is overseen by a five member Fiscal Council. The NOC has considerable financial and budgetary autonomy, but the capital budget is approved by Congress.							
	NOC strategy and behavior: The NOC is a fully integrated petroleum company, diversified in petrochemicals, fertilizers, power generation, renewable energy, and biofuels. It dominates the domestic market in virtually all business segments, and is active in 27 countries. The NOC's national mission objective includes energy self-sufficiency and the development of backward and forward linkages.							
							The NOC is the largest individual holder of concessions in Brazil and has a majority interest in most other concessions.	Petrobras was created as state-owned enterprise with majority state participation. The government deliberately granted the NOC administrative and financial independence and a commercial mandate.
							The NOC is the largest investor in research and development among the oil majors and a recognized leader in deep and ultra-deepwater exploration and production.	Although the NOC was granted a monopoly in the petroleum sector (with the exception of retail distribution), the participation of domestic and foreign private companies was never prohibited.
							Recent discoveries in the deep-water pre-salt area have largely improved the NOC's resource base and resource potential. But risk profile has increased, since pre-salt exploration and development is unknown, technologically complex, and very expensive.	When the NOC was established, there was no oil industry in Brazil. The country was not perceived as prospective, and costs were higher than those in more established oil provinces.
							The country has a well-defined local content policy, and the NOC has a strong track record of developing the local supply industry and local skills and promoting technological advances.	The NOC had to develop the industry without the benefit of relying on existing know-how and operations. Investing in technology, human capital, and the development of the domestic supply industry was inevitable and has allowed the NOC to develop a strong competitive advantage in the domestic market by relying on its core commercial operations.
							Since the large pre-salt discoveries in 2007, the government has partially reversed its policy of cooperative and competitive participation, granting its NOC privileges over the prolific pre-salt basin and paving the way for increased state participation in the sector. The bills approved by the Brazilian congress in June 2010 present new challenges and opportunities for both the NOC and POCs.	

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Table 4.4. Case studies: overview (continued)

Company	VCI and value drivers						Key factors	Main conclusions
Petro China, China	VCI:						The NOC faces typical learning curve, risk and cost challenges associated with sizeable expansion in unfamiliar markets. However, this strategy is likely to yield its benefits in the medium term. In addition, the NOC's profitability has been under pressure from increasing costs in its mostly mature upstream sector. Prices for refined products were held below international market levels from 2005 to 2008. As a result, the NOC incurred losses in its refining operations averaging five percent of revenues per year. A similar situation applies to the natural gas market, where prices are kept below market levels to support the development of fertilizer manufacturers.	More competitive fiscal regimes would attract foreign investors and help the NOC to address declining production from mature assets that require the use of advanced production technology. Price subsidies reduce the cash flow available to the NOC for reinvestment in its core business and may contribute to delaying the reforms needed to create robust internal market conditions. Large, complex bureaucracies may create competitive disadvantages for the NOC.
Establishment:	2004	2005	2006	2007	2008	5-Yr Avg		
Mission Statement:	0.46	0.38	0.33	0.35	0.33	0.37		
To transform Petro China into an international energy company with strong competitiveness.								
<p>Geology: At the end of 2008 China's oil and gas proved reserves stood at 14.8 billion barrels and 86.7 trillion cubic feet respectively. While there are significant onshore gas reserves, China's natural gas market is relatively undeveloped.</p> <p>State context: China's dependence on oil imports and the government's concern about the security of supplies are important factors' in China's efforts to secure greater access to global oil and gas resources. Government's loans to and infrastructure investment in oil producing countries may have helped to create comparative advantages for Chinese NOCs. Except for political stability and voice and accountability, China's Governance Indicators have been steadily improving over the period 2004–08.</p> <p>Petroleum sector governance: The NOC has no regulatory functions. A number of agencies and ministries are responsible for specific aspects of sector governance.</p> <p>Corporate governance: CNPC owns 87 percent of Petro China's equity, and public shareholders own the remaining 13 percent. CNPC is traded on the Shanghai; Hong Kong SAR, China; and New York Stock Exchanges. One-third of the members of the BOD are independent. BOD appoints the company's senior management, but the Ministry of Personnel also involved. A "supervisory board" monitors financial matters and oversees BOD senior management.</p> <p>NOC strategy and behavior: The NOC is China's largest producer of oil and natural gas, accounting for 60 percent of oil production, 80 percent of gas production, 70 percent of oil and gas transportation, and 35 percent of refining capacity. It has interests in various oil and gas assets in twelve countries including Kazakhstan; Venezuela, RB; and Peru. The NOC also has substantial interest in refining, petrochemicals, and natural gas transportation. Its national mission is to contribute to the creation of employment opportunities. The NOC does not have noncommercial or local content objectives or obligations, since these are discharged by the CNPC.</p>								

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Table 4.4. Case studies: overview (continued)

Company	VCI and value drivers						Key factors	Main conclusions											
Petronas, Malaysia	VCI:						Petronas' fiscal burden increased between 2004 and 2008, likely due to the progressive features of Malaysia's fiscal regime for hydrocarbons. There is no indication of different tax treatment for the NOC and POCs.	Focus on operatorship, technical skills, and the development of the local supply industry allowed the NOC to improve its efficiency, while fulfilling its national mission objectives.											
Establishment: 1974.							Natural gas price subsidies are approximately 7 percent of total revenue.	An attractive fiscal regime ensures POCs' investment, which in turn helps the NOC to arrest declining domestic reserves.											
Mission statement: Become an "oil and gas multinational of choice". Develop a leading core oil and gas business in which Petronas is "capability advantaged" and expand these businesses internationally. Focus on profitability and growth. Develop an increasingly international culture and world class organizational management and business practices while retaining a distinct Malaysian identity. Be a good corporate citizen in the areas where the company operates.	<table><tr><th>2004</th><th>2005</th><th>2006</th><th>2007</th><th>2008</th><th>5-Yr Avg</th></tr><tr><td>0.51</td><td>0.41</td><td>0.42</td><td>0.46</td><td>0.38</td><td>0.44</td></tr></table>	2004	2005	2006	2007	2008	5-Yr Avg	0.51	0.41	0.42	0.46	0.38	0.44	Geology: At the end of 2008 Malaysia's oil and gas reserves stood at 5.5 billion barrels and 84 trillion cubic feet respectively. Most fields have been producing for over 30 years, and production levels are declining fast. Remaining fields are of lower quality, relatively small in size, and far from existing infrastructure.					Although the NOC has exclusive powers over the country's petroleum resources, it does not seem to have used it to capture immediate gains to the detriment of long term value creation. Rather it seems that the NOC and its government have pursued a strategy of partnering and risk sharing with private companies.
2004	2005	2006	2007	2008	5-Yr Avg														
0.51	0.41	0.42	0.46	0.38	0.44														
	State context: Hydrocarbon revenue as a percentage of total government revenue increased from 20 percent in 2004 to 44 percent in 2008. Federal debt is quite modest, which provides fiscal flexibility. But the government appears to rely on the NOC to provide resources to the country's economy at difficult times. Among Malaysia's Governance Indicators, government effectiveness scores very highly. But voice and accountability and political stability have been deteriorating over the period 2004–08.						The NOC's good financial performance is generally ascribed to its low cost integrated operations.												
	Petroleum sector governance: The NOC was given exclusive rights and powers over Malaysia's petroleum resources since its establishment. There is no independent upstream policy/regulatory entity. The NOC has regulatory powers in upstream and the Malaysian Prime Minister has considerable influence over sector policy. The Ministry of Energy, Green Technology and Water, through the Energy Commission is responsible for midstream and downstream hydrocarbon sector regulation.						The NOC is a key vehicle for local content. Investment in training and education is an important element of the NOC strategy.												
	Corporate governance: The Prime Minister appoints the chairman of the BOD, who is also CEO. The BOD has no independent members. The BOD has considerable powers, and the NOC has considerable financial and budgetary autonomy.																		
	NOC strategy and behavior: At the beginning of the 1990s, the NOC decided to enter the international upstream business, probably driven by the decline of its domestic mature assets. Today Petronas is an integrated oil and gas company with interests in petrochemicals and maritime shipping and logistics. More than 40 percent of its revenue comes from international operations (mainly Africa), while export revenue was around 37 percent of total revenue in 2008. The NOC's objectives are clear and publicly stated. Historically it had a central role for local content development. Natural gas prices are subsidized.																		

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Table 4.4. Case studies: overview (continued)

Company	VCI and value drivers	Key factors	Main conclusions												
Petro SA, South Africa	VCI: <table><tr><th>2004</th><th>2005</th><th>2006</th><th>2007</th><th>2008</th><th>5-Yr Avg</th></tr><tr><td>0.09</td><td>0.26</td><td>0.22</td><td>0.23</td><td>0.22</td><td>0.20</td></tr></table> <p>Geology: At the end of 2008 South Africa had proven oil and gas reserves of 15 million barrels and 318 billion cubic feet respectively. Exiting reserves are located offshore southern South Africa or near the border with Namibia. There is currently no onshore drilling, and very limited offshore exploration since 2001. Industry analysts suggest that hydrocarbon potential may exist in deep water.</p> <p>State context: The petroleum sector has played a minimal role in South Africa's economy. The country is a net petroleum importer. The Black Economic Empowerment policy, which aims to generate sustainable growth through the redistribution of wealth and opportunities to disadvantaged communities, has played a key role in shaping institutional arrangements and foreign investment in all economic sectors, including petroleum. Although a slight deterioration was recorded for all Governance Indicators over the period 2004–08, South Africa scores remain considerably above the regional average.</p> <p>Petroleum sector governance: The Department of Minerals and Energy (DME) has policy setting responsibilities and oversees various sector regulators. The National Energy Regulator of South Africa (NERSA) regulates policy over the energy industry and is responsible for implementing South Africa's energy plan. The Petroleum Agency, a subsidiary of CEP Group, is tasked with the promotion and licensing of petroleum exploration and production rights. The NOC has no regulatory functions.</p> <p>Corporate governance: The NOC is a public limited company wholly owned by the state, through the CEF Group, which is a state-owned enterprise itself. The DME exercises the ownerships rights of the state. Of the 15 BOD members, 5 are not government officials or company executives. The BOD has ample authority and power within the limits imposed by strategic and operational policies and targets set by the DME. The company is required by law to pay a certain level of dividends to its shareholders (the state) on an annual basis. Petro SA is audited by the Auditor General.</p> <p>NOC strategy and behavior: The NOC focuses on upstream oil and gas exploration and production, and is a world leader in gas to liquids (GTL) technology. The NOC has a thin exploration and production asset base, mainly relying on gas fields offshore of Mossel Bay. The NOC sells its products at market price and receives government subsidies to support its GTL production and petroleum product purchases. The NOC aims to become a player across the entire petroleum sector value chain. To this end a large refinery project is underway and is expected to become operational in 2015. The NOC's objectives are clear and publicly known. They include improving South Africa's security of supplies, promoting local development, and employment opportunities under the Black Economic Empowerment initiative.</p>	2004	2005	2006	2007	2008	5-Yr Avg	0.09	0.26	0.22	0.23	0.22	0.20	<p>The NOC has consistently exceeded its national mission objectives. However, it has fallen short of its 30 percent target share of national production.</p> <p>Between 2004 and 2008, the sharp devaluation of the national currency, the Rand, has amplified the effect of the worldwide trend in rising finding and development costs. Nonetheless, the NOC has been able to generate positive cash flow and to maintain its exploration budget. But exploration success has yet to materialize.</p> <p>Increased NOC involvement in refining investment is likely to trigger more upstream investment to guarantee security of supply. To improve production levels and its reserves replacement rate, the NOC has stepped up its upstream investment, both domestically and internationally.</p> <p>The company relies on partnerships with POCs, which lowers its investment risk and exposes it to international best practices. This is particularly relevant when geology and distance to market present challenges.</p>	<p>The Mineral and Petroleum Resources Development Act of 2002 became effective in 2004 but was not applied until 2008. Implementation of the reforms introduced by law was unclear. The obligation to renegotiate pre-1994 leases to incorporate new requirements generated uncertainty and affected the level of investment in the sector.</p> <p>National mission goals, particularly those related to energy security, employment opportunities, and local economic development are among the main imperatives for the company. However, operational performance of the company has been deteriorating, particularly since 2006. Future sustainability may require a rebalancing of objectives that create competing demands on the NOC's limited resources to allow it to create a stronger asset base.</p>
2004	2005	2006	2007	2008	5-Yr Avg										
0.09	0.26	0.22	0.23	0.22	0.20										

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Table 4.4. Case studies: overview (continued)

Company	VCI and value drivers						Key factors	Main conclusions												
PTT, Thailand Establishment: 1978. Mission Statement: To focus on fostering security of supply and firm foundation that would lead to economic potency and add value for Thailand and its people. Achieve harmonious balance between economic, social, and environmental growth. World-class self-financed integrated petroleum and related corporation in Thailand and overseas, aiming for value maximization for the ultimate benefit of the organization, balancing commercial and government objectives.	VCI: <table><tr><th>2004</th><th>2005</th><th>2006</th><th>2007</th><th>2008</th><th>5-Yr Avg</th></tr><tr><td>0.38</td><td>0.24</td><td>0.30</td><td>0.29</td><td>0.41</td><td>0.32</td></tr></table> <p>Geology: At the end of 2008 Thailand's oil and gas reserves were estimated at 454 million barrels and 12 trillion cubic feet respectively. Proliferous petroleum basins are located both offshore and onshore, but the majority of current production comes from the Gulf of Thailand—a mature area with some exploration opportunities, particularly marginal fields.</p> <p>State context: The Thai government's policies and the National Economic and Social Development Plan aim to support free market, and to encourage an increasing role for the private sector in economic and social development. Thailand is a net importer of both oil and gas. Energy security is a key policy driver for petroleum exploration, as well as energy efficiency and diversification. Thailand's Governance Indicators have been deteriorating over the period 2004–08, particularly the control of corruption and political stability.</p> <p>Petroleum sector governance: PTT has no regulatory functions. The Energy Policy and Planning Office (Ministry of Energy) oversees the performance of all state-owned enterprises in the energy sector. The Ministry of Energy has policy setting responsibilities. Far-reaching sector reforms in the upstream sector were introduced by the Energy Industry Act in 2007, but these have only been partially implemented. The Act established an independent regulator, the Energy Regulatory Commission, with some regulatory powers over the natural gas sector.</p> <p>Corporate governance: PTT Public Company Limited is a joint stock company traded on the Stock Exchange of Thailand since its partial privatization in 2001. The government owns 67.1 percent of the company directly and through the Vayupak fund. The Thai Ministry of Finance exercises the ownership rights. PTT is governed by a 15 member BOD, whose members are appointed by the shareholders pursuant to the recommendations of the Nomination Committee. Approximately 87 percent of the BOD members are government officials, company executives, or both. The NOC has financial and budget autonomy. The NOC's accounts are audited by the Auditor General of Thailand.</p> <p>NOC strategy and behavior: PTT is a vertically integrated energy company with domestic and international operations in exploration and production, transportation, refining and petrochemicals, and wholesale and retail petroleum products distribution. It is the largest oil and gas producer in Thailand. About 25 percent of current oil and gas comes from its international ventures. PTT does not provide petroleum price subsidies. Its corporate social responsibility agenda is largely defined by the company, and comparable to that of most POCs.</p>						2004	2005	2006	2007	2008	5-Yr Avg	0.38	0.24	0.30	0.29	0.41	0.32	Thailand has a significant number of non-state-owned upstream operators. Oil refining is also largely competitive, with POCs controlling two out of five major refineries. Pricing of petroleum products is market-based. The NOC has a monopoly in the procurement, wholesale, and distribution of natural gas in the domestic market. PTT has a reasonable level of budget autonomy from the government, which allows streamlining and speeding up planning and investments. The NOC is a key instrument for achieving the government's national energy security objectives, which translates into the NOC's strategy of value creation through integration along the energy value chain. The NOC's efficiency and financial performance metrics reflect the complexity and capital intensive nature of its integrated business.	Thailand's openness to competition in the upstream hydrocarbon sector allows the country to advance the exploration of its largely unexplored territory without relying entirely on its NOC. PTT's corporate governance is an example of compromise between Asian and Western governance traditions, balancing the government's strategic priorities and the need to improve efficiency and transparency in the company's business. Controversy and delays in the implementation of the institutional and market reforms introduced by the 2007 Energy Industry Act may affect both sector and NOC performance if not addressed in a timely manner by the government.
2004	2005	2006	2007	2008	5-Yr Avg															
0.38	0.24	0.30	0.29	0.41	0.32															

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Table 4.4. Case studies: overview (continued)

Company	VCI and value drivers	Key factors	Main conclusions												
Sonatrach, Algeria Establishment: 1963. Mission statement: To meet Algeria's present and future needs; to maximize the long-term value of Algeria's hydrocarbon resources; and to contribute to national development, primarily by providing the required hard currency revenues.	VCI: <table border="1"><thead><tr><th>2004</th><th>2005</th><th>2006</th><th>2007</th><th>2008</th><th>5-Yr Avg</th></tr></thead><tbody><tr><td>0.72</td><td>0.69</td><td>0.77</td><td>0.67</td><td>0.65</td><td>0.68</td></tr></tbody></table> <p>Geology: At the end of 2008 Algeria's oil and gas reserves stood at 12.2 billion barrels and 159.1 trillion cubic feet respectively. The concentration of hydrocarbon accumulations in the Eastern Sahara reflects current technology knowledge and the historical evolution of exploration efforts. Algeria remains both unequally explored and underexplored.</p> <p>State context: Petroleum revenue represents approximately two thirds of total government revenue. Sonatrach is a major contributor to its country's economy. This has at times affected its ability to reinvest sufficient resources in its core activities, affecting the pace of exploration and development. Algeria fares poorly on all World Governance Indicators. Rankings over the period 2004–08 have worsened steadily.</p> <p>Petroleum sector governance: The NOC was divested of its regulatory powers in 2005. The Ministry of Energy and Minerals has policy responsibility. Two independent regulators, ALNAFT and ARH, are respectively responsible for: (i) managing national hydrocarbon resources, including licensing rounds, concessions and contracts; and (ii) regulation and oversight of pipeline network access, tariffs and safety, and environmental regulation.</p> <p>Corporate governance: The NOC is a public limited company wholly owned by the State. The Ministry of Energy and Minerals exercises the ownership rights of the state. Most directors are government officials or executives. The NOC budget is subject to approval by the General Assembly.</p> <p>NOC strategy and behavior: The NOC was initially only responsible for the transportation and marketing of hydrocarbon products. It has evolved into a fully integrated oil and gas company, diversified in power generation and renewable energy. The NOC has interests in a number of non-core commercial activities. It has limited international exploration and production ventures (mainly in Africa), and faces a mature and declining resource base. Sonatrach is tasked with promoting backward linkages through the "Algerianization" of the oil and gas sector and its contribution to socioeconomic programs. The extent of this contribution is not disclosed. Petroleum product prices are subsidized.</p>	2004	2005	2006	2007	2008	5-Yr Avg	0.72	0.69	0.77	0.67	0.65	0.68	<p>Amendments to the 2005 Hydrocarbons Law were passed in 2006. In contrast with the original reform that aimed to increase competition in the upstream oil and gas sector, Sonatrach was mandated to participate in all upstream, midstream and downstream (refining) projects with a minimum controlling interest of 51 percent. In addition, the law introduced a 50 percent windfall tax when oil price is above \$30.</p> <p>The recent high oil and gas prices, and the NOC's strategic location with respect to consumers' market in Europe, on the one hand have helped to support the NOC's financial performance.</p>	<p>Political conditions in Algeria and the country's reliance on Sonatrach's revenue streams are such that Sonatrach's investment decisions rest on a complex set of political, economic, and project specific considerations. For the NOC to sustainably create value, its financial autonomy and resources would need to be commensurate to its mission.</p> <p>The quasi-monopoly position of the NOC in key rent-generating links of the sector value chain has been a deterrent to company and market reforms. This will ultimately affect the NOC's long-term ability to preserve its reserves base.</p> <p>Focus on short term rent capture may hamper NOC's value creation, even if rent extraction mechanisms target foreign investment. In other words, low return on investment compared to other countries will likely reduce future investments, and low levels of foreign investments will in turn increase the demand on NOC's own resources to support sector development. Ultimately, this is likely to result in lower oil and gas revenue for the government.</p>
2004	2005	2006	2007	2008	5-Yr Avg										
0.72	0.69	0.77	0.67	0.65	0.68										

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Table 4.4. Case studies: overview (continued)

Company	VCI and value drivers						Key factors	Main conclusions
Statoil, Norway	VCI:						Recognizing the benefits of private investment in the sector, the NOC was not granted a monopoly. The state held shares in another Norwegian oil company, Norsk Hydro, and fully private Saga Petroleum and international oil companies were allowed to invest in the sector.	The NOC owes much of its success to the ability of the Norwegian government to adapt its policies to changes in geological, economic, and market conditions. These factors, coupled with good governance transparency, an already developed industrial sector, and closeness to consuming markets in Europe, were crucial conditions for value creation by the NOC.
Establishment: 1972.	2004	2005	2006	2007	2008	5-Yr Avg		
Mission Statement: To maximize value and potential on the Norwegian continental shelf (NCS) while profitably increasing international production. It includes developing profitable midstream and downstream businesses and creating a platform for new energy sources.	0.37	0.34	0.35	0.43	0.39	0.40	During the NOC's first decade of operations, it was granted the following privileges: (i) minimum participation of 50 percent, carried through the exploration phase, in all petroleum licenses, implying veto power on all development decisions; and (ii) once a discovery was declared commercial, the option to increase participation by up to 30 percent (to a total of 80 percent) based on a sliding scale linked to production levels. These privileges were revoked in the second half of the 1980s. There were worries about the influence of Statoil on the domestic economy and (potentially) domestic politics.	The government's decisions to open the petroleum sector to private investors and eventually to revoke the NOC's state privileges were farsighted policy measures. By partnering with experienced international operators, the NOC was able to accelerate its learning curve and to develop a portfolio of assets without having to take the exploration risk. When its privileges were revoked, the NOC had to find its place in the market, but by then it had the size, strength, and knowledge to do so.
	<p>Geology: At the end of 2008 Norway's proven reserves were estimated at 7.5 million barrels of oil and 78.2 trillion cubic feet of gas. Production in the Norwegian continental shelf started 40 years ago, and the area is generally considered mature or declining. But major portions of the Barents Sea and the deepwater part of the Norwegian Sea are still frontier. The coastal areas of the southern part of the continental shelf are also relatively immature.</p> <p>State context: Petroleum revenue accounts for approximately 35 percent of total government revenue. But Norway has adopted policies to mitigate macroeconomic distortions resulting from the exploitation of petroleum resources. Norway's Governance Indicators are above the regional average, but the control of corruption and government effectiveness rankings have been slightly deteriorating over the period 2004–08. Norway's culture of transparency and accountability is considered a key ingredient for sound and sustainable management of petroleum resources.</p> <p>Petroleum sector governance: The "Norwegian model" separates responsibilities between the energy ministry (the Ministry of Petroleum and Energy, or MPE), Statoil, and independent regulators that oversee all sector participants (Norwegian Petroleum Directorate, or NPD, and a safety and environmental authority). State Direct Financial Interest (SDFI) was established in 1985 to allow the Norwegian State to participate in the Norwegian petroleum sector directly as an investor.</p> <p>Corporate governance: Statoil was wholly owned by the state until its merger with Norsk Hydro in October 2007 ("Statoil-Hydro" referred to as "Statoil"). Statoil is 67 percent owned by the Norwegian government and is quoted on the Oslo and New York stock exchanges. By international standards, Statoil has a strong corporate governance structure. The roles and responsibilities of the shareholders, the BOD, and Statoil's management are clearly defined. The BOD is composed of 11 members, of which 3 represent the NOC's employees. The others are independent.</p> <p>NOC strategy and behavior: The NOC is vertically integrated. It is a dominant player in the domestic market, where it controls 80 percent of total oil and gas production. Internationally, the NOC carries out upstream operations in 40 countries. The NOC owns and operates one of Norway's two refineries and has a 10 percent stake in a refinery owned and operated by Shell in the Netherlands. During the initial phase of development of the sector, Statoil played an important role in the development of local content. In time, this role was phased out. The NOC is now commercially oriented, and its relationship with the state is increasingly at arm's length. The NOC's corporate sustainability programs are comparable to POCs.</p>						Over the years, Statoil has become a more commercially oriented business. Two factors influencing this decision were: (1) Norway's entry into European Economic Area in 1994, (the requirement for non-discriminatory granting of NCS licenses resulted in increased competition from POCs in Norway); and (2) Statoil looking to compete internationally and needing to improve efficiency.	The state did not burden the NOC with excessive fiscal burden or non-core non-commercial obligations.

Source: Authors.

Table 4.5. Composition of corporate governance sample

NOC Revenue from Int'l Ops	Country Resource Endowment (billions of barrels of oil equivalent)			
	More than 100	50–100	10–50	Less than 10
Over 50%				GDF (<i>France</i>) ENI (<i>Italy</i>) PTT (<i>Thailand</i>)
Between 30–50%			Petronas (<i>Malaysia</i>)	
Between 10–30%	PDVSA (<i>Venezuela</i>)		CNOOC (<i>China</i>) ONGC (<i>India</i>)	PetroSA (<i>South Africa</i>)
Less than 10%	QP (<i>Qatar</i>) Rosneft (<i>Russian Federation</i>) Gazprom (<i>Russian Federation</i>)	KMG EP (<i>Kazakhstan</i>)	Petrochina (<i>China</i>) Sinopec (<i>China</i>) Pemex (<i>Mexico</i>) Petrobras (<i>Brazil</i>) Sonatrach (<i>Algeria</i>) Statoil (<i>Norway</i>)	Ecopetrol (<i>Colombia</i>) OGDCL (<i>Pakistan</i>)

Legenda:*Italics* indicates NOCs that are not vertically integrated.**Bold** indicates NOCs that belong to countries that derive more than 30 percent of their fiscal revenue from oil and gas.*Shaded areas* indicate NOCs with special privileges.

Source: Authors.

4.3.1.1 EXTERNAL GOVERNANCE

External governance arrangements relate to the relationship between the NOC and the state as its owner—that is, the ownership structure of the NOC and the organization of state ownership. Table 4.6 provides an overview of the external governance arrangements for the twenty NOCs included in the corporate governance sample.

With the exception of Ente Nazionale Idrocarburi (ENI), the states hold the majority share of voting rights in their NOC. ENI's organization is no different from that of a POC with a distributed shareholding base. The Italian Government owns 30.3 percent of the NOC's share capital. But it retains considerable control over certain decisions of the BOD through its veto power, which can be exercised under specific circumstances detailed in the company's by-laws (the so called "Golden Share").⁶ The veto power has never been exercised, but its existence permits the government to exercise considerable influence over the company's affairs, which justifies ENI's inclusion in the governance sample.

For most of the NOCs included in our sample, the ownership function of the government is exercised either by the ministry of finance or other centralized authority (53 percent of our sample), especially in countries that depend more heavily on petroleum revenue.⁷ The choice does not appear to be linked to the size of the NOC, the relative importance of its domestic and international activities, or the size of the country's resource endowment. Given the relatively small size of our sample, these finding may not be indicative of a general trend. Nonetheless, is likely that countries that depend more heavily on petroleum revenue would tend to exert their ownership rights directly or indirectly through the Ministry of Finance.

Ten out of twenty NOCs in our sample have special privileges granted to them by law, such as the exclusive right to conduct petroleum activities (solely or in association with

Table 4.6. External governance arrangements for selected NOCs

NOC	Year incorp.	Type	Listings	% govt. control	State ownership function	Number of NOCs	Special privileges
CNOOC Ltd	1982	Joint stock	Hong Kong SAR, China S.E.; New York S.E.	66.00	The State Owned Assets Supervision and Administration Commission exercises the ownership right of the Government through the China National Offshore Oil Corp. (CNOOC-Parent), itself wholly owned by the government of China. CNOOC-Parent owns 66% of the shares in CNOOC Ltd through various internationally-based subsidiaries.	3	CNOOC Ltd. is the only company permitted to operate offshore China, solely or in association with other companies subject to Production Sharing Contracts negotiated by CNOOC-Parent with input from CNOOC Ltd. CNOOC Ltd. has the right to take up to a 51% interest in any commercial discovery offshore China.
Ecopetrol	1951	Joint stock	Bolsa de Valores de Colombia, New York S.E.	89.90	Ministry of Mines and Energy	1	No special rights established by law.
ENI	1953	Joint stock	Borsa Italiana, New York S.E.	30.30 ⁽¹⁾	Ministry of Economy and Finance	1	No special rights established by law.
Gazprom	1992 ⁽²⁾	Joint stock	St. Petersburg S.E., London S.E.	50.00	The Federal Agency for State Property Management (38.373%), and indirectly through the Federal Government ownership in Rosneftgaz (10.740%) and Rosgazifikatsiya (0.889%).	4	No special rights established by law
GDF		Joint stock	Euronext (France)	36.4 ⁽³⁾	Government Shareholding Agency	1	No special rights established by law.

Notes:

(1) Eni's by-laws grant to the Minister for Economy and Finance, the following special powers: (a) opposition to the acquisition of material interests representing 3% of the share capital of Eni SpA (b) opposition to shareholders agreements or other arrangements involving 3% or more of the share capital of Eni SpA; (c) veto power duly motivated by the case of prejudice to the interests of the State with respect to shareholders resolutions to dissolve Eni SpA, to cause a transfer, merger or demerger, to transfer the registered office of Eni SpA outside Italy, to change the corporate purposes or to amend or modify any of the special powers listed in the by-laws; and (d) appointment of a Board member without voting right.

(2) On the 17th of February 1993, pursuant to the Russian Federation Government's Directive following the Russian Federation Presidential Decree of November 5, 1992, State Gas Concern Gazprom was transformed into Russian joint stock company (RAO) Gazprom. In 1998 RAO Gazprom was reincorporated into an open joint stock company.

(3) Until December 2007 the government owned approximately 80 percent of GDF's outstanding shares. After the merger between GDF and Suez in 2008, the government owns 35.7 percent of GDF Suez share capital, and 36.4 percent of the voting rights.

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Table 4.6. External governance arrangements for selected NOCs (continued)

NOC	Year incorp.	Type	Listings	% govt. control	State ownership function	Number of NOCs	Special privileges
KMG EP	2004	Joint stock	London S.E., Kazakhstan S.E	62.00	Ministry of Energy and Minisera Resources, through Samruk-Kaznya (holding company).	1	Right of first refusal on any onshore oil and gas right, interest or asset offered for sale in Kazakhstan; preferential access rights to KMG oil and gas transportation assets; right to ask KMG to enter into direct negotiations with the government for any unlicensed oil and gas acreage in Kazakhstan; 50% minimum carried participation in upstream projects.
OGDCL	1997 ⁽¹⁾	Public limited company	London S.E., Islamabad S.E., Karachi S.E.	85.20	Federal Minister for Petroleum, Natural Resources and Privatisation	3	No special rights established by law.
ONGC	1994	Joint stock	Bombay S.E., National S.E. of India	84.23	President of India directly (74.14%), and indirectly through the Government ownership in Indian Oil Corporation (6.069%) and the Gas Authority of India Ltd (1.392%).	14	No special rights established by law.
PDVSA	1975	Public limited company	Not listed.	100.00	Ministry of Energy and Petroleum.	1	The law mandates the NOC to have a minimum 60 percent interest in any petroleum producing activity in Venezuela, RB.
PEMEX	1938	Public limited company	Not listed.	100.00	Secretaría de Energía (SENER)	1	Exclusive rights to explore for and exploit oil and gas in Mexico, and to transport natural gas through the national pipeline system until 2029. ⁽²⁾

Notes:

(1) OGDCL was established as a statutory corporation in 1961 and made self-financing in July 1989. The company was incorporated as a public limited company in October 1997.

(2) POCs can invest in transportation and distribution, and build alternative pipelines to reach their clients.

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Table 4.6. External governance arrangements for selected NOCs (continued)

NOC	Year incorp.	Type	Listings	% govt. control	State ownership function	Number of NOCs	Special privileges
Petrobras	1953	Joint stock	Sao Paulo, New York, Buenos Aires, and Madrid S.E.	55.7 ⁽¹⁾	Ministry of Finance	1	No special rights between 1997–2009. Since 2010: (i) exclusive operatorship in the pre-salt province and selected areas; and (ii) 30% 2 minimum participation in these areas.
Petro China	1999	Joint stock	Hong Kong SAR, China S.E.; New York S.E., Shanghai S.E.	86.71 ⁽²⁾	The State Owned Assets Supervision and Administration Commission through the China National Petroleum Corporation (CNPC), itself wholly owned by the government.	3	Exclusive rights to enter into onshore exploration and production contracts with foreign operators through CNPC.
Petronas	1974	Public limited company	Petronas Holding is not listed, but 4 of its subsidiaries are listed on the Malaysia Bursa ⁽¹⁾	100.00	The Ministry of Finance (but some rights are reserved to the Prime Minister).	1	The Petroleum Act of 1974 gives Petronas ownership of, and exclusive rights to explore and produce, petroleum onshore or offshore Malaysia.
Petro SA	2002	Public limited company	Not listed.	100.00	Department of Minerals and Energy, through the Central Energy Fund.	1	No special rights established by law.
PTT	1978 ⁽³⁾	Joint stock	S.E. of Thailand	67.13	The Ministry of Finance directly through its 51.7% ownership, and indirectly through the Vayupak Fund.	1	PTT is the monopoly purchaser, wholesaler, and distributor of natural gas in Thailand.
QP	1974	Public limited company	Not listed.	100.00	Emir of Qatar	1	Sovereign guarantee provided by the Government.

Notes:

(1) The Brazilian government owns 40 percent of Petrobras' outstanding share capital, but has a 55.7 percent voting share.

(2) CNPC owns 86.42 percent of Petrochina's outstanding share capital directly, and 0.29 percent indirectly through Fairy King Investment Ltd.

(1) The traded subsidiaries include Petronas' exploration and production company, its natural gas transmission company, its refining company and its petrochemical company.

(2) PTT was partially privatized in 2001.

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Table 4.6. External governance arrangements for selected NOCs (continued)

NOC	Year incorp.	Type	Listings	% govt. control	State ownership function	Number of NOCs	Special privileges
Rosneft	1993	Joint stock	London S.E., Moscow Interbank Currency Exchange, Russian Trading System	83.00 ⁽¹⁾	75.16% held by OJSC ROSNEFTEGAZ, wholly owned by the Federal Government; 0.000000009% held by the Federal Agency for State Property Management;	4	No special rights established by law.
Sinopec Ltd	2000	Joint stock	Hong Kong SAR, China S.E.; New York S.E., London S.E., Shanghai S.E.	75.80	The State Owned Assets Supervision and Administration Commission through the Sinopec Corp (Sinopec-Parent), itself wholly owned by the govt.	3	No special rights established by law.
Sonatrach	1963	Public limited company	Not listed.	100.00	Ministry of Energy and Minerals	1	The 2006 Hydrocarbons Order reintroduces the mandatory participation of Sonatrach with a minimum 51 percent for exploration, production, transportation and refining activities. In the upstream, the NOC is carried through exploration.
Statoil	1972	Public limited company	Oslo S.E., New York S.E.	70.83	The Ministry of Petroleum and Energy (66.89 percent) and the State Pension Fund (3.94 percent).	1	No special rights established by law.

Notes:

(1) The Federal Government owns 75.16 percent of the outstanding shares, but 9.45 percent are recorded by Rosneft as treasury shares.

Source: Authors, companies' filings, annual reports, and websites. Reference year: 2008.

POCs), and mandatory minimum levels of NOC participation in petroleum operations. Countries that give their NOCs special privileges tend to be dependent on petroleum revenue, while in countries that are net oil importers or have small resource endowments NOCs tend to have to compete with POCs. This policy choice seems to reflect the propensity of oil dependent countries to use their NOCs to capture additional rents (in addition or in preference to the fiscal regime). It may also reflect a government's desire to control the pace of exploitation of the resource base through mandatory participation of the NOC in petroleum activities and legal restrictions on ownership and access to petroleum resources. NOCs that enjoy the strongest privileges are those that are entirely owned by their government.

The analysis of the external governance arrangements of the sample NOCs did not reveal any special pattern of ownership compared to other SOEs that operate in strategic or vital economic sectors. But it is possible that the combination of concentrated ownership and special rights shelters the NOC from competition from POCs and other NOCs, and may reduce incentives to efficiency.

4.3.1.2 INTERNAL GOVERNANCE

Internal governance includes institutional arrangements, such as the composition, structure, functioning and authority of the BOD, and the NOC's management processes, such as recruitment, oversight and replacement of key executives, decision-making process, sources of capital, the degree of budgetary autonomy, disclosure and transparency standards, the skill base, and human resources policies. Table 4.7 summarizes the internal governance arrangements for the NOCs in our sample. It is important to note that publicly available information on internal governance processes is scarce for most NOCs. Available information generally focuses on budget and financial autonomy, audit procedures, and disclosures. These are summarized in table 4.8.

Almost all NOCs in our sample appear to confirm the general trend observed in SOEs and privately-owned enterprises towards a reduction in the size of BOD, which aims to improve the efficiency of the decision-making process.⁸ In our sample NOCs, the duties of the BODs are generally comparable and similar to those usually attributed to the BODs of other SOEs and of companies in the private sector. But there are differences in level of authority and decision-making power across the sample. For example, in some NOCs, budget, or investment decisions, or decisions that have a significant financial impact on the company's affairs require formal approval by the government or by parliament. In these cases, the BOD and the general shareholders' assembly are not the ultimate governing bodies of the company.

Independent directors with professional and academic backgrounds in the legal, financial, economic, and technical fields are members of the board in most of the NOCs included in our sample. This is in line with the general trend observed in other SOEs towards increased professionalization and empowerment of BODs. In this paper, independent directors exclude government officials, employees of the company or any of its affiliates, or representatives of employees. The number of independent BOD members observed for our sample NOCs varies between zero and 80 percent, generally reflecting the concentration of ownership (although not proportionally). Government officials from various government levels—including parliament and sub-national governments—are members of the BOD for most of the NOCs in our sample. In some cases, a high level government official—often at the minister level—is the chairman of the BOD.

Assessing the true level of independence of BOD members is quite complex, even when nomination committees are established. While nomination committees can be an

Table 4.7. Internal governance structure for selected NOCs

NOC	BOD Size	Indep. dir.	Structure	Appointment Authority	Duties of the BOD	BOD Committees	Expertise of Independent Directors	Term of Service
CNOOC	11	5	3 executive directors; 8 non-executive directors, of which 5 independent	Directors are elected by the shareholders after nomination by the nomination committee. Independent directors are appointed by the BOD by majority decision or elected by the shareholders at the general meeting.	The BOD powers include to: appoint corporate officers and executive management; review operating and financial performance; approve financial statements; appoint independent auditors; approve debt issuance; declare dividends; approve registration of securities; evaluate management performance; set compensation levels; and monitor compliance with the code of ethics.	Audit; Nomination; and Remuneration committees, each staffed with non-executive directors with a majority of independent director.	All independent directors are professionals or scholars with experience in legal, economics, financial and investment matters.	3 years renewable
Ecopetrol	9	6	Directors include the Minister of Finance, the Minister of Mines and Energy, and the Director of the National Planning Agency.	Except for the 3 government appointees, the BOD members are elected by the general assembly at annual general meeting.	The BOD has sufficient power to enforce the codes of conduct, engage in high level decision making, and has direct impact on the activities of the company.	Audit; Nomination; and Corporate governance. All members of the audit committee and at least one member of the other two committees must be independent.	All independent directors are professionals with experience in engineering, legal and financial matters.	1 year renewable
ENI	9	3	The company by-laws mandate that at least 3 independent directors be members of the BOD when the BOD members are more than 5 (at least 1 independent director otherwise). There are no government officials in the BOD.	Qualified directors are elected by the general assembly at annual general meeting. The appointment of directors is implemented by means of lists presented by shareholders that represent at least 1% of the ordinary shares with voting rights. The lists must specify the candidates possessing the independence pre-requisites	The BOD powers include to: define corporate governance rules; establish internal committees; define organizational, administrative, and accounting guidelines; define the strategic guidelines and objectives of the NOC; approve annual budgets; approve any transaction with significant impact on the NOC's results and liquidity.	Internal controls; Compensation; and Oil and gas and energy. These committees are currently staffed with non-executive directors.	All directors are professionals or scholars with experience in the legal, economics, financial and investment matters.	3 years renewable

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Table 4.7. Internal governance structure for selected NOCs (continued)

NOC	BOD Size	Indep. dir.	Structure	Appointment Authority	Duties of the BOD	BOD Committees	Expertise of Independent Directors	Term of Service
Gazprom	10	2	Directors include the Deputy Minister of Energy. In line with the Federal Commission for the Securities Markets, members of the governing bodies account for ¼ of the BOD.	Directors are elected by the shareholders at the annual general meeting. The Federal Government has the right to elect 5 directors.	The BOD powers include to: develop company strategy; approve annual budgets and investment programs; decide on changes in the NOC's share capital, and buyback of shares and bonds; open or close subsidiaries; set the compensation of the management committee; and appoint and terminate management committee's members.	Audit; Human resources; and Remuneration.	Independent directors are professionals with experience in legal and financial matters.	1 year renewable
GDF	21	9	Government representatives include the Ministry of Energy, the Ministry of Economy and several government agencies.	11 directors are appointed by the shareholders at the annual general meeting; the state appoints 6 directors by decree; 3 directors represent the employees.	The BOD powers include to: develop company strategy; approve annual budgets and investment programs; decide on changes in the NOC's share capital, and buyback of shares and bonds; open or close subsidiaries; set the compensation of the management committee; and appoint and terminate management committee's members.	Audit; Ethics; Environment and sustainable development; Strategy and investment; Compensation; and Nomination committees, each chaired by an independent director.	Independent directors are professionals with experience in economics and financial matters.	4 years renewable
KMG E&P	8	3	Government representatives are also executives of NC KMG, itself wholly owned by the government through Samruk-Kaznya.	5 directors are appointed by Samruk-Kaznya; the 3 independent directors are appointed by the BOD and approved by the shareholders at the annual general meeting.	The powers of the BOD include to: define the strategy and long-term objectives of the NOC; monitor the implementation of approved policies; approve internal procedures and monitor their implementation; and manage internal conflicts.	Strategy and planning; Audit; Remuneration; and Nomination. Independent directors chair the Strategy and the Audit committees.	Independent directors are professionals with experience in financial affairs and oil and gas exploration and production.	3 years renewable

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Table 4.7. Internal governance structure for selected NOCs (continued)

NOC	BOD Size	Indep. dir.	Structure	Appointment Authority	Duties of the BOD	BOD Committees	Expertise of Independent Directors	Term of Service
OGDCL	11	8	The director general or Petroleum Concessions, the Chief of Economics and Finance of the Ministry of Petroleum, a member of the provincial assembly of Balochistan, and the chairman and CEO.	The directors are elected by the shareholders at the annual general meeting.	The powers of the BOD include: to design strategies and evaluate projects which may provide the NOC with a competitive; and to supervise the implementation of all corporate policies and codes of ethics to ensure efficiency and transparency.	Human resources; Finance; Technical; and Audit. The latter comprises 4 non-executive directors.	Independent directors are professionals with experience in petroleum operations, financial and economic matters.	n/a
ONGC	17	8	2 government officials from the Ministry of Petroleum are non-executive BOD members.	All directors are appointed by the President of India.	The power and authority of the BOD appear to be limited, and influenced by the government through the tight control of appointments.	Audit and ethics; Remuneration, Shareholders and investors grievance; Human resources; Health safety and environment; Financial management; and Project appraisal.	Independent directors are professionals with experience in business administration and energy matters.	2 years renewable
PDVSA	10	0	The Minister of Energy and Mines is the CEO and Chairman of the BOD. All but 2 BOD members are directors of PdVSA. There are 2 external directors: the president of Compañía Anónima Venezolana de Industrias Militares, and an LNG expert adviser to the Ministry of Energy.	All directors are appointed by the President of Venezuela, RB.	The BOD is responsible for: preparing and presenting the NOC operational results; formulating and executing the operational, financial and social strategies; and convening annual and special meetings of shareholders. Partnerships with other companies are proposed by the BOD, but require the National Assembly's approval.	n/a	n/a	2 years

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Table 4.7. Internal governance structure for selected NOCs (continued)

NOC	BOD Size	Indep. dir.	Structure	Appointment Authority	Duties of the BOD	BOD Committees	Expertise of Independent Directors	Term of Service
Pemex	15	0	Secretary of Energy, Secretary and Undersecretary of Finance and Public Credit, Secretary of Economy, head of the President's Office, and Secretary of Public Function.	The President of Mexico appoints 10 directors (6 government officials and 4 professional directors), and the petroleum workers' union appoints 5 directors.	The BOD powers include to: provide leadership and strategic management; in accordance with the Energy Sector Program, establish production, marketing, technology, general administration, and finance policies; issue intercompany guidelines on financial, credit, tax, accounting, security, budgetary and similar matters; monitor the operating risk management system established by the Director General; monitor the performance and approve the business plan of the NOC; approve material transactions; approve the appointments and removal of key executives; and approve the annual financial reports.	Audit and performance evaluation; Investment strategy; Payment; Leases, works and services; Environment and sustainable development; Transparency and accountability; and Technology and research and development.	n/a	n/a
Petrobras	9	2	The State Minister of Mines and Energy, the Executive Secretary of the Ministry of Mines and Energy, the military commander of the Southeast, a member of the National Energy Policy Council, and the president of the National Development Bank.	The government appoints the CEO and 6 directors. Minority shareholders elect at least 1 director. Preferred shareholders can elect 1 director if, together and excluding the majority shareholder, they hold at least 10 percent of the NOC's equity.	The BOD determines the long term strategy of Petrobras and oversees the acts of the Executive Board, which directs operations and manages the company.	Audit; Compensation and succession; and Environment.	Independent directors have experience in corporate finance, and quality of spending in private and public organizations.	1 year, renewable

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Table 4.7. Internal governance structure for selected NOCs (continued)

NOC	BOD Size	Indep. dir.	Structure	Appointment Authority	Duties of the BOD	BOD Committees	Expertise of Independent Directors	Term of Service
Petro China	14	5	The CEO and Chairman are executive directors.	Directors are elected by the shareholders at the annual general meeting.	The authority of the BOD includes: convening shareholders' general meeting; implementing the resolutions passed by the shareholders; determining the NOC's business plans and investment proposals; formulating the NOC's financial budgets; and formulating the NOC's dividends and loss recovery proposals. An external supervisory board monitors financial matters and actions of senior management.	Audit; Investment and development; Evaluation and remuneration; Health safety and environment; and Supervisory.	Independent directors have professional experience in finance, economics and engineering.	3 years renewable
PTT	15	1	Deputy Permanent Secretary for Energy (Chairman), Secretary General of the Office of National Economic and Social Development Board, Director General of the Department of Mineral Fuels, Deputy Permanent Secretary for Foreign Affairs, Permanent Secretary of the Office of the Prime Minister, Director General of the Department of Lands, Deputy Permanent Secretary for Finance, and Chief Financial Officer and President and CEO of PTT PLC.	The Annual General Meeting of shareholders elects qualified directors who have previously been selected and nominated by the Nomination Committee (based on certain criteria).	The duties of the BOD include: to define the NOC's vision, directions, and strategies; to endorse major strategies and policies, including objectives, financial targets, and operating plans; to establish corporate accounting, financial reporting, and financial auditing policies; to manage conflicts of interest; to define comprehensive risk management guidelines and to establish efficient risk management systems and process; and to establish senior management's compensation policies.	Audit; Nomination; Corporate governance; and Remuneration.	Independent directors are professionals with experience in finance, economics, engineering, and business administration.	3 years
QP	7	0	The BOD includes: the Minister of Energy and Industry and representatives of his office, and economic experts from the Office of the Emir.	Directors are appointed by the Emir of Qatar.	n/a	n/a	n/a	n/a

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Table 4.7. Internal governance structure for selected NOCs (continued)

NOC	BOD Size	Indep. dir.	Structure	Appointment Authority	Duties of the BOD	BOD Committees	Expertise of Independent Directors	Term of Service
Rosneft	9	3	The BOD includes: the Deputy Prime Minister of the Russian Federation; the Minister of Industry and Energy of the Russian Federation; and the Head of the Federal Agency for State Property.	Directors are elected by the shareholders at the annual general meeting.	The BOD has full decision making powers.	Human resources and remuneration; Strategic planning; and Audit.	Independent directors are professionals with experience in finance, economics, and business administration.	7 years
Sinopec	11	3	The BOD does not include government representatives. A Supervisory Board (9 members), which reports to the General Assembly, oversees the BOD. The Supervisory Board includes 4 employees' representatives, and 1 independent member.	Directors are elected by the shareholders at the annual general meeting. The chairman and vice-chairman are directors of the NOC and are elected and removed by a majority vote by the BOD. Candidates for non-independent directors are nominated by Sinopec's BOD, the supervisory committee, or shareholders who hold 5% or more of the NOC's voting shares.	The BOD has power and authority to: elect corporate officers and executive management; review operating and financial performance; approve financial statements; appoint independent auditors; approve debt issuance; declare dividends; approve the registration of securities; set compensation levels; and recruit key executives.	Audit; Compensation; Supervisory; and Strategic Planning.	Independent directors are professionals with experience in accounting, economics, and engineering.	3 years renewable. Independent directors may not hold office for more than 6 years.

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Table 4.7. Internal governance structure for selected NOCs (continued)

NOC	BOD Size	Indep. dir.	Structure	Appointment Authority	Duties of the BOD	BOD Committees	Expertise of Independent Directors	Term of Service
Sonatrach	13	0	The BOD comprises representatives of: Ministry of Finance (2), Central Bank (1), and Ministry of Energy and Mines (2). In addition to the President and General Manager of the NOC, there are 4 executive directors, 2 employees' representatives, and 1 external appointee with expertise in oil and gas operations.	The General Assembly, chaired by the Minister of Energy and comprising the Minister of Finance, the Governor of the Central Bank, the Commissioner General for Planning, and a representative of the Presidency, is the highest governance body. The Minister of Energy has extensive powers: it appoints Sonatrach's President and General Manager (PDG), who is also the Chairman of the BOD, and provides prior consent to the appointment by the PDG of the executive committee.	The powers of the BOD, the Chairman and PDG are provided for in the company's by-laws, which are approved by presidential decree. The powers of the company are very wide and concern all activities.	Ethics, Executives, International Projects Coordination, Projects Review	n/a	n/a
Statoil	10	7	There are no public officials, and no company representatives on the BOD, other than employee's representatives.	Directors are elected by the Corporate Assembly (CA), on the recommendation of the Nomination Committee. The CA has 20 members: 12 are elected by the shareholders and 8 are elected by employees. The Nomination Committee, which comprises 3 independent directors and the Director General of the Ministry of Petroleum and Energy, also recommends individuals to be considered for the CA. The annual general meeting of shareholders elects the Nomination Committee, the external auditor and approves all financial reports.	The BOD appoints the president and CEO, and defines their mandate, powers of attorney and terms and conditions of employment. The duties of the BOD include: corporate strategy issues, approval of business plans, approval of quarterly and annual results, monthly performance reporting, management compensation issues, CEO and top management leadership assessment and succession planning, health, safety and environment review, project status review, people and organization strategy and priorities, enterprise risk evaluation and an annual review of the BOD's governing documentation.	Audit; and Compensation.	Independent directors have experience in the oil and gas industry, corporate governance, finance, and legal affairs	2 years

Source: Authors, companies' filings, annual reports, and websites. Reference year: 2008.

Table 4.8. Internal governance processes for selected NOCs

NOC	Budget Autonomy	Financial Autonomy	Audit Process and Disclosures
CNOOC	The BOD has decision making powers on budget and investment plans, but government entities participate at various stages of budget preparation and approval.	The BOD has decision making powers on financial matters, but must obtain government approval for certain investments and foreign borrowing.	External auditors. Reports filed on relevant stock exchanges.
Ecopetrol	The BOD has decision making powers on budget and investment plans.	The BOD has decision making powers on financial matters.	External auditors. Material information disclosure policy in accordance with Colombian and US Securities and Exchange Commission's (SEC) standards.
ENI	The BOD has decision making powers on budget and investment plans.	The BOD has decision making powers on financial matters.	External auditors. Reports filed on relevant stock exchanges.
Gazprom	The BOD has decision making powers on budget and investment plans.	The BOD has decision making powers on financial matters.	External auditors. Reports filed on relevant stock exchanges.
GDF	The BOD has decision making powers on budget and investment plans.	The BOD has decision making powers on financial matters.	External auditors. Reports filed on relevant stock exchanges.
KMG E&P	The BOD has decision making authority on budget and investment plans, but government approval is required at various stages.	The BOD has modest decision making powers on financial matters.	External auditors. Reports according to national accounting guidelines.
OGDCL	The BOD has decision making authority on budget and investment plans.	The BOD has decision making powers on financial matters.	External auditors.
ONGC	The BOD has decision making powers on budget and investment plans.	The BOD has decision making powers on financial matters.	External auditors.
PDVSA	The Minister of Energy and Petroleum establishes the NOCs overall policies, and approves annual production levels, capital expenditures and operating budgets. Partnerships with POCs require the National Assembly's approval.	The BOD has modest decision making powers on financial matters. Dividend policies linked to the government's financial needs.	External auditors. Since 2005 the NOC no longer submits audited financial reports to the SEC. Annual reports are published by the NOC.
Pemex	The BOD has decision making powers on budget and investment plans, but budget must be approved annually by Congress.	The BOD has modest decision making powers on financial matters.	Uses external auditors.
Petrobras	The BOD has decision making powers on budget and investment plans, but Congress approves investment budget.	The BOD has decision making powers on financial matters.	Uses external auditors. The NOC reports according to IFRS. Reports filed on relevant stock exchanges
Petro China	The BOD has decision making powers on budget and investment plans, but must obtain the approval of the National Development and Reform Commission for a broad range of investment projects.	The BOD has decision making powers on financial matters, but must obtain government approval for certain investments and foreign borrowing.	Uses external auditors. Reports filed on relevant stock exchanges.
Petronas	The BOD has decision making powers on budget and investment plans.	The BOD has decision making powers on financial matters.	Uses external auditors. Reports according to national accounting guidelines.

(continued on next page)

Table 4.8. Internal governance processes for selected NOCs (continued)

NOC	Budget Autonomy	Financial Autonomy	Audit Process and Disclosures
PetroSA	The BOD has decision making powers on budget and investment plans., but budget is subject to approval by the Ministry of Energy and the Parliament	The BOD has decision making powers on financial matters.	The Auditor General of South Africa. Reports are publicly disclosed.
PTT	The BOD has decision making powers on budget and investment plans.	The BOD has decision making powers on financial matters.	Financial statements are always audited by the governmental Office of The Auditor General of Thailand with reports filed in Bangkok.
QP	All budget decisions are executed through the office of the Emir in concert with the BOD.	The BOD has modest decision making powers on financial matters.	Uses external auditors.
Rosneft	The BOD has decision making powers on budget and investment plans.	The BOD has decision making powers on financial matters.	Uses external auditors. Reports filed on relevant stock exchanges
Sinopec	The BOD has decision making powers on budget and investment plans.	The BOD has decision making powers on financial matters.	Uses external auditors. Reports filed on relevant stock exchanges
Sonatrach	The BOD has decision making powers on budget and investment plan. Budgets are approved by the General Assembly.	The BOD has decision making powers on financial matters.	Uses internal auditors. Reports according to national accounting guidelines and US GAAP since 2006
Statoil	The BOD has decision making powers on budget and investment plans.	The BOD has decision making powers on financial matters.	Uses external auditors. Reports filed on relevant stock exchanges

Source: Authors, companies' filings, annual reports, and websites. Reference year: 2008.

effective way to reduce political interference and to increase the independence of the BOD, the relative voting power of majority and minority shareholders ultimately affects the choice of candidates and the composition of the committee, which in turn affects its power and effectiveness. Only thirty percent of the NOCs in the sample have a nomination committee.

Most of the NOCs in the sample (70 percent) have established audit committees and compensation committees. While almost all of them have an official corporate governance policy, a few have established corporate governance committees, ethics committees, or sustainability committees. But this is probably a new trend for SOEs in general. Eighty percent of the NOCs in the sample use external auditors and publish their annual reports. NOCs that are quoted on international stock exchanges prepare their report according to national and international accounting standards.

4.3.2 Selected NOCs Corporate Governance Scorecard

Compared to the corporate governance standards for a sample of large oil and gas corporations examined in another study, the NOCs in our sample appear to have reasonably sound institutional arrangements (M&E 2008). Table 4.9 compares the corporate governance standards for our sample NOCs to the result of the M&E study for the criteria surveyed in both studies.⁹

Table 4.10 provides a comparison of internal and external governance arrangements for the NOCs in our sample. We have assessed the sample NOCs against a set

Table 4.9. Governance standards: sample NOCs vs. large oil and gas companies

Criteria	M&E survey's results	Sample NOCs
Company has an official corporate governance policy	85%	85%
Chief Executive Officer and Chairman of the BOD are different persons	60%	80%
Compensation Committee	70%	70%
Corporate Governance Committee	45%	20%
Nomination Committee	55%	30%
Ethics Committee	35%	20%
Sustainability Committee	15%	25%
Board directors are re-elected annually	25%	20%

Source: Authors, M&E 2008.

of dimensions that reflect the OECD guidelines and the latest trends in corporate governance of large corporations. Although these criteria do not capture all dimensions of good corporate governance, they represent an important subset and are objectively measurable.

At least in terms of legal and institutional arrangements, our review of the corporate governance arrangements of the sample NOCs did not reveal significant departures from generally accepted standards for SOEs or POCs. But a word of caution is in order: the institutional structure (that is, the organization of governance) is only one element of good corporate governance. The procedures and processes that govern the functioning of such structure can be more critical for the quality and strength of corporate governance than the structure itself. Therefore, although on paper NOCs appear to fare well on corporate governance, the practice is difficult to assess. For example, the role played by board committees with respect to improving the quality and transparency of the BOD's decision-making processes largely depends on the skills of the committee's members (that is, whether the members are experts in the subject matters that are assigned to the committee), the composition of the committee (that is, whether the members are mostly independent and non-executive directors), and the weight of minority shareholders. Ethics committees that are staffed with executive directors or government appointees may lack the credibility of more balanced ones. Similarly, nomination committees that are largely controlled by the majority shareholder are less likely to be free to make objective suggestions. The assessment of the overall quality of corporate governance of the NOCs included in our sample would require access to information that is often not publicly available and would entail a certain level of subjectivity. This was not attempted in this paper.

Given the relatively small size of our sample, our finding may not be indicative of a general trend. Nonetheless, it seems that resource dependent countries and countries that depend on imports to satisfy most of their energy needs opt for the centralized model of ownership. In these countries, the state often holds the totality or the majority of the voting rights in the share capital of the NOC, and tends to influence the decision making power of the NOC directly through the appointment of government officials on the BOD, or indirectly through external approvals for decisions that have strategic or sizeable financial implications. NOCs that derive a considerable part of their revenue from international operations tend to have faster decision making processes. The state tends to exert more influence over NOCs that enjoy special privileges.

Table 4.10. Governance scorecard for selected NOCs

NOC	Official CG policy	CEO and chairman different persons	No Govt officials on the BOD	Stock exchange listing	Mainly indep. directors	No external approval needed	Committees of the BOD						Strategy or equivalent	Directors are re-elected annually	External auditor	Score	
							Audit	Compens.	Corporate governance	Nomination	Ethics	Sustainability				Nr.	%
Ecopetrol	√	√		√	√	√	√		√	√				√	√	10	66.67
OGDCL	√	√		√	√	√	√	√		√			√		√	10	66.67
GDF	√	√		√	√	√	√			√	√	√			√	10	66.67
ENI	√	√	√	√		√		√			√		√		√	9	60.00
ONGC	√	√		√			√	√			√	√	√		√	9	60.00
Pemex	√	√					√	√	√			√	√		√	9	60.00
Petrochina	√	√	√	√			√	√				√	√		√	9	60.00
Statoil	√	√	√	√	√	√	√	√							√	9	60.00
CNOOC	√	√	√	√			√	√		√					√	8	53.33
Gazprom	√	√		√		√	√	√						√	√	8	53.33
KMG	√	√		√			√	√					√		√	8	53.33
Sinopec	√	√	√	√		√	√	√					√		√	8	53.33
Petrobras	√	√		√			√	√				√		√	√	8	53.33
Petronas	√					√		√	√	√			√		√	7	46.67
PTT	√	√				√	√	√	√	√						7	46.67
Rosneft	√	√		√		√								√	√	6	40.00
Petro SA	√						√	√					√			4	26.67
QP		√	√												√	3	20.00
Sonatrach											√		√			2	13.33
PdVSA																0	—
No. of observations	17	16	6	13	4	10	14	14	4	6	4	5	10	4	16		
% of total	85.00	80.00	30.00	65.00	20.00	50.00	70.00	70.00	20.00	30.00	20.00	25.00	50.00	20.00	80.00		

Source: Authors.

Note: Percentage scores—last column—are calculated by dividing the governance indicators observed for each NOC by the total numbers of indicators (15). The last line shows the percentage of the sample NOCs for which the relevant governance indicator was observed.

Cultural differences across countries also play a significant role in explaining why similar corporate governance structures may function in a very dissimilar manner. Sam provides an interesting analysis of cultural differences between Asia and the United States and their impact on corporate governance arrangements (Sam 2007). The author notes that, while the Anglo-American model of governance is characterized by diluted ownership and clear separation of ownership and control, the Asian business system is based on patriarchal cultures. As a result, in many Asian corporations, the minority shareholders have limited power to overturn the decision of the majority shareholders. In other words, "The real problem is misalignment of interest between majority and minority shareholders, and not between investors and executives as found in Anglo-Saxon countries." Hence, in these markets, the issue of corporate control cannot be expected to play a significant role, and companies are less likely to appreciate the benefit of undergoing costly reforms. For some firms, the adoption of Western practices and adjustments to international norms is deemed necessary for reasons of legitimacy to gain access to international markets and global finance (Ahlstrom and others 2004; Carney 2005). But even the most internationally oriented companies have to deal with domestic reality. In practice, this may require the development of a hybrid system of governance that allows the company to achieve its objectives while maintaining its ability to interact with its domestic environment. The Chinese, Thai, Malaysian, Russian, and Kazakh NOCs are examples of cultural adaptation, where Anglo-American corporate governance systems are fused with stricter bureaucracy and more centralized decision-making.

4.4 Lessons Learned

In addition to the maximization of the net present value of the economic rent, governments often pursue a variety of development and socioeconomic objectives, including inter-temporal equity, the promotion of backward and forward linkages, the promotion of bilateral trade, energy self sufficiency, and security of supplies. These objectives and their relative priorities, together with each country's unique constraints and concerns, determine the types of policies and tools available to policy makers. Since the NOC is only one of these tools, it is important to ensure coherence and coordination between the NOC and other policy tools, in particular the petroleum rights allocation system, the fiscal regime, and other tools such as market regulation.

Whether a government chooses to establish a NOC or to rely on POCs to achieve the objectives of its petroleum sector policy, its primary concern should be to maximize the social benefits derived from such policies. But defining what constitutes maximum social welfare is essentially a political question, which helps explain the variety of objectives pursued (and policy tools used) by governments over time.

NOCs are often the product of a political choice for direct government intervention in the sector, usually motivated by the strategic relevance of petroleum or its importance to the country's economy. Economic considerations, such as the desire to address market deficiencies or inefficiency or to maximize rent capture, are seldom the primary reason for establishing the NOC. This implies that subjectivity is unavoidable when comparing the relative benefits of the NOC and other policy tools. Although there are established criteria to guide policy formulation in cases that involve a certain level of value judgment, in practice deciding whether or not establishing the NOC maximizes value creation is a matter of political choice.¹⁰

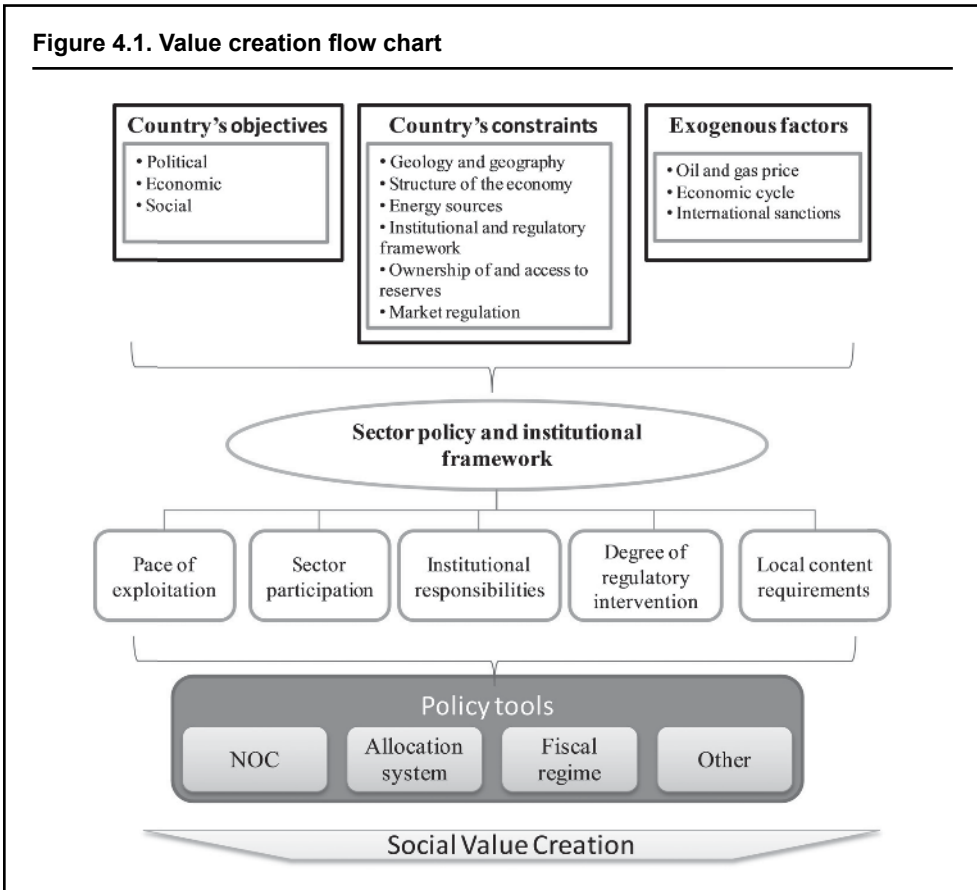
NOCs are used to achieve a wide range of policy objectives. But in some cases other policy tools may be more effective.¹¹ For example, to stimulate the development of a local supply industry or the creation of forward linkages fiscal incentives or market regula-

tion may be more effective and sustainable than relying on the NOC. Allocation systems and fiscal regimes may be more effective than direct state participation to maximize the size and value over time of the rent captured by the government. In particular, through the allocation system can be designed to: (i) ensure that petroleum exploration and production rights are awarded to the most efficient operator; (ii) reduce the possibility of collusion among bidders; and (iii) increase the level of competition (Tordo 2009). Progressive fiscal regimes can correct inefficiencies at allocation due to asymmetry or lack of information on the real value of petroleum resources that will be extracted from a particular area. Moreover, depending on the type of fiscal regime, the government's direct participation through the NOC, especially on concessional terms, may have an impact on the attractiveness of the country to POCs and on the government take.¹²

In principle, if the fiscal system is efficient in allocating risks and sharing benefits between the state and the private investors, there would be no economic justification for the participation of the NOC if its economic efficiency is lower than that of private investors. This argues in favor of policies that foster the NOC's efficient behavior, including corporatization, commercialization, and the elimination (or at least limited use) of special privileges and other discriminatory practices.

Whatever the reason for establishing the NOC, its role, objectives, and governance need to be tailored to reflect the set of objectives, constraints, and concerns that are unique to each country. These define the boundary conditions for value creation by the NOC. Figure 4.1 provides a simplified representation of this approach.

Figure 4.1. Value creation flow chart



Source: Authors.

Since social and political objectives, constraints, and concerns are often country specific, it is difficult to identify general principles for NOC value creation that apply to all countries in all circumstances. Therefore, drawing from experience of the NOCs analyzed in sections 4.2 and 4.3, this section focuses on policies and measures that aim to achieve economic objectives. These are summarized below:

- *Special privileges granted to the NOC by its home government do not necessarily translate into value creation.* To be successful, petroleum exploration and development activities require specific knowledge of the relevant geological basins, technological competence, project management expertise, and the ability to bear and manage associated risks. All of these factors are a direct function of experience, which need not necessarily be acquired in the specific country or the specific petroleum basin. This means that newly established NOCs are likely to be disadvantaged compared to experienced POCs or NOCs from other petroleum producing countries owing to information asymmetry, insufficient scale of operation, and inefficiency arising from excessive risk aversion.¹³ To overcome these deficiencies, many petroleum producing countries choose to grant special privileges to their NOC, ranging from the monopoly over all or some petroleum activities, to the exclusive right to conduct petroleum activities (solely or in association with POCs), to mandatory minimum levels of NOC participation in petroleum operations. In some cases, special privileges are granted to the NOC through constitutional provisions that reserve the ownership and exploitation rights exclusively for the state. The preferential treatment of the NOC can be an effective tool to address information and capacity asymmetries. In principle, protectionism shelters the NOC from competition, allowing it to focus on developing the necessary competence and economies of scale. However, like many forms of industrial policy, special treatment of the NOC is most effective when it is granted on a temporary basis. If the NOC knew that it could rely on special privileges forever, it would have limited incentives to become efficient and competitive. Furthermore, although scale is an advantage in the oil and gas business, the marginal benefit associated with it becomes negative after a company reaches a certain optimal size. Box 4.1 illustrates the opportunities and pitfalls of special privileges.
- *The NOC can be instrumental to the promotion of forward and backward linkages. But the results depend on policy design.* Especially in developing countries (and in developed countries in the early stages of development of the sector), NOCs tend to be given a primary role in advancing local content. This may range from the creation of backward linkages to processes and activities aimed at creating forward linkages and in some countries may go beyond the oil and gas sector value chain. More often than not, however, NOCs have little control over their government's local content policies, either in terms of policy objectives or implementation choices. The economic efficiency and the effectiveness of a local content policy depend more on its design than they do on who implements it (the government, the NOC, the POCs, or all of them). Chapter 1 outlined the elements of good local content policy design. In particular, the policy should: (i) aim to achieve clear and measurable targets; (ii) set realistic objectives that take into account the degree of technological strangeness; (iii) gradually maximize local value added; (iv) focus on the development of local capabilities that can be transferred to other sectors; (v) provide for the assessment and disclosure of progress

Box 4.1. The grant of Special Privileges to a NOC: Opportunities and Pitfalls

Statoil (Norway). During its first decade of operations, Statoil benefited greatly from two key privileges: (i) minimum participation of 50 percent, carried through the exploration phase, in all petroleum licenses, implying a veto power on all development decisions; and (ii) once a discovery was declared commercial, the option to increase the participation by up to 80 percent based on a sliding scale linked to production levels. In the second half of the 1980s, the Storting (Norwegian Parliament) revoked these privileges. There were worries about the influence of Statoil on the domestic economy and potentially domestic politics. However, by then Statoil had already developed solid technical competence and a large domestic portfolio of assets. Following this decision, Statoil became more commercially oriented, and its relationship with the state became increasingly arm's length. Ultimately, the decision to revoke Statoil's special privileges proved to be advantageous for both the state (which could rely on efficient exploitation of its non-renewable resources) and the NOC (which wanted to become an international operator and needed to improve its efficiency and reduce its operating costs to do so).

KMG EP (Kazakhstan). The NOC was only recently created in 2004 through the merger of two exploration and production companies, JSC Uzenmunaigas and JSC Embamunaigas. In 2005 KMG EP was partially privatized. The NOC's parent company, NG KMG, is an integrated oil and gas company wholly owned by the government of Kazakhstan. Since KMG EP's initial portfolio of assets contained mature fields, the government granted it a series of commercial privileges by law, aimed at facilitating its future growth. These included: (1) the right of first refusal on any onshore oil and gas rights, interests, or assets offered for sale in Kazakhstan; (2) preferential access rights to NG KMG's oil and gas transportation assets; (3) the right to ask NG KMG to enter into direct negotiations with the government for rights to any unlicensed oil and gas acreage in Kazakhstan without a competitive tender process; and (4) the right to acquire those rights from NG KMG. These policies gave KMG EP a clear competitive advantage. Special privileges are not the only component of the government's ownership strategy. The government wanted its NOC to have a modern corporate governance structure to give its management the flexibility needed to execute its non-organic growth strategy (that is, growth by acquisition as oppose to growth through the drill bit). KMG EP does not have large noncommercial obligations and is not required to undertake non-core commercial activities beyond those acquired at the time of its creation. Thanks to the coherent set of policies adopted by the government, along with good geology, KMG EP became the second largest Kazakh oil producing company in 2009. The government is pleased with KMG EP's results and has not explicitly indicated its intention to lift the special privileges granted to it. However effective this strategy has proved in helping KMG EP rapidly build an asset portfolio and economies of scale, it has not quite helped the NOC to achieve competency in the management of petroleum exploration activities. The assets acquired by the NOC are maturing, but as long as the government's protectionist policy remains in place, there may be no real incentive for the NOC to diversify its portfolio internationally or to assume exploration risk.

Sonatrach (Algeria). When Algeria gained independence in 1963, Sonatrach was created with the initial intention to fast-track the resolution of contentious pipeline issues and later to be the instrument of state control over the industry. The industry was nationalized at the beginning of the 1970s. But the fall in oil prices in the 1980s and state's increased dependence on petroleum revenues underpinned a partial policy change. A law was passed in 1986 that partially liberalized the upstream petroleum sector. Foreign companies could carry out upstream activities but only with a minimum 51 percent participation by Sonatrach. Although the reform did not produce the results that the government was hoping for, Sonatrach was able to replenish its hydrocarbon reserves at a time when the NOC had extremely limited financial and technical resources. By 2001 oil prices were low again, and the countries' petroleum production was starting to decline. Once again the government considered changes in the special privileges policy to attract foreign investors. After a long debate, a law was passed in 2005 to restructure the sector. The NOC was relieved of its regulatory powers, and its special privileges in the upstream sector were to be removed, leaving the NOC with the option to participate up to 30 percent in exploration and production contracts with other state and

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Box 4.1. The grant of Special Privileges to a NOC: Opportunities and Pitfalls (continued)

private companies. Oil prices were starting to rise and the country's stability had improved. The reform seemed well timed. Except it was not. It was indeed hard for the NOC to let go of its special privileges once its cash flow started to increase again. Furthermore, the NOC was seen as a national champion with a considerable role in social and economic development. In 2006, when oil prices were rapidly surging and nationalization sentiments were growing in several producing countries, the law was partially amended. The NOC was mandated to participate in all upstream, midstream, and downstream (refining) projects with a minimum controlling interest of 51 percent. Sonatrach was able to retain key special privileges. But it also has to shoulder the burden of maintaining its share of producing assets while stepping up exploration efforts in declining economic conditions and investors' confidence.

towards targets; (vi) be coherent with other government policies and tools; and (vii) be flexible and dynamic. Policies that disregard these principles risk creating long-term inefficiency and distortions, and in some cases even corruption. In terms of implementation, the NOC may well be given a prominent role among other stakeholders. But the government needs to avoid overburdening the NOC with non-core non-commercial objectives that may be at odds with other functions of the NOC. This is particularly relevant in countries where the NOC is the only company authorized to carry out petroleum activities and thus has limited possibilities for sharing the exploration and development risk with other parties, since this strategy requires, among other things, a superior level of operational efficiency and the ability to prioritize core business investments. Furthermore, oversight and enforcement of local content policy—a role that belongs to the state—should be separated from the facilitation and implementation of the policy—a role that can be played by both the NOC and POCs. Box 4.2 contains examples of NOCs that have played a prominent role in promoting local content in their country and assesses their impact on NOC value creation.

- *Sector reforms that have a long gestation period generate uncertainty and hamper value creation.* All countries reviewed in this section have a long history of government attempts to reorganize their petroleum sector or their NOC in pursuit of efficiency, higher levels of activity, greater control, improved governance, and other political or economic objectives. These reforms have had mixed results. In some cases, they exhibit a predictable and evolutionary pattern towards a consistent long-term goal. In others, they tend to change direction and appear to respond more to short-term circumstances instead of a long term vision. Setting aside differences in policy objectives and tools, the clarity, pace of implementation, and consistency of political commitment also vary widely across the sample countries. In general, creating value at sector and NOC levels is easier when sector and NOC reforms follow a clear trajectory and are philosophically consistent over time, or if the time lag and direction of changes can be reasonably anticipated. This is particularly relevant in the oil and gas sector, which is characterized by long project cycles and high levels of capital investment. Complex reforms that require a long implementation period are at particular risk of being derailed from their intended objectives or from achieving their intended results, particularly when the institutional environment exhibits a

Box 4.2. Local Content Policies and NOC Value Creation

Brazil and **Malaysia** have some similarities when it comes to the design of local content requirements and the role played by their NOCs, **Petrobras** and **Petronas**, in policy implementation. For both countries, “increasing the contribution of the sector to local economic development” is among the objectives of their petroleum sector policy. To this end, minimum local content requirements are encouraged through the licensing process. Malaysia mandates local incorporation of foreign companies and a minimum share of domestic equity holding and requires petroleum companies to acquire all materials and supplies locally or to purchase them directly from the manufacturer when not locally available. Brazil awards petroleum rights in competitive licensing rounds on the basis of three parameters: cash bonus, work program, and local content. Brazil’s regulator, Agencia Nacional do Petroleo, determines the minimum acceptable share of local content, which differs depending on the location of the block and the phase of development. Given that the Petroleum Act of 1974 gives Petronas exclusive rights and powers over Malaysia’s hydrocarbon resources, the NOC has been the main vehicle for its country’s local content policies, which translate into contractual obligations under petroleum sharing contracts that Petronas negotiates and enters into with participating POCs. In addition, Petronas has invested in creating a skilled workforce, developing technology, and supporting the local supply industry. By comparison, Petrobras does not have to enforce its government’s local content policies, since this is the task of the regulator. However, Petrobras has adopted local content as its own operating strategy. Contrary to Petronas’ experience, when Petrobras was established, there was no oil industry in Brazil. The country was not perceived as prospective, and costs were higher than those in more established oil provinces. This situation left Petrobras no choice but to develop the industry from scratch. Investing in technology, human capital, and the development of the domestic supply industry was inevitable. This choice allowed the NOC to build a strong competitive advantage and to reduce its own operating costs and remains at the core of Petrobras’ business strategy. Petrobras is well known for its superior technology and operating experience in deepwater and ultra-deepwater exploration and production. This capability was developed domestically, building on existing industrial capability and shipbuilding expertise. Similar to the behavior of the Malaysian government toward Petronas, the Brazilian government did not impose specific targets or interfere with Petrobras’ strategic and operating decisions, even when they generated less revenue for the government. For both countries the hierarchy of objectives was clear: backward linkages were important, but energy security was paramount. As a result, the two NOCs were able to define local content policies that suited both their government’s objective to use the petroleum sector as a springboard for growth and economic development and their own business and value creation strategies.

Heading for a change? One thing that Malaysia and Brazil do not have in common is geology. Most Malaysian fields have been producing for over 30 years, and production levels are declining. The remaining fields are of lower quality, relatively small in size, and far from existing infrastructure. This not only affects Petronas’ business strategy and its government’s energy policy, it also affects the extent to which local content policy can be used to further Malaysia’s economic development and the type of local content requirements that should be chosen going forward. By comparison, although Brazil is a large oil producer, only 60 percent of its proved reserves are developed. The country still has a large number of sub-mature and frontier acreage, including the sub-salt province. Brazil has strongly enforced local content policies in the past. But it may have good reason to relax some of its local content requirements in the future. Petrobras’ domestic success with the drill bit is likely to further strain the regional oilfield services industry, which is already under pressure because of the government’s insistence that more of the equipment used offshore be owned by Brazilian firms or built in Brazil. The Brazilian government would need to be watchful to avoid choking local capacity, as this would result in increased costs and delays for Petrobras and other operators and ultimately slow the pace of development of the pre-salt deposits and the value created from their exploitation.

South Africa’s local content policy is different from other petroleum producing countries, in that the country aims to address both technological disadvantages and broader societal

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Box 4.2. Local Content Policies and NOC Value Creation (continued)

issues. The country has opted for a local content requirement mandated by law to fast-track equitable access to and sustainable development of South Africa's mineral and petroleum resources. The recently introduced Black Economic Empowerment (BEE) policy requires minimum equity holdings by previously disadvantaged parts of the population. It also includes employment and procurement requirements. Owing to the strong domestic focus of its operations, **Petro SA** employs primarily South Africans and relies on local companies and suppliers for the majority of its procurement needs. Petro SA's asset ownership strategy tends to be geared towards sustainable national growth. The criteria for investing include job creation and poverty alleviation. This includes opportunities for local participation. For example, the decision to locate the Coega refinery in one of the poorest provinces in South Africa was largely guided by social development considerations. But South Africa and Petro SA are not blessed with good geology, and the NOC has to import petroleum to satisfy its country's consumption needs. Petro SA has a track record of overperformance in local content development and BEE implementation. However, production is declining and no major discoveries have been made. Petro SA's operational performance has been deteriorating since 2006. To support future growth, the NOC has been stepping up its exploration expenditure and aims to pursue a strategy of vertical integration to mitigate project risk. The NOC's strategy and investment choices reflect an attempt to balance the need to invest efficiently and secure supplies with domestic economic development and wealth redistribution objectives. The financial crisis and related credit crunch have increased demands on Petro SA to extend financial assistance to its domestic suppliers to fulfill the requirements of the government's local content policy. At the end of 2008, Petro SA had sufficient funds to carry out its planned investment program. But if new discoveries are not made soon, the government may have to consider a more flexible mix of commercial and social objectives that leaves the NOC with sufficient resources to build a more solid portfolio of producing assets.

high level of overlapping responsibility among government entities. Based on the experience of the countries and NOCs reviewed in this section, a critical success factor for sector and NOC governance reforms is the length of the gestation period—that is, reforms that take a long time to get off the blocks tend to generate uncertainty, which affects the ability of the NOC and POCs to create value. Box 4.3 explores the experiences of two countries with sector and NOC reforms.

- *Good geology does not always translate into value creation.* Government control over and intervention in the petroleum sector is generally linked to a country's dependence on petroleum revenues, which in turn is linked to the size of the petroleum sector compared to the rest of economy. Countries that have large oil and gas resource endowments are more exposed to the risk of "Dutch disease," where the inflow of foreign currency and its impact on the country's foreign exchange rate have destructive effects on the non-oil tradable sectors. This decreases competitiveness and further increases the country's dependence on the oil sector. The size of a country's resource endowment may also affect its resource extraction strategy, including policy decisions about industry participation, licensing strategy, and the pace of exploitation (Tordo 2009). In general, there appears to be a negative correlation between oil dependence and sector openness, and this dependence is often linked to a country's oil exporting status. A study on the behavior of oil producing countries in Latin America carried out by Palacios (2002) concludes that oil exporters have been less prone to liberal-

Box 4.3. Consistency and Speed of Government Reforms and NOC Value Creation

Ecopetrol (Colombia). When Ecopetrol was established in 1951, and up until 2003, it was a wholly state-owned industrial and commercial company responsible for administering Colombia's hydrocarbon resources. Prior to 1955, Ecopetrol's role was administrative and regulatory, and it oversaw POCs that carried out exploration and production activities under a concessionary system established in the 1920s. By the 1970s, oil and gas production had grown, and Ecopetrol's role had evolved accordingly. The NOC participated in upstream activities with private companies operators and owned the two largest refineries in Colombia. Following the often observed pattern that links government dependence on petroleum sector to increased government control, in 1974 Colombia reformed its petroleum sector and redefined Ecopetrol's role. Petroleum sharing contracts were introduced, and POCs were required to associate with Ecopetrol. The NOC had a minimum 50 percent interest carried through exploration. Although the fiscal terms were rather unattractive to private investors, the large discoveries of the 1980s were sufficient to generate interest. Colombia's crude oil reserves reached their maximum in 1994 and have been declining since. In an effort to improve production levels and exploration activity, the government decreased Ecopetrol's minimum carried participation to 30 percent, which resulted in the signing of 32 new contracts (Palacios 2002). But reserves kept declining while production increased. The political conflict and violence that had afflicted Colombia since the early 1950s had been a barrier to sector development. Indeed, Colombia's petroleum sector policy options were limited, and its choice to increase the involvement and role of Ecopetrol over time was probably necessary. By the early 2000s, however, the security situation had greatly improved. At the same time, reserves and production were declining, and Colombia was risking the loss of its self-sufficiency and its exporter status, with obvious economic consequences. The government and its NOC did not waste time. In 2003 the government lifted the minimum NOC equity requirement in preparation for a more radical reform of Ecopetrol, which by then had 76 exploration and production sharing agreements with POCs. The fiscal regime was relaxed to attract foreign investment. Ecopetrol was relieved of its regulatory and policy responsibilities, and an independent regulator, the National Hydrocarbon Agency, was created. In 2006 the government authorized the capital increase of Ecopetrol, which could issue shares on the Colombian stock exchange provided that state ownership did not drop below 80 percent. By 2007 the NOC was debt free thanks to the IPO, the proceeds of which it was allowed to fully retain. Changes had also been made to its internal governance arrangements. The NOC was given financial autonomy and no longer had to compete for resources under the state budget. Ecopetrol's board of directors was restructured to include a majority of professional board members, and a new corporate governance policy was established. In September 2008, Ecopetrol's American Depositary Receipts (ADRs) began trading on the New York Stock Exchange. Although it is too early to assess whether the measures taken by the government and its NOC will be sufficient to reverse the trend in reserves and production, the average rate of decline for the period after the reform until 2009 was 2 percent, compared to 9.3 percent between 2000 and 2003. After all, the vast majority of Colombia's sedimentary basins are still underexplored. Hence, these reforms could have important long-term effects. Colombia's experience would seem to indicate that political commitment and cooperation between the NOC and its government and fast and coherent execution are critical to the implementation of far-reaching sector and corporate governance reforms.

Petro SA (South Africa). South Africa's petroleum prospectivity is generally considered low, with upside potential in deep water. This perception may be due to insufficient investment in exploration due to the gradual withdrawal of POCs during the 1970s and 1980s as a result of political sanctions. Petro SA's current production of oil and gas is used for domestic consumption. Led by concerns over the increasing cost of oil import, rapidly declining oil and gas reserves, and unequal access to opportunities for large swath of its population, in 2002 the government set out to reform its petroleum sector once again. The Mineral and Petroleum Resources Development Act of 2002 included a complex set of social and sector reforms, and paved the way for the introduction of new regulatory bodies in addition to the already thick network of agencies and state companies involved in the oil, gas, and energy sectors.

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Box 4.3. Consistency and Speed of Government Reforms and NOC Value Creation (continued)

The measures envisaged by the 2002 Act required important institutional and market adjustments. Although the direction of the reform was reasonably clear, there was uncertainty over how it would be implemented. The 2002 Act, which did not become effective until 2004, did not apply until 2008. The law mandated holders of leases that were granted before 1994 to renegotiate the terms of their leases to incorporate the new requirements. Uncertainty over the final terms of their leases led investors to invest cautiously. Petro SA, whose strategy is to partner with POCs to mitigate exploration and operational risk, was affected by the decrease in activity, which was exacerbated by rising equipment and operational cost across the industry. Petro SA's operational performance and value creation capability has been suffering in the past few years. The government's choice to move forward with the reform was clearly linked to the broader need to address historical inequalities. But the timing and bureaucratic complexity of the reform hampered the achievement of its objectives.

ize than oil importers. Earlier in this section we suggested that countries and NOCs that enjoy large resource endowments may have fewer incentives to produce them efficiently and to maximize the net present value of their extraction, especially when partnership and alliances with POCs are not the prevalent business strategy. Based on the experience of the NOCs in our case study sample, NOCs that belong to countries with small resource endowments and complex geology can generate value as efficiently, if not more efficiently, than those with more favorable geology. This would suggest that institutional and behavioral factors can mitigate initial conditions. Box 4.4 contains two examples of NOCs' experience with value creation in different geological contexts.

- *Risk sharing and competition have positive effects on NOC value creation.* The exploration, development, and production of petroleum entail various activities, ranging from undertaking geological surveys and identifying hydrocarbon resources to commercially exploiting them. These activities involve different levels and types of risks and uncertainty. It is difficult to determine the existence and size of oil and gas resources, their quality, potential production levels, finding and development costs, and future prices in advance. Therefore, petroleum exploration has the highest level of risk of all activities in the value chain. Although the chance of exploration drilling success has been steadily rising over the last 50 years—mainly driven by advances in seismic imaging technology—exploration remains risky. The average exploration success rate worldwide is approximately one in three wells. In the 1960s the average was one in six (Tordo 2009). Risk management is an important feature of the oil industry, and deciding who should take the risk and in what measure are important policy (and operational) decisions. If a government chooses to develop the resource directly or to hire POCs to develop the resource on its behalf, it will have to bear the risk of exploration and development entirely. This is the case in countries that have very strict access-to-resource policies, where the NOC has exclusive rights to explore and produce petroleum and limited capacity to partner with POCs or other NOCs. Risk is not, however, the only challenge that governments, their NOCs, and POCs must face. Petroleum exploration and development activities require specialized, high-tech equipment and skills that are often not available

Box 4.4. Geology and NOC Value Creation

PDVSA (República Bolivariana de Venezuela). *República Bolivariana de Venezuela* has one of the largest hydrocarbon endowments in the world, ranked second behind Saudi Arabia in proved oil reserves and eighth in proved natural gas reserves at the end of 2009. It is a net exporter of both crude oil and natural gas. However, much of Venezuela's resource endowment consists of extra-heavy crude oil and bitumen deposits (most of which are situated in the Orinoco Belt), which require specialized and costly refining processes in order to obtain desirable end products such as gasoline and aviation fuel. Besides having the largest resource endowment of the countries in the case study sample, Venezuela is also one of the most dependent on oil revenue. Government policies have not been particularly effective in addressing the Dutch disease.

Oil exploitation in Venezuela started in the early 1900s. At the time, exploration and production activities were carried out by multinationals under concessions agreements. The first integrated petroleum law was enacted in 1943 and reflected the 50-50 fiscal regime that had been launched by AGIP (the Italian NOC) in Egypt (see chapter 2). Sixteen years later, Venezuela established its first NOC, which had to compete for concessions with POCs. The sector underwent gradual restructuring until the early 1970s, when declining reserves and production levels triggered a change of policy that increased the level of government control over and direct participation in the sector. PDVSA was created in 1975, following the nationalization of the oil industry. The law imposed restrictions on the participation of domestic POCs in the sector, and foreign investment had to be authorized by congress. PDVSA was tasked with the development of the petroleum resources and with providing revenue to the government for economic development and social welfare needs. By the early 1990s, the government's dependence on oil revenue had grown, and more demands were placed on PDVSA, which at times affected the NOC's ability to invest in its operations. Sovereignty in the Venezuelan case was motivated more by a desire to capture oil rents than to control the production of resources, which explains the sometimes tense relationships between the state, PDVSA, and the POCs (Palacios 2002). Indeed, the latest set of reforms (2006–07) appeared to be triggered by rising oil prices and the government's desire to increase rent capture. Following the reform, PDVSA's mandatory minimum participation in exploration and production activities is 60 percent. The government does not reserve the right to natural gas and refining activities. But since the domestic price of products is below market price, *República Bolivariana de Venezuela* has no private refiners. Since the start of the reform, PDVSA's mission has evolved to include a wide range of social and developmental services. This seems to have taken a toll on the NOC's operational efficiency (see full case study analysis in part II of this paper) and its ability to create value in core business activities. Perhaps PDVSA is an example of the challenges of managing very large resource endowments.

Petronas (Malaysia). At the end of 2009, Malaysia's reserves were about 5.5 billion barrels of crude oil (0.4 percent of world crude oil reserves) and 88 trillion cubic feet of natural gas (1.3 percent of world crude oil reserves). Oil production in Malaysia is declining fast. The majority of its fields have been producing for over 30 years, and remaining fields are of lower quality, relatively small in size, and far from existing infrastructure. In the 1960s, significant oil resources were discovered in Malaysia's Sabah, Sarawak, and Terengganu regions and developed by foreign oil companies under a concessionary system. In 1974 the government launched the reform of its oil sector to increase its control over a strategic commodity. Petronas was created and given exclusive power to develop the country's petroleum sector resources.

Although the NOC was (and still is) subject to considerable government control through the Prime Minister's office, from the very beginning the government gave it a clear commercial and profit-oriented mandate. Since the NOC had decision-making power over the development of the sector, one of the first measures it took was to introduce petroleum sharing contracts, following Indonesia's example. POCs were initially reluctant but eventually accepted the new regime. In 1978 Petronas started exploration and production activities. By the early 1990s, Malaysia's resource base had matured, and Petronas decided to look for oil and

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Box 4.4. Geology and NOC Value Creation (continued)

gas abroad. The decision was controversial, but the government, concerned with energy security, did not interfere. Almost seventeen years later, Petronas' revenue from international operations reached 40 percent of total revenue and surpassed export revenues. Petronas has a dominant position in Malaysia, but a significant amount of petroleum production—35 percent—comes from POCs.

Although Petronas has exclusive privileges in the petroleum sector, the government and its NOC have taken a long-term view to sector development and have pursued a strategy of partnering and risk sharing with private companies. The NOC strategy focused on operatorship, developing technical skills, risk sharing with POCs, and supporting the local supply industry to improve its efficiency and its value creation capacity. Finally, unlike *República Bolivariana de Venezuela*, the organization of Malaysia's hydrocarbon sector has been stable since the nationalization in 1974 despite the periodic reorganizations of ministries and regulatory entities. More importantly, the NOC's and government's objectives and actions have been aligned for the most part. A comparison of operational and financial performance of Petronas and PDVSA over the period 2004–08, adjusted to take into consideration differences in economies of scale, reveals Petronas' superior value creation capability. Thus, Petronas is an example of the incentives that come from having to rely on small and complex resource endowments to create value.

(or available in limited quantities) in the host country. Capital investment is usually high, and the largest investments occur several years before production. As a consequence, “governments and investors are much more likely to observe higher levels of activity (and ultimately faster economic growth and higher profits) if they can spread their investment over several projects through partnering with other market participants” (Tordo 2009). POCs and NOCs use partnering to lower the risk and improve efficiency of operations, improve return on investment, and achieve higher growth rates. By choosing the right partners, POCs and NOCs can also improve their technical and project management skills. Risk and financial leverage management are even more crucial for NOCs that are not allowed by their government to operate internationally, or do not enjoy sufficient levels of budget and financial autonomy. This is often the case for NOCs in oil dependent countries. Box 4.5 explores the relationship between sector openness and NOC value creation.

- *Corporate governance matters to value creation. But some aspects are more relevant than others.* An important underlying assumption of the conceptual model described in chapter 3 is that governance affects the strategic options available to NOCs and is therefore important to value creation. The case studies suggest that the level of technical and managerial competence of the NOC is a distinguishing factor for value creation, together with the extent of government interference in the management and decision-making processes of the NOC. The latter appears to be more closely related to the degree of economic or strategic relevance of the petroleum sector to the specific country than it is to the percentage of independent BOD or BOD committees members. Indeed, independent professional members of the BOD can enhance the quality and transparency of NOC decisions, but they have limited impact on policy decisions made by the majority shareholder. All other things being equal, the quality and skills of human resources is crucial to NOC value creation, particularly in cases where market discipline weak. In most countries in our sample group, changes in NOC governance

Box 4.5. Openness and NOC Value Creation

Pemex (Mexico). Mexico is the most restrictive of the case study countries regarding access to petroleum reserves. In the early 20th century, POCs accounted for the majority of Mexican oil exploration and production. Like in most other countries, Mexico's constitution asserted state ownership of the subsoil, but the petroleum sector was not reserved to the state. By 1917 approximately 90 percent of all oil properties were foreign-owned (de la Vega-Navarro 1998). In 1920 Mexico was the second largest producer after the United States, and the largest exporter in the world (El Mallakh and others 1984). But ten years later, new discoveries in the United States and in Venezuela, and harsher fiscal terms in Mexico, shifted investors' interest away. Due to the lack of investment, production levels declined by 80 percent in the period 1929–32 (Palacios 2002). Tensions between the unions and uncompromising foreign investors led to litigations, which were settled by the ruling of the Mexican supreme court and were the trigger for nationalization. In 1938, an amendment to article 27 of the constitution provided for the inalienability and imprescriptibility of ownership rights to petroleum resources vested in the state. The NOC, Pemex was established with monopoly rights over the exploitation, refining, transportation, processing, and distribution of oil, gas, and products. Dissatisfied with the decision of the supreme court, international oil companies began a boycott of Mexican oil, which made the establishment of the national oil industry even more challenging for Pemex. The government did not have the expertise or capacity to manage the newly nationalized petroleum sector. Improper reservoir management in producing fields and low levels of exploration followed. In the meantime, the government proved unable to contain the pressure of the workers' union, and the NOC's employment levels swelled beyond proportion.

By the 1950s, the situation was dire. POCs were invited to help Pemex through service and risk contracts. The trend in production levels quickly reversed, but by then Mexico's internal consumption had also increased. Since price controls were in force in the domestic market, the reduction in export volumes was particularly hurtful for Pemex. Furthermore, in the mid-1960s Mexico started importing oil, which Pemex had to sell in the domestic market at subsidized prices. Insufficient investment clearly contributed to Mexico's loss of exporter status, but it was not the only factor. Risk contracts with foreign companies were abolished by the late 1950s. Pemex was relying on domestic drilling contractors, which proved to be extremely costly, and it was investing part of its scarce financial resources in petrochemicals (Bermudez 1976). Unable to contain its costs and subjected to increasing demands from the government, Pemex had to borrow heavily to finance its operations.

Large discoveries in the second half of the 1970s allowed the country to once again become an exporter. This was a curse, however, as Pemex began to generate revenue, which allowed the government to sustain its expenditure and development patterns and to postpone badly needed macroeconomic and sector reforms. The interests of Pemex and the government became increasingly misaligned. The pattern of excessive rent capture, underinvestment, and inefficient operations has continued to this day.

In October 2008, a new reform attempt was made. The Mexican Congress approved ten bills, which included changes to the NOC's corporate structure to improve its efficiency and decision-making process and changes to the fiscal regime to attract private investors in high-priority projects. Unfortunately, implementation has been slow and controversial. More drastic reform would be needed to reverse production declines, but this may not be possible given Mexico's institutional and political environment. Pemex's experience speaks to the importance of risk sharing and partnering strategies, even when the NOC benefits from a large resource endowment. The impossibility of partnering with other companies has deprived Pemex of access to technologies and managerial expertise and left it to assume the drill bit risk entirely. Government interference and excessive fiscal take further compromised Pemex' ability to create value.

Among the case study countries, Pemex's faces unique limitations. Every other NOC in our study group uses some form of risk sharing and partnering. **PDVSA**, whose country also limits foreign participation, has never excluded POCs from participating in petroleum operations. In fact, PDVSA relied on POCs to develop its more complex heavy oil fields. Its most recent

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Box 4.5. Openness and NOC Value Creation (continued)

nationalization reform intended more to increase rent capture than to increase government control over petroleum operations. **Sonatrach** has exclusive rights over its country's petroleum resources, and since 2006 it has had majority participation rights in all upstream, midstream, and downstream activities. Since the nationalization of the oil industry in Malaysia, **Petronas** has exclusive rights over the country's petroleum resources, which it exploits through production sharing contracts with POCs. Finally, **KMG EP** and **PetroChina**, which are also endowed with special privileges, pursue a strategy of collaboration and risk sharing with POCs and other NOCs.

that had a positive impact on value creation were triggered by changes in the balance between domestic supply and demand. On the other hand, important new petroleum discoveries or particularly high commodity prices have often triggered changes in the level of government intervention and interference in the management of their NOC, in some cases leading to the reversal of previous corporate governance reforms. The histories of PDVSA, Pemex, Sonatrach, and, more recently, Petrobras are examples of this tendency. In net importing countries that face increasing domestic energy demand, NOCs tend to be given a commercial focus, with limited government interference in strategy and financial management even when the BOD mostly comprises government officials. In some cases, strong government support provides the NOC with a competitive advantage over POCs and other NOCs. But there are risks associated with government support. Judging from the ratings produced by Standard & Poor's (S&P), capital markets view the creditworthiness of a NOC more positively if its government is clearly prepared to provide financial support in times of stress. The stronger a government's commitment as perceived by ratings analysts, the more favorably the NOC is rated. Fifteen of the NOCs analyzed in this paper are rated by S&P. Among those NOCs, eight benefit from indications that their governments would provide extraordinary support if needed and six NOCs from indications of strong and almost certain support by their government (appendix 5). In general, the higher the government dependence on the petroleum sector, the wider the support afforded to the NOC. Nevertheless, government support is not always beneficial for the NOC. Clearly governments are unlikely to provide critical support to the NOC without representation on or control over the BOD and decision-making processes. Therefore, the larger the credit safety net offered by the government, the less autonomy it grants the NOC. The strongest evidence of this trend in our case studies, and in S&P's ratings reports, comes from the NOCs and countries that have the largest and most lucrative resource endowments. In these cases, NOCs are viewed to be critical to their governments as major sources of funding and to the country's economic growth and diversification. NOCs from importing countries (such as China and Thailand) may enjoy similar levels of government support due to their strategic critical role in ensuring their country's energy security. Similar to the special privileges discussed above, this type of safety net may in some cases become a deterrent to efficiency and innovation for the NOC. Box 4.6 explores examples of the relationship between corporate governance and NOC value creation.

Box 4.6. Corporate governance and NOC Value Creation

Petrobras, Petronas, and Statoil are often offered as examples to demonstrate the relationship between value creation and technological advantages and managerial prowess, much of which was internally generated as the companies evolved. Each company benefits from the freedom to enter into partnerships and joint ventures with POCs and other NOCs and operates in a petroleum sector that is relatively open to competition. These features have always characterized their strategy, even when their governments have afforded them special privileges. In fact, special privileges were granted to these NOCs with the objective of fast tracking economies of scale by allowing the NOC to build a portfolio of assets and technical and managerial skills through mandatory participation in contracts or concessions operated by POCs. Consequently, since their establishment, the respective governments have granted their NOCs administrative and financial independence and given them a commercial focus. The three countries wanted to use the petroleum sector as a springboard for economic development and diversification. Although local content policies were mandated by law, and the NOCs were given a special role in promoting them (this no longer formally applies to Statoil), they were tailored to the development of backward linkages that would benefit the NOC and the country as a whole. The policies were designed to enhance existing capacity, and had feasible objectives for the creation of new capacity and therefore were not a burden to their NOCs. Since a strong local supply industry would decrease outflows of foreign currency as well as the cost of operations, the interests of the government and those of its NOC were aligned. The three NOCs adopted a similar strategy with respect to investment in technology and human capital. Managerial and technical competence provided them with a dominant position in their domestic markets, allowing them to improve efficiency and develop competitive advantages, which would not have occurred had the NOCs passively relied on their special privileges. Competent management meant that, notwithstanding the prevalence of government officials on their BOD, the government generally did not interfere with the NOC's strategy and operational management.

What triggered changes in corporate governance for these NOC?

Brazil and Petrobras were pursuing energy self-sufficiency when the NOC was partially privatized, and its corporate governance was reformed to reflect the requirements of a joint stock quoted company. At the same time, the government revoked Petrobras' special privileges. The NOC had to compete with POCs for access to petroleum resources. However, Petrobras had already developed a knowledge of domestic geological basins and deepwater technology that gave it a natural advantage over other market participants. Indeed by that time special privileges were useless and counterproductive to the rapid development of Brazil's resource base. More private investment was needed to leverage the NOC's capacity. After the recent large discoveries in the pre-salt area, the situation has changed. Brazil is no longer chasing energy self-sufficiency. Control over the pace of exploration of the large pre-salt resources and increased rent capture motivated a further change in Petrobras' corporate governance. Special privileges have been chosen to protect and exploit the newly-found resources. Hopefully the government will look to the experience of other large resource owners and avoid the pitfalls that come from excessive self-reliance, interference with the NOC strategy and management, and poor macro-fiscal management.

When the Storting decided to partially privatize Statoil, it was against the backdrop of decreased profitability due to the oil price crash in 1998, and significant cost overruns by the NOC. Its privileges had been revoked almost 14 years earlier over concerns about the growing influence of Statoil on politics and the domestic economy. By that time, Statoil had developed a large portfolio of domestic assets and operational knowledge that mitigated the loss of privileges. Regardless, its privileges would have been revoked in 1994 when Norway decided to join the European economic zone, which required adherence to non-discriminatory market policies. With partial privatization in mind, the government initiated a series of sector and governance reforms aimed to improve checks and balances and to pave the way for increased competition. Prior to privatization, Statoil was hoping to receive part of the petroleum assets managed by the State Direct Financial Interest (SDFI), which was

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Box 4.6. Corporate governance and NOC Value Creation (continued)

also restructured. The NOC already had a dominant position at home, but wanted to expand internationally, and it hoped to limit the cost of acquiring participation in new assets through a license swap. It did eventually receive the majority share of SDFI's divested assets. A few years after privatization, with rising oil prices and falling production levels, Statoil was looking to fast-track its international expansion. A consolidation with Norsk Hydro seemed ideal. The government favored the merger and asked the Storting to approve it. State ownership in the combined entity dropped to 67 percent (from 80 percent), but the new entity was bigger and stronger. The trigger for the merger was not rent capture or control over the industry. Rather it was Norway's declining fields, stiffer competition for international acreage, and the need to strengthen Statoil's position in the Norwegian Sea and the Norwegian sector of the Barents Sea, an environmentally harsh deepwater region of the Arctic that may hold large hydrocarbon deposits.

Petronas is wholly owned by the government of Malaysia. Three of its subsidiaries are listed on the Malaysia Bursa. Petronas' corporate governance arrangements do not rank particularly high on the governance scorecard shown in table 4.10 primarily because of the level of government presence in the corporate structure and the absence of external checks and balances that are associated with quoted companies. But these deficiencies do not appear to have significantly affected the NOC's performance. On the contrary, a symbiotic relationship has developed over time between the NOC and its government. Petronas' strategy of helping to create forward and backward linkages, promoting energy self sufficiency, and seeking diverse sources of energy has played an important role in the Malaysian economy. Its role was—and remains—so indispensable to the economy that through several governments and various price cycles the NOC managed to keep its tax contribution below 30 percent until the early 1980s, and it now fluctuates around 35 percent, which is one of the lowest tax takes in the NOC study sample. Petronas' experience suggests that the corporate governance structure may be less relevant to value creation than the procedures and processes that govern the functioning of such structure.

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Notes

1. While a score of 0.3 is better than a score of 0.2, and a score of 0.35 is better than 0.3, the reader is cautioned against assigning too much meaning to the VCI: non-linear proxy variable distributions may adversely affect a linear interpretation of the VCI scale.
2. Petronas holding is not listed, but some of its subsidiaries, including Petronas E&P, are listed on the Malaysian stock exchange.
3. PIW's ranking of the world's 50 largest oil companies is based on operational data from over 120 firms. The criteria that PIW uses are oil reserves and production, natural gas reserves and output, refinery capacity, and product sales volumes. Companies are assigned a separate rank within each category. The six individual categories are then combined to determine their overall ranking. As such, the index is similar to the operational performance sub-index of the VCI.
4. In this paper, SOEs or government business enterprises are legal entities created by a government to undertake commercial or business activities on behalf of an owner government. SOEs have a distinct legal form and are established to operate in commercial affairs. While SOEs may also have public policy objectives, they should be differentiated from other forms of government corporations or entities established to pursue purely non-financial objectives.
5. A detailed discussion of the corporate governance of standards of SOEs, typical challenges and observed trends is beyond the scope of this paper. An ample body of literature exists on this topic. The following literature has been used as reference framework for the analysis and conclusions contained in this paper: OECD (2004, 2005a, 2005b, 2005c, 2005d), Reddy (2001), and Robinett (2006).
6. Golden shares allow governments to privatized companies while maintaining significant control of politically sensitive operations through a minority shareholding. Combined with the company's articles of association, the golden shares typically allow governments to exercise crucial votes on takeovers, reorganizations and board appointments to block foreign acquisitions or any undermining of government influence. Developed during the period of privatizations, they were often used by governments to protect sensitive industries. A recent decision of the European Court of Justice confirms that these arrangements are contrary to EU law since they impede the free movement of capital (Elias 2010).
7. There are three main models of ownership function organization: (i) the "decentralized model" where the responsibility for each SOE is assigned to the relevant line ministry; (ii) the "centralized model" where the ownership function is centralized under a single ministry (for example the ministry of finance) or a central administrative entity; and (iii) the "dual model" where the ownership function is shared between the line ministry of the SOE and a central administrative entity. Some countries, such as the UK, Germany, and the Czech Republic, use more than one model for different SOEs.
8. The size of BOD for our sample of NOCs ranged from 7 (Qatar Petroleum and Kazmunaigaz) to 21 members (Gaz de France) with an average of 11 members. For a discussion on trends in BOD composition and size see inter alia de Wied and Monsky (2010), Korn Ferry Institute (2008), Daum and Neff (2005), and Board Alert 2004.
9. The Management & Excellence (M&E) ranking measures oil and gas companies' compliance takes into account 387 international standards related to sustainability, corporate governance, corporate social responsibility, ethics and transparency. The standards are derived from institutions such as the US Securities and Exchange Commission, Sarbanes-Oxley, Dow Jones Sustainability Index, Global Reporting Initiative, International Labour Organization, Extractive Industries Transparency Initiative, and the UN Global Compact among others. The 2008 study reviews the performance of 20 major international and national oil companies, namely Statoil/Hydrdo, ENI, Petrobras Pemex, Petrochina, ADNOC, Gazprom, Saudi Aramco, PDVSA, ENAP, Total, BP, Shell, ConocoPhillips, ExxonMobil, Marathon, Repsol, Chevron, OMV, and Lukoil.
10. See for example Pareto (1927), Kaldor (1939), Hicks (1939), Bergson (1938), Hayek (1945), Samuelson (1947), and Webb (1976).

11. A detailed discussion of value creation through the design of allocation systems, fiscal regimes, and market regulation is beyond the scope of this paper. Ample literature exists on these topics. See for example Garnaut and Ross (1975), Chu U Kalu (1994), Baunsgaard (2001), Johnston (2003), Tordo (2007), and Tordo (2009).

12. "The impact on project economics of the government's participation through the NOC deserves special consideration. If concessional conditions apply to the government back-in interest (if the government does not pay its way in, or pays it only partially) this would have implications for the net present value of project cash flow accruing to the POCs. In addition, since the POCs are usually allowed to recover project expenses (including the share that accrue to the NOC) with a limited or unlimited carry forward, this may result in an implied borrowing rate for the host government that is higher than its marginal borrowing rate. Unrecovered expenses affect the calculation of project profitability indices, which in turn may affect the level of government revenue when profit sharing or taxes are determined on these bases" (Tordo 2007).

13. Policy makers are normally reluctant to take the political risks of petroleum exploration. If exploration results in commercially viable discoveries, the decision is rewarded. On the other hand, if the state loses money because exploration is unsuccessful, the conventional wisdom is that public criticism is harsh. Risk aversion therefore likely translates into increased levels of bureaucracy and slow decision making, which affects the operational freedom and efficiency of the NOC.

Conclusion

Are certain corporate governance structures more likely than others to affect positive value creation?

One of the premises of our research was that corporate governance matters because it affects the strategic options that the NOC has to create value. External governance—the ownership structure and organization of ownership—influences the NOC’s mission and objectives and the presence of incentives that promote cost efficiency and innovation. In general, NOCs that are wholly owned by the state tend to have larger national missions objectives and fewer incentives to improve efficiency than partially privatized NOCs. All other things being equal, internal governance mechanisms—the procedures and processes that govern the functioning of the institutional structure of governance—are more critical for value creation than external governance mechanisms. Particularly in the petroleum sector where prices, technology, competition, and management techniques are continuously changing, nimble decision-making processes and budgetary, financial autonomy, and high levels of technical and managerial competence are crucial to value creation, regardless of whether or not the NOC is wholly owned by the state.

Government interference in the NOC decision making processes seem to be more closely related to the degree of economic or strategic relevance of the petroleum sector to the specific country, rather than the percentage of independent BOD or BOD committees members. Assessing the independence of BOD members is a complex endeavor, especially in companies with high concentration of ownership. On the other hand, independent professional members of the BOD can enhance the quality of NOC decisions, as well as their transparency, but they have limited impact on policy decisions made by the majority shareholder.

Cultural differences across countries play a significant role in explaining why similar corporate governance structures may function in a very dissimilar manner. The adoption of Western practices and adjustments to international norms is often deemed necessary for reasons of legitimacy, to gain access to international markets and global finance. But diluted ownership and clear separation of ownership and control—that are characteristic of the Anglo-American model of governance—may work in a different way in countries that have a tradition of bureaucracy and more centralized decision making processes, and where minority interests do not receive same levels of protection.

Is it easier to create value for NOCs that belong to countries with large resource endowments?

In theory larger petroleum endowments should lead to more value creation. In practice, many technical, economic, and institutional factors affect the efficiency of resource exploitation. The geological properties of a basin, the physical qualities of the resource,

and its location affect the cost of exploitation. For example, the Orinoco belt in *República Bolivariana de Venezuela* contains the largest heavy crude oil reserves in the world. But the production, transportation, and refining of heavy oil poses special challenges compared to lighter quality oils. This has implication for the cost of production as well as the price of crude oil extracted which, owing to its characteristics, trades at a discount to lighter quality oils. Hence owners of heavy crude oil reserves are more exposed to downswings in oil prices since their operating leverage is, *ceteris paribus*, higher than that enjoyed by owners of lighter quality crudes. Setting technical considerations aside, intuitively the exploitation of large petroleum fields and large resource endowments enjoys the advantage of economies of scale, which in turn lead to more efficient value creation.

Empirical evidence suggests that government control over and intervention in the petroleum sector is generally linked to a country's dependence on petroleum revenues, which in turn is linked to the size of the petroleum sector compared to the rest of the economy. In other words, countries that are blessed with good geology tend to adopt more restrictive access policies than countries with smaller endowments. Often the NOC is the custodian of the country's resource wealth, and in some case the sole company authorized to explore for and exploit the resource. Countries that take this development model to the limit choose to bear all risks associated with extraction. Although the chance of exploration drilling success has been steadily rising over the last 50 years, exploration remains a risky business. Furthermore, the decision to carry out sole risk operations has consequences, including limited access to technology and knowledge sharing, and funding limitation. This in turn affects the efficiency, cost, and pace of extraction, and eventually value creation. The experience of the NOCs analyzed in this paper would seem to indicate that large resource endowments are a disincentive to efficient production and the maximization of the net present value of their extraction, especially when partnerships and alliances with POCs and other NOCs are not the prevalent business strategy.

Countries that have large oil and gas resource endowments face a more difficult task when it comes to macroeconomic management. It is more difficult to guard against the risk of Dutch disease when the inflow of foreign currency is very large. Also public knowledge of the presence of large reserves makes it difficult for governments to maintain a rigorous fiscal policy stance. Dutch disease further deepens the country dependence on oil revenue, which in turn leads to further government control and political involvement over the exploitation of the resource and the NOC decision making processes. Countries that exhibit high levels of oil dependency are more likely to impose higher financial burdens on their NOC or to use their NOC to finance budget gaps. When this behavior becomes entrenched, a cycle of negative value creation starts, in some cases displacing vital maintenance and exploration investment and endangering the long term sustainability of the NOC.

Ultimately, the political, institutional, and societal qualities of a country—more than the actions of its NOC—are critical to determining to what extent the gift of nature will translate into value creation. In other words, the size of the resource endowment matters to value creation, but the manner in which it is exploited matters more. Large resource endowments lead to higher value creation if the resource is extracted efficiently and revenues from its sale are re-invested to support production levels and replace reserves. Given the complex network of often conflicting interests between efficiency of exploitation and state needs, following this approach may be harder for NOCs that belong to countries with large resource endowments, than it is for their peers in less endowed countries.

Can restrictions on access to petroleum activities be effective policy tools to enhancing value creation by the NOC?

Most petroleum producers have used some form of restriction to the participation of the private sector in petroleum activities, ranging from granting their NOC the monopoly over all or part of the petroleum sector value chain (although restrictions on downstream or midstream activities are less frequent) to mandating minimum state ownership or minimum state participation in all or some type of petroleum activities. In some cases restrictions on private participation stem from constitutional provisions that reserve certain strategic sectors to the state. Alternatively, the policy may be motivated by the desire to increase rent capture, or to exercise a stronger control over the exploitation of the resource, or simply by country circumstances that make the participation of the private sector a difficult proposition (think of Colombia during the guerrilla period). The motive for imposing restrictions on access, existing capacity at country level, and the country's international obligations affect the policy options that are available to the government to achieve the desired results. The chosen policy in turn affects the strategies that the NOC can pursue to create value.

Among the countries surveyed in this paper, many impose, or have imposed, some form of restriction on the participation of the private sector in petroleum (in some cases limited to crude oil) exploration and production activities by granting special rights to their NOC. Generally these privileges have taken the form of mandated association between the NOC and POCs, with minimum levels of state participation. This formula is often used by countries and NOCs that are new to the petroleum sector with several aims: (i) fast tracking the learning curve through the association with experienced industry participants; (ii) reducing information asymmetries between industry participants and the state; (iii) increasing rent capture; (iv) reducing exploration risk; and (v) accelerating the exploration and production of the country's resources while maintaining control over sector activities.

Full exclusion of industry participation in petroleum exploration and production activities is rare. Among the NOCs analyzed in this paper, only Pemex has monopoly rights. This policy decision was driven by political and philosophical reasons more than by economic considerations. Given the number of factors that interact to create value, it would be difficult to point to "monopoly" as the single most important contributor. Nonetheless, setting aside considerations related to risk management, NOC financial autonomy, operating and financial leverage, transfer of technology and expertise, and optimal depletion strategy, it can be noted that there are decreasing marginal gains from economies of scale beyond a certain optimal size even in the petroleum sector where size is important. Hence, from a purely economic view point it would seem that NOCs and their country would derive less advantages from the adoption of a policy of prohibited access to exploration and production activities than they would from a policy of limited access.

Well designed restrictions on access—that is those that take into consideration the characteristic of the resource, domestic capacity, the fiscal regime, and market structure—can be very effective tools to address information and capacity asymmetries. Sheltering the NOC from competition helps it to focus on developing the necessary competence and economies of scale. However, this policy has decreasing effects on value creation over time and, unless granted on a temporary basis, may discourage the NOC from developing efficient and competitive processes.

Does the pursuit of national mission objectives hamper the creation of value by the NOC?

What constitutes “the national mission” is country specific, but it usually includes the creation of some kind of backward or forward linkages—such as fostering the transfer of technology, creating employment opportunities, increasing local ownership and control, and promoting economic growth and diversification—and may include energy security and energy self sufficiency. It is often argued that the pursuit of national mission objectives imposes costs on NOCs, and might reduce their incentive to maximize profits, which in turn hinders the NOCs’ ability to raise capital on the financial market, and leaves their home States’ treasuries to bear the burden of inefficient capital allocation.

When it comes to NOCs there is hardly such thing as a “purely commercial mandate”. It is mostly a matter of degrees. For some NOCs national mission objectives constitute a large part of their mandate, and do create demands on scarce resources that would otherwise receive a different allocation. For others, the national mission is lock step with the NOC’s core business, and does not create competing demands on its resources. On the contrary, it enhances NOC value creation. This is often the case for NOCs that belong to importing countries which are concerned with energy security issues. Typically these NOCs would receive support from their government, including actions that shore up the NOC’s outbound investments, and the grant of wider decision making, and financial and budget autonomy to the NOC. NOCs that operate only in the domestic market are often required to invest in creating a skilled workforce, develop technology, and support the local supply industry. But this should be part of the NOC’s strategy to lower the cost of operations and obtain the “social license to operate”. The requirement to develop forward linkages is more challenging since developing industries that make use of the oil and gas sector’s output requires large scale operations and technology that is not available in all petroleum producing countries. When conditions are in place, forward linkages enhance value creation by capturing the advantages of vertical integration.

It is clear from the experience of the NOCs analyzed in this paper that national mission objectives hamper value creation when their pursuit is in conflict with other key value added functions of the NOC, such as the efficient and sustainable conduct of activities related to the exploration and exploitation of petroleum resources. Defining proper national mission objectives for the NOC is thus critical to value creation. This is particularly relevant in countries where the NOC is the only company authorized to carry out petroleum activities, with limited possibility to share the exploration and development risk with other parties, since this strategy requires, inter alia, a superior level of operational efficiency and the ability to prioritize core business investments.

Appendixes

Key Stages of the Value Chain

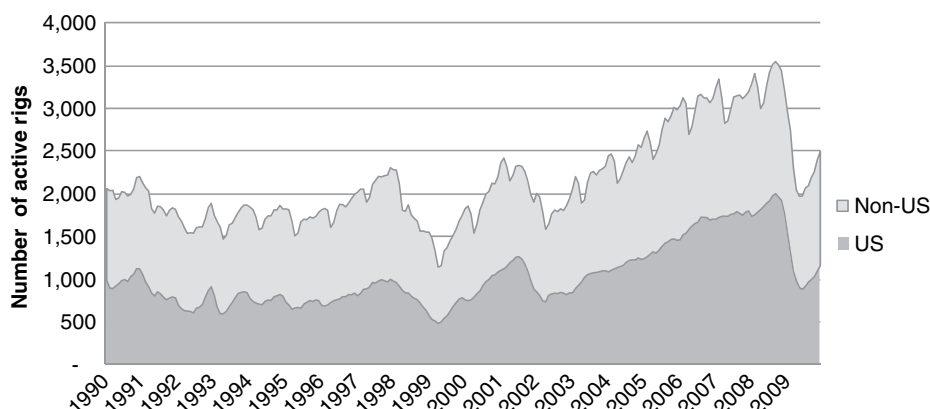
This appendix provides a brief technical introduction to the key stages of the value chain, illustrated in figure A1.1, and describes their connections.

Exploration and Production

The principal hydrocarbon resources are crude oil and gas. Crude oil is not a homogeneous material; its physical appearance varies from a light, almost colorless liquid to a heavy viscous black sludge. Oil can therefore be classified along several dimensions, of which density and sulfur content are two of the most important. Density is measured according to guidelines set by the American Petroleum Institute (API): light crudes generally exceed 38° API, while heavy crudes have an API gravity of 22° or less. If the sulfur content is less than 1 percent, crudes are usually described as sweet; if it exceeds that level, sour. The quality of a crude oil is reflected by its price, relative to other crude oils (Bacon and Tordo 2005).

Gas can be found either in separate accumulations from oil (nonassociated gas), or in combination with or in solution in crude oil (associated gas). The composition of gas produced at the wellhead varies widely, but in most cases it contains pure natural gas (also known as methane, which is colorless and odorless); natural gas liquids (NGLs) such as ethane, butane, propane, iso-butane, and natural gasoline; and a number of impurities, including carbon dioxide and water. Dependent on the NGL content, gas is described as either wet or dry. Within the reservoir, gas is also often associated with condensate, a light oil that is gaseous under reservoir conditions. Over the past decade, efforts to find gas have been stepped up considerably; previously, much gas had been found by chance when the real exploration target was oil. Since gas has to be moved by pipeline or by dedicated liquefied natural gas (LNG) vessels, developing new markets for it is much more expensive than for oil. This has led to a large amount of “stranded gas” — that is, gas that has little or no commercial value because it has no identifiable market.

Suitable sedimentary basins for oil and/or gas exploration are usually identified using relatively simple means such as aerial and satellite photography, as well as magnetic surveys. More detailed information about specific locations is then obtained through seismic surveys, which are considerably more expensive. Through complex computer analysis, the data are interpreted to create images of geological formations and possible deposits of hydrocarbons. Exploratory drilling using rigs suitable for the specific environment (that is, land, shallow water, or deep water) is the next step. Much ancillary equipment, products, and services are associated with drilling, and many petroleum companies typically contract an outside services company for these purposes. The market for drill rigs and drilling services is considered a reliable lead indicator of the industry’s overall activity and investment levels. Figure A1.1 shows the evolution of the active drill rig count index over the past 20 years.

Figure A1.1. Global active drill rig count, 1990–2009

Source: Authors, from data published by Baker Hughes Incorporated—downloadable from http://investor.shareholder.com/bhi/rig_counts/rc_index.cfm.

If hydrocarbons have been found in sufficient quantity, the development process begins with the drilling of appraisal wells in order to better assess the size and commercial viability of the discovery. This is followed by drilling for full-scale production, and the building of infrastructure to connect the wells to local processing facilities or evacuation routes. Onshore infrastructure tends to be less complex and much cheaper than offshore infrastructure.

The speed at which the pressure in the reservoir forces the petroleum upward is known as the flow rate; it depends, for example, on the properties of the reservoir rock and, in the case of crude oil, on the viscosity—in short, on the reservoir's characteristics. Natural (primary) pressure typically recovers much less than 50 percent of oil and 75 percent of gas. In order to boost flow rates and overall recovery factors (the percentage of hydrocarbons recovered for commercial purposes) in the face of inevitable natural decline rates, various methods can be used. Secondary recovery methods include the injection of water or gas into the reservoir, and the installation of surface-mounted or submersible pumps. Tertiary recovery methods (or enhanced oil recovery, EOR) involves the use of sophisticated techniques that alter the original properties of the oil. The decision as to whether—and which—secondary or tertiary recovery methods are appropriate for a certain reservoir often involve trade-offs between commercial considerations (significantly increased production costs can accelerate and possibly increase overall output) and geological considerations (aggressive production can damage a reservoir and lead to lower overall recovery factors).

Even on a standard upstream project it is not unusual for five years to pass between the initial exploration stages and full-scale commercial operations. For projects with challenging access, geological, or infrastructure requirements, the lead times can be longer still. These time horizons, coupled with the fact that sudden changes in well-flow management can damage underlying reservoirs (see the section on production/depletion management below), result in structural rigidities in petroleum supply, which often exacerbate price swings.

Most observers agree that the oil and gas industry is a maturing one.¹ Although there appears to be no danger of hydrocarbons running out in the foreseeable future (Lynch 2004; Mitchell 2004; Mabro 2005; Greene, Hopson, and Li 2006; and Watkins 2006), the most traditional onshore and shallow-water offshore fields are rapidly depleting, leaving projects that are more technically complex (for example, deep-water offshore reservoirs or those in remote areas with challenging climates and no existing infrastructure links) and thus more costly (Goldman Sachs 2003; UBS 2004; Douglas-Westwood 2008).

Transportation and Storage

From a production site, crude oil and gas need to be transported to the appropriate processing facility; from there they are distributed or marketed. Petroleum can also be stored at various points along the value chain for reasons that include securing supply and price hedging/speculation.

Crude oil is stored in large-diameter holding tanks and is transported by pipeline, truck, railroad, and/or tanker to refineries for processing. Well-known long-distance pipelines include the Druzhba pipeline from Russia to Europe, the Trans-Alaskan pipeline, and the recently opened Baku-Tbilisi-Ceyhan pipeline (which connects the Caspian with the Mediterranean Sea). But ocean tankers are the most common medium of inter-continental transport. Many key export ports are in or close to the important petroleum-producing regions of the world: for example, Saudi Arabia's Ras Tanura facility in the Persian Gulf is the world's largest offshore oil-loading facility, with a capacity of approximately 6 million barrels per day. Major import and trading hubs, each with extensive storage and loading facilities, include the Houston Ship Channel, the Louisiana Offshore Oil Port, Rotterdam, and Singapore. Refineries, which usually are located near major import hubs to limit additional transport charges, purchase crude on the open market or directly from producers.² Having completed the refining process, oil products can be distributed by the same means as crude oil. Road transport is most common, but extensive networks of product pipelines can be found around the world.³

Natural gas may be stored underground in a variety of methods, most commonly in depleted reservoirs, aquifers, or salt caverns. The transport options for gas depend on its physical state. NGLs can be transported either by pipeline or by tanker truck, but dry gas (methane) can only be transported by pipeline, and even then not across the seabed of deep oceans. The prohibitive cost of the necessary pipelines severely limits the trade of natural gas around the world. An option for long-distance gas exports is LNG, which is described in more detail below.

Piped gas has to be transported all the way from the production site to the final destination (a power station, industry, or domestic consumer, for example) using multiple types of pipelines and pipeline networks along the way. By adjusting the degree of pipeline compression, such networks can also be used as additional storage facilities.⁴ The physical balancing of an integrated gas network to enable scheduled transits (and, possibly, short-term trading as well) is a highly complex task. In nonexporting countries, the gas producers do not usually own major parts of the gas pipeline infrastructure (transmission grid) and instead sell the gas at the entrance point to the main gas grid. But in major gas-exporting countries, such as Russia and Norway, the state-backed producers frequently hold long-term supply agreements as well as an equity stake in the gas pipelines serving international target markets.

Major pipeline projects require substantial up-front investment, and are not viable without clearly identifiable (and ideally long-term and committed) users, a sound revenue/tariff model, and tailored financing. When more than one country is involved, such projects are also subject to geopolitical considerations (Victor, Jaffe and Hayes 2006). As with any supply or evacuation infrastructure, sunk costs are a substantial risk, but once they have been made they can dramatically improve the economic viability of many actual and potential petroleum projects in the vicinity.

Refining and Marketing

Crude oil almost always needs to be refined into oil products prior to consumption, with the main product categories being fuel oil, gas oil, jet/kerosene, gasoline, naphtha, and liquefied petroleum gas (LPG). Gas oil and jet/kerosene are often described as “middle distillates,” and gasoline and naphtha as “light distillates.” The three main energy-related uses for oil are transport, power generation, and heating. There are also nonenergy or process uses, such as feedstock for the petrochemicals industry. The different end uses differ markedly in their vulnerability to fuel substitution. The transport and nonenergy markets have a low vulnerability, making them relatively captive markets for oil. For power generation and heating, however, the markets can easily switch among fuels (especially among gas, coal, and oil), so their price elasticity tends to be higher (UBS 2000).

Oil refining is the process of separating the hydrocarbon molecules present in crude oil and converting them into more valuable finished petroleum products.⁵ Refineries can consist of a number of different process units that undertake the separation, conversion, and treatment of oil. The initial stage of a refinery run involves the heating and separation of crude into its constituent parts in a distillation column. Then the different fractionations are directed to conversion units to be chemically altered through the introduction of heat, pressure, catalysts, or hydrogen. The output of these conversion units is then treated or blended. Refineries are usually categorized by size and configuration. The configuration or sophistication of a refinery depends on its technical capability to process different kinds of crude feedstock into a large number of different products.

Because of their chemical properties different crude oils produce very different yields when refined. Crudes that are lighter (in terms of density) and sweeter (in terms of sulfur content) naturally produce a higher yield of lighter, more valuable products such as gasoline and a smaller one of lower-value products such as residual fuel oil,⁶ but even these trade at a premium in the market. Refiners strive to process an optimal mix of crude oil (crude slate), depending on each refinery’s individual configuration of process units, current and anticipated product prices, desired product mix (product slate), and the relative price of the crude oil available.

The key driver of oil product demand patterns is a country’s or region’s level of economic development. While in developing countries heavy fuel oil is still in considerable demand for industrial uses, developed countries—with their service economies and focus on personal mobility—require mostly middle and light distillates. Oil product demand usually follows a seasonal pattern: it is interesting to note, though, that the United States is the only major consuming market where seasonal demand peaks in summer. This is due to the exceptionally high demand for gasoline relative to other oil products (motor and aviation gasoline account for 46 percent of oil product demand in the United States, but only for 22 percent in the European Union) and the fact that

summer is a so-called “driving season” in the United States. In other countries of the northern hemisphere, the importance of heating oil, propane, and kerosene as heating fuels create a winter peak in the seasonal demand pattern (UBS 2000; BP 2008).

Refining is a global, highly cyclical business in which profitability is sensitive to marginal changes in product supply and demand. The principal measure of profitability is the gross refining margin (GRM), which is calculated as the difference between the revenues received and the cost of feedstock plus other cash costs such as labor, maintenance, and working capital. The GRM excludes noncash costs such as depreciation, so a positive GRM may still translate into an accounting loss. The margin after noncash costs is the net refining margin. Both margins are usually expressed on a per-barrel basis. Although refining margins are unique for each plant, refineries in the same region tend to experience similar margins because their output markets share the same product prices, the same availability of crude grades, and, therefore, often similar technical configurations. The three primary refining centers in the world, for which refining margins are typically quoted, are the U.S. Gulf coast, northwestern Europe, and Singapore.

Marketing refers to the distribution and sale of refined products, whether through wholesale or retail. Road transportation fuels are primarily distributed at retail stations, heating oil is usually delivered to residential and industrial customers, kerosene is purchased directly by individual airlines and airports, and residual fuels are also sold directly to shipping companies, utilities, and industrial plants. Marketing margins (pretax pump prices less spot prices for oil products) tend to be more stable than refining margins, and the overall profitability of retail stations is further enhanced by the ever-increasing nonfuel sales of items such as convenience goods.

Gas Processing and Marketing

Many petroleum companies are involved not only in the production of gas but also in its processing and marketing. Usually, gas must be processed in dedicated plants (so-called fractionators) to become suitable for pipeline transportation: NGLs and impurities are extracted from the gas and the NGLs are further fractionated into their constituent parts and sold. In addition to piped natural gas and NGLs, LNG is a third, core “gas product”; gas-to-liquid (GTL) technology might also have significant future market opportunities.

The distribution of piped gas to the end consumer is usually done by utility companies, but petroleum firms are involved in longer-distance transmission and in direct deliveries to industrial users, power plants, and so on. NGLs are also sold to industrial, wholesale, and retail clients (in the latter case usually through stations). The GTL process converts natural gas into a range of high-quality, colorless, odorless, and biodegradable products normally made from crude oil; these include transport fuel, naphtha, and oils for lubricants. Although so far the technology has been largely applied in smaller demonstration plants, Qatar is now building several world-scale GTL facilities in order to diversify its gas commercialization strategy.

Of the total production of 2,940 billion cubic meters (bcm) of gas in 2007, only 550 bcm (18 percent) was traded internationally by pipeline and only 226 bcm (8 percent) was traded in the form of LNG, implying that about three-quarters of global output was consumed domestically (BP 2008).⁷ But due to declining indigenous production and the expected increased significance of gas in the future, the trade in LNG is projected to grow strongly over the following years and decades. At the moment, Japan and South

Korea still account for more than half of all LNG imports, but the market is bound to become more geographically balanced over time.

The technical process of producing LNG involves three stages: first, the processed natural gas is progressively cooled to minus 160°C, when it becomes liquid at atmospheric pressure and shrinks to one six-hundredth of its gaseous volume. The liquefaction process is done in dedicated LNG plants close to the wellhead and gas-processing plant. The LNG is then stored in insulated tanks before being loaded into dedicated cryogenic tankers for shipment. At the destination, it is received at an LNG-receiving terminal, where it is regasified and injected into the local gas grid. LNG projects are capital intensive, and it is common practice to enter into at least a 20-year supply contract in order to reduce project risks and justify investment. Traditionally, the LNG plant and export terminal were owned by the upstream petroleum company, whereas the import terminal and tankers were owned by the receiving company (in most cases an electric utility). Because of the increasing competition among LNG-producing sites worldwide, however, major oil and gas firms increasingly hold an equity stake in the receiving facility to ensure that they benefit from their LNG production.

Petrochemicals

Petrochemicals are chemicals made from crude oil and natural gas; they account for approximately 40 percent of the world's chemical market. The two main groups of primary or base petrochemicals are olefins (including ethylene, propylene, and butadiene) and aromatics (including benzene, toluene, and xylene). Chemical products based on these base materials include polyethylenes, polyvinyl chloride, styrene, and polystyrene, as well as polypropylene, which in turn are the basis for a wide range of everyday products such as pipes and tubing, plastic bags and bottles, telephones, coffee pots, electronic components, and car tires.

The oil industry became involved in petrochemicals from the 1920s, since naphtha (from refineries), natural gas, and NGLs constituted the principal feedstock. Because of the inherent advantages, refineries and petrochemicals plants are often situated close to each other and are often linked by pipeline. The most common profitability measure for petrochemicals is the cash margin per ton, usually reported for the two main "upstream" products, ethylene and propylene.

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Notes

1. Adelman (2004), however, has long emphasized the importance of price incentives and technological progress, pointing to the industry's track record of defying "gloomy" predictions.
2. In recent years, in a bid to capture a greater share of the petroleum value chain, some producers have strengthened their refining business, increasing their share of product export versus crude export.
3. As an illustration, a map of all Western European refineries and crude oil and oil product pipelines can be downloaded at <http://www.concawe.be>.
4. Powerful compressors are required to force the gas through a pipeline, otherwise it would just sit inside without moving forward. When storage is unavailable, and current gas flow exceeds market demand, compression can be lowered or stopped until a change in the market or available storage capacity occurs.
5. Preston (1998) provides a good introduction to the history of refining as well as key technical terms, and sources of operational information.
6. Fuel oil has long been used as an energy source in heavy industry but has become unpopular in developed countries for its high pollution and undesirable combustion levels. It can also be processed into petroleum coke and asphalt/bitumen.
7. The BP Energy Review does not provide a breakdown for NGLs and GTL, but it is plausible that NGLs are largely consumed domestically and that GTL output is still insignificant.

Examples of Local Content Policies

In 1973, the *United Kingdom's* Offshore Supplies Office provided financial assistance to the local supply industry to increase local participation in the supply of goods and services to the oil industry. The office also monitored purchases made by oil companies. While no legal sanctions were imposed on companies with low local content, there was a general expectation that these companies would find it more difficult to be successful in a licensing round (Cameron 1986). At the time, local firms initially supplied technically simple products and services, and oil majors relied mostly on established foreign suppliers. Between the mid-1970s and mid-1980s, the rise in oil prices and increasing production intensified local demands for government intervention through incentives and local content policies. When prices started falling and oil majors started to rationalize their business and cut costs, there were fears that local suppliers would find it difficult to survive. These fears proved overblown, and local firms adjusted to the new environment through diversification to cater to different sectors, regional concentration, and investment in research and development (Chapman et al 2004). This happened while the government was stepping down local content requirements owing to increased pressure towards fair competition from the European Union. To paraphrase Auty, the UK experience would seem to indicate that local content policies may be redundant (Auty 2008).

Norway is known for its approach to the development of strong local service and construction sectors related to oil exploration and development. Local participation ranged from favoring the NOC, Statoil, in licensing rounds—on the premises that this would increase the chances of developing local suppliers—to encouraging the use of locally produced goods and services and leveraging the country's expertise in shipbuilding and marine services. In 1972 local content policies were formalized in legislation, and the Goods and Services Office was established to: (i) support the local supply industry through joint ventures and encourage research and development and transfer of technology; (ii) review tendering procedures to ensure that local companies are given a fair chance to participate; and (iii) establish minimum local content requirements and monitor their implementation. In 2006 Statoil merged with Norsk Hydro, a private-public company in which the Norwegian government had held a 44 percent share since 1999.¹ Even before the merger, Statoil's responsibilities had gradually changed over the previous 30 years, and its role as an instrument for local content development gradually disappeared. Statoil has expanded internationally both upstream and downstream, and it is now operating in 25 countries (Olsen 2002). However, the Petroleum Act (Sections 8, 23, and 54) lays down requirements regarding oil companies' purchasing policy: (i) competitive Norwegian suppliers shall be given genuine opportunities to secure orders; (ii) operating companies are required to inform the Norwegian supply and contractor industry in advance of the bidding process; and (iii) the operators have a duty to perform in Norway at least 50 percent of all research and development required by field development.

The entry of the United Kingdom and Norway into the European Economic Area in the 1990s affected their ability to continue granting preferential treatment to local companies. By this point, however, these countries had already developed a solid base for the local supply and contractor industry. Furthermore, the World Trade Organization (WTO), embodying a set of multilateral liberalization agreements, has had a profound global impact as a norm setter (WTO 2007). While membership in WTO and other international trade bodies is often a high priority for governments, it also restricts the use of preferential policies that can increase local content. In addition, some countries have entered a number of bilateral agreements that affect trade. Since WTO rules focus on the bidding phase, many countries have adapted their local content strategies to overcome WTO's restrictions.

Malaysia's NOC, Petronas, has been a key factor in the development of local capabilities and an industrial base to support oil and gas exploration and production since the 1970s. The development of a local supply sector was encouraged through licensing requirements, which included: (i) mandatory local incorporation of foreign oil companies and a minimum share of domestic equity holding; and (ii) the obligation to acquire all materials and supplies locally or to purchase them directly from the manufacturer when not locally available (Klueth and others 2007).

Requirements for the use of local goods and services are common in petroleum contracts in *Nigeria*. These requirements mandate the use of local goods and services if they are of equal quality and availability to imported ones and if their prices are no more than 10 percent higher than imported goods and services. In addition, training and local employment obligations are common. These requirements were strengthened in the 2000, 2005, and 2006 licensing rounds during which, among the criteria for award, bidders were asked to commit to the development of Nigerian expertise and know-how. Local content requirements became more stringent in the 2005 marginal fields licensing round: bidders were required to associate their bids with local content vehicles in the form of Nigerian companies (that is, locally incorporated companies with a majority—usually 60 percent—of Nigerian shareholders). The Nigerian company would provide local goods and services, while the international company would be the technical partner. However, the low uptake by the market may be an indicator that the restriction was too stringent given local capacity levels (Tordo 2009). The Nigerian Oil and Gas Industry Content Development Bill was approved on April 22, 2010. The Bill further strengthens the requirements for developing the local industrial and services sectors and introduces mechanisms to coordinate and monitor implementation. The law requires all oil and gas explorers, producers, transporters, and exporters to use a greater share of indigenous Nigerian service companies and personnel in their project development plans. Furthermore, in a move designed to boost local investment funds, every multinational company must hold a minimum of 10 percent of its annual profits in a Nigerian bank. The country's NOC, NNPC, operates a Nigerian Content Division that promotes local content in the oil and gas sector by training engineers and welders, scaling up of local steel plate and pipe manufacturing, and increasing the availability of low-interest loans to local contractors. A three-year grace period is provided to allow foreign companies to adjust their procurement and investment strategies. However, long-term investment is needed to build local capacity. According to some industry observers, this may be a challenging policy objective since the continuous instability in the Niger Delta has driven many investors to consider exiting the country (BMI 2010).

In 1997 *Venezuela* launched its third licensing round in the oil and gas sector. Twenty fields were offered under operating service agreements, while five fields were reserved for Venezuelan companies or consortia with a Venezuelan operator (Tordo 2009). The Venezuelan government has relied on its NOC, PDVSA, to fund and implement a heavily interventionist strategy. The latest oil price rally allowed the government to direct a considerable share of oil revenues to improve social conditions. But the pursuit of this strategy has weakened PDVSA's ability to invest in the oil sector, endangering its capacity to generate revenues. In the long term, this is likely to affect the sustainability of *República Bolivariana de Venezuela's* local content policies. In addition, the government's price controls have concealed underlying imbalances within the Venezuelan economy. Sustained increases in social spending have brought about only modest social benefits (Hults 2007).

Angola's NOC, Sonangol, has been the main vehicle for enhancing local participation in the oil and gas sector. By leveraging its important role as concessionaire, Sonangol has created a strong network of service companies, more or less directly linked to the oil sector, through joint ventures with international service companies. In addition, Sonangol recently widened the scope of its business to include an airline, banks, and insurance companies. Overall, Sonangol's national mission includes the promotion of local content in many sectors.

In *Trinidad and Tobago*, economic sustainability has been the major driver for the development of a local content and participation policy for the energy sector. The surpluses derived from this sector have been targeted for the development of other sectors and the diversification of the country's economic base. International oil and service companies are encouraged to share their expertise through education and training, the employment of nationals, contracting of local companies, and the use of local capital (Ministry of Mines and Energy 2004). The Ministry of Trade's green paper on local investment in Trinidad and Tobago lays down the targets of the government's industrial policy and the measures planned for the period 2007–12 (Ministry of Trade and Industry 2007).

In 1987, *Brazil* opened its petroleum sector to companies other than its NOC, Petrobras. By then the development of Brazil's industrial and services sectors was already advanced. The liberalization of the sector allowed the country to accelerate the exploration and development of its petroleum resources. At the same time, it maintained firm control of the sector through regulation and the direct participation of the NOC. Petrobras' extensive knowledge of and operating experience in Brazil's petroleum basins allows it to remain the largest individual holder of concessions and to maintain a majority interest in most other concessions. But the eight licensing rounds aimed to further reduce Petrobras' market advantage by limiting the number of concessions that could be awarded to the same operator in specific basins. The policy objectives of the Brazilian government were: (i) to encourage the exploration and production of the country's petroleum resources to remain self-sufficient in oil production and to reduce natural gas imports, and (ii) to increase the contribution of the sector to local economic development. Cash bonus and local content were the only bidding parameters for the first four licensing rounds. The bid evaluation criteria used in the most recent licensing rounds assign a 40 percent weight to each cash bonus and work program, and a 20 percent weight to local content broken down between exploration and production phases (Tordo 2009). In the first licensing round in 1999, the average local content was 25 percent during the exploration phase and 27 percent in the development phase. These percentages increased gradually, reaching 69 and 77 percent, respectively, in the ninth licensing round held in 2007.²

South Africa's post-apartheid Black Economic Empowerment program, which offers preferential training and employment to black communities, mandates minimum levels of local content for all sectors of the economy. But formal legislation specific to oil and gas is still in its early stages. The South African Oil & Gas Alliance (SAOGA) is a non-profit organization established by the provincial government of the Western Cape to support and promote the growth of local industry in the upstream oil and gas sector. SAOGA is also the membership organization for approximately 170 local upstream suppliers. The three main strategic imperatives of the organization are to: (i) build local industry by facilitating infrastructure projects and access and through skills development and training programs, suppliers development and certification programs, and public policy intervention; (ii) carry out marketing and business development activities on behalf of member companies by organizing trade missions and conference trips, running networking and matching events, publishing a suppliers directory, and identifying opportunities through market research and liaison with procurement managers; and (iii) promote investment in South Africa by attracting international upstream supplier companies to establish local branches or partner with local companies.

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Notes

1. Norsk Hydro was founded in 1905 by Norwegian entrepreneurs Sam Eyde and Kristian Birkeland as Norsk Hydro-Elektrisk Kvaelfstofaktieselskap (Norwegian Hydro-Electric Nitrogen Corporation). The company originally exploited waterfalls to generate electricity used in the production of nitrogen fertilizers. Gradually the company expanded its business into other sectors. In 1971 the Norwegian government increased its stake in the company to 51 percent. By the 1990s, the company's size justified a decentralized organization plan grouping the company into four business segments, each serving as the strategic and financial center for its composite divisions: agriculture, oil and gas, light metals, and petrochemicals. In 1999, Hydro acquired Saga Petroleum ASA, and the government of Norway's stake was reduced to 44 percent. <http://www.fundinguniverse.com/company-histories/Norsk-Hydro-ASA-Company-History.html>.

2. These numbers are provided by the Brazilian Government at http://www.brazil-rounds.gov.br/portugues_topo/resumo_geral.asp#.

Overview of Key Research on NOCs

Until recently, researchers had largely neglected national oil companies (NOCs) and their performance. A number of important papers on oil resource ownership were written in the 1980s and early 1990s. Thereafter, however, the industry received limited attention: oil prices were low, supply seemed secure, and the fall of communism opened new opportunities for the major international oil companies (Wolf 2008). It was not until the early 2000s that the transparency, governance, and efficiency of NOCs started to interest the research community, policy makers, and the general public. The following sections contain a brief review of some of the most salient literature on state-owned enterprises (SOEs)—particularly NOCs—and provide a background for this paper.

What do we know about state-owned enterprises?

Most of the existing literature on the theoretical basis for state intervention in the economy and its comparative advantage vis-à-vis private ownership was produced between the 1960s and the early 1990s. Empirical analysis during this period was mainly concerned with investigating the effect of ownership on the performance of SOEs. To identify the drivers of performance, researchers frequently used cross-sectional analysis of ownership effects and longitudinal analysis of pre- and post-privatization performance of SOEs in various sectors of the economy. The results were generally consistent and indicative of underlying trends and causes common to all industries. But no sufficient evidence was provided as to the superiority of state ownership or the effect on performance of country specific or sector specific factors. As discussed below, this has been partially addressed in more recent work on the effects of macroeconomic and corporate governance reforms on SOEs performance.

Do ownership and control affect the performance of SOEs?

The relationship between institutional structures and the performance of SOEs has been the subject of intense debate in the economic literature. Research in this area mostly relates to the effect of internal governance mechanisms (mainly the ownership structure of the firm) and external governance mechanisms (capital market monitoring and the legal and institutional systems) on the performance of SOEs.

A number of authors have reviewed the theoretical arguments related to the differences between state and private ownership,¹ but no conclusive evidence exists of the superiority of one or the other in promoting economic efficiency. Similarly, empirical literature has so far provided mixed evidence.

One group of analyses compares the pre- and post-privatization performance of a wide range of companies privatized through public share offerings.² The findings are generally consistent across industries and countries: privatized companies show

a significant increase in profitability, efficiency, investment, dividend payments, and output and a decrease in financial leverage.

Boubakri, Cosset, and Guedhami (2005) suggest that changes in performance vary with the extent of macroeconomic reforms and the business environment—particularly the relative development of the stock market and the protection of property rights—and the effectiveness of corporate governance. In particular, “economic growth is associated with higher profitability and efficiency gains; trade liberalization is associated with higher levels of investment and output; and financial liberalization is associated with higher output changes. The relinquishment of control by the government is a key determinant of profitability, efficiency gains, and output increases.” The authors argue that there are important differences between the sources of post-privatization performance in developed and developing countries. In particular, for all economic sectors, internal governance mechanisms appear to be more relevant in developed countries, while external factors, such as economic growth, trade openness, financial liberalization, stock market development and protection, and enforcement of property rights, appear to be more relevant in developing countries.

The effects of the separation of ownership and control on performance are investigated by Gupta (2005), who analyzed data on partial privatizations for 339 manufacturing and service sector firms owned by the central and state governments in India. He finds that listing on the stock market improves profitability, while transferring management control improves labor productivity. Although preliminary, these results provide useful input to the design of partial privatizations in similar institutional environments.

For most of the 1990s, reform of SOEs focused on privatization, which was seen as the most direct solution to the problems of state ownership. However, SOEs with uncapped environmental or other liabilities have no real hope of attracting private buyers. Furthermore, some countries lack the competitive marketplace, private capital, and legal and regulatory system needed to make privatization successful. Even if privatization is possible, governments may choose to own enterprises if they are natural monopolies, have strategic value, or provide important public services. There may also be strong political and labor opposition to privatization. Recognizing that privatization is not always a viable option for SOEs, some authors began to investigate the effects of corporatization on SOEs performance. Aivazian, Ying, and Qiu (2005) looked at the effect of corporatization without privatization on performance in China. They argued that the sources of efficiency can be traced to the reform of the internal governance structure of these firms, suggesting that it may be optimal for governments to corporatize SOEs before privatization.

Do ownership and control matter to the performance of NOCs?

Despite the economic importance of NOCs, there is surprisingly little empirical research on the effects of ownership type in the petroleum sector. The first comparative efficiency analysis of NOCs and privately owned oil companies (POCs) was carried out by Al-Obaidan and Scully (1991) using various frontier analysis methods. The authors analyzed the behavior of 44 companies during the period 1976–82 and attempted to measure differences in allocative, scale, and technical efficiencies. They concluded that if NOCs were converted to private, for-profit enterprises, they could satisfy demand with nearly less than half of their current resource inputs.³

Using both nonparametric and parametric techniques on a sample of 80 companies for the period 2002–04, Eller, Hartley, and Medlock (2007) argue that the relative technical

inefficiencies of NOCs and POCs, determined on the basis of commercial objectives only, are largely the result of governments exercising control over the distribution of rents.⁴

Victor (2007) also analyzes the relative efficiency of NOCs and POCs in converting hydrocarbon resources into production and revenue. Using a univariate linear regression on a sample of 90 companies observed in 2004, the author finds that on average NOCs produce nearly two-thirds less per unit of reserves than the largest POCs, and generate significantly less revenue per unit of production.

Researchers at the University of Texas compared the performance of five NOCs relative to their stated commercial goals using business analysis, and compared their social and economic development performance against explicit and implicit targets (CEE, 2007).⁵ The researchers also analyzed the commercial frameworks for NOCs, focusing on public sector governance, corporate governance, fiscal regimes, commercialization, and hydrocarbon regulation. Their findings provide some evidence that corporate governance structures, flexible fiscal and capital budget regimes, and upstream competition contribute to the performance of both NOCs and their countries' hydrocarbon sector.

Using a dataset of 60 public share offerings by 28 NOCs between 1977 and 2004, Wolf and Pollit (2008) show that privatization is associated with comprehensive and sustained improvements in performance and efficiency. Many of these improvements are realized in anticipation of the initial privatization date, accrue over time, and level off after the initial change in ownership. The authors argue that partial privatizations in the oil sector may capture a significant part of the performance improvement associated with private capital markets without the government having to relinquish control of its NOC.

Wolf (2008) further investigates the effects of ownership on performance using data from the Petroleum Intelligence Week's Top 50 oil and gas companies over a period of twenty years. The author finds that: (i) non-OPEC NOCs underperform their private sector counterparts in terms of labor and capital efficiency, revenue generation, and profitability; (ii) OPEC NOCs show higher efficiency metrics than the private sector; and (iii) all NOCs produce a significantly lower annual percentage of their upstream reserves than their private counterparts. The author hypothesizes that the adoption of more conservative reserve management policies by NOCs, and the use of different reserves valuation criteria may partially explain these differences.

In March 2007, researchers at Rice University completed one of the most comprehensive studies on the changing role of NOCs in the international energy market. The study aimed to provide a reference framework for analyzing the strategies, objectives, and performance of NOCs, with particular reference to their impact on international oil supply, pricing, and geopolitics. The study included case studies on the history and formation of fifteen state-owned oil companies and two economic modeling studies assessing the operational efficiency of NOCs. The researchers also analyzed the consequences of noncommercial objectives on operational efficiency and the effect that NOC operations abroad have on the societies in which they work. The authors concluded that: (i) national goals are important to NOCs and go well beyond the maximization of returns on capital to shareholders;⁶ (ii) in some cases, national priorities interfere with the NOC's ability to maximize the value of their oil resources, replace reserves, expand production, and perform in a technically efficient manner;⁷ and (iii) certain institutional and regulatory structures help the NOC to focus efficiently on its core business. The efficiency of NOCs, the authors argued, will influence the future availability of oil and future pricing trends. To reduce the vulnerability to changes in NOCs' investment patterns, the authors argued that oil importing countries would need to make major policy changes to their energy

strategies, including promoting free trade, adopting measures to improve the efficiency of NOCs, promoting market competition, and curbing political interference in NOC's commercial investment decisions.

In March 2008 a group of researchers at Chatham House published a report on investment trends in foreign oil projects by companies from China, India, Japan, South Korea, and Malaysia (Chatham House 2008). The authors observed that, for most of these companies, overseas investments are part of their countries' wider thrust into the world economy and are often supported by governments to increase bilateral economic and political relations.

One of the difficulties in evaluating NOCs stems from the complex interaction between commercial and noncommercial objectives (such as job creation, technology transfer, and local development), which leads them to depart from classical profit-maximizing behavior. In 2006 researchers at Stanford University launched a study on NOCs' strategy, performance, and implications for global energy markets. The research, which is still ongoing, has produced a number of important contributions towards explaining the organization and performance of NOCs and the complex interaction between NOCs and their countries' governments. One of the most recent findings relates to the exportability or desirability of the institutional separation of policy, regulatory, and commercial functions—the so called “Norwegian Model” (Thurber and others 2010). The authors suggest that the separation of functions is most useful and feasible in cases where political competition exists and institutional capacity is relatively strong. When technical and regulatory talent is particularly lacking in a country, better outcomes may result from consolidating these functions in a single body until institutional capacity has further developed. Countries like Nigeria with vibrant political competition but limited institutional capacity pose the most significant challenge for oil sector reform: consolidated control over the sector is impossible, but separation of functions is also difficult. In such cases, the authors conclude, reformers should focus on making incremental but sustainable improvements in technical and institutional capacity.

Do better corporate governance and transparency affect the performance of SOEs?

The corporate governance of SOEs has been the subject of several papers, which suggest that corporate governance directly affects the level and sustainability of SOEs' performance. Wong (2004) argues that in many countries, previous SOE reform efforts failed to deliver sustained improvements in performance because they did not fully address the core governance deficiencies of public enterprises— multiple and conflicting objectives, excessive political interference, and opacity. The author suggests that clear objectives, transparency, and political insulation are preliminary conditions for improving SOEs' efficiency and proposes a set of governance reforms for two classes of SOEs: those with a singular focus on value maximization and those with a mixture of commercial and social objectives.

The OECD Guidelines on the Corporate Governance of State-Owned Enterprises (2005) provide a benchmark to help governments assess and improve their ownership of these enterprises. The guidelines offer suggestions on how to solve typical corporate governance challenges. Among the key recommendations for improving the competitiveness and transparency of SOEs, the guidelines underline the importance of (i) the strict separation of the state's ownership and regulatory functions; and (ii) the centralization of ownership functions in an ownership entity or the effective coordination of ownership

entities, which should act independently and in accordance with a publicly disclosed ownership policy.

Fremond O. et al (2006) review the corporate governance arrangements in a number of SOEs in emerging market economies. They conclude that effective corporate governance provides a coherent and tested framework for addressing key weaknesses in SOEs that is consistent with indefinite state ownership or continuing privatization.

The governance structure of NOCs has not been widely investigated. In a position paper on good governance for NOCs, Marcel (2005) argues that good governance requires (i) a clear definition of the NOC's mission, role, and responsibility to the state; (ii) objective and effective decision making; and (iii) transparent performance measurement systems. A report on good governance in the petroleum sector (Lahn et al, 2007) further investigated Marcel's findings. The report summarizes the lessons learned from the experience of thirteen petroleum producing countries presented at a meeting held under the Chatham House rule. The participants emphasized the importance of the national context on systems of governance at sector and NOC levels. Successful changes in governance of the national petroleum sector depend on the following national elements: (i) the national culture, and particularly the way power and authority is exercised and the patterns of behavior that are encouraged or incentivized; (ii) institutional capacity—that is, the adequacy of existing skills and abilities to adapt to new institutional settings; (iii) dependence of the economy on petroleum revenue, which affects local content policies and the level of political interest in the sector; and (iv) the level of a country's general development, system of government, and administrative structure. The report advocates the separation of policy, regulation, and commercial responsibilities. In countries where the NOC has sector oversight responsibility, it must demonstrate a capacity to effectively demarcate its roles as operator and regulator.

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Notes

1. For a review of these arguments see Williamson 1964; Jensen and Meckling 1976; Laffont and Tirole 1993 (agency theory), Alchian 1965; Alchian and Demsets 1972 (property rights), Tullock 1965; Buchanan 1968; Niskanen 1971 (and public choice theory), Milgrom and Roberts 1988; Pollit 1997 (theory of influence of activities) and Sappington and Stiglitz 1987; Perotti 1995; and Pollit 1997 (the notion of privatization as a credible government commitment to reduced future interference).
2. Megginson et al. (1994); Boubakri and Cosset (1998); D'Souza et al (2005), Jia et al (2005), Gupta (2005).
3. Looking at the efficiency of integrated NOCs the authors concluded that "SOEs' managers serve many principals and are required to pursue multiple goals, many of which are inconsistent with economic efficiency." They found that "on average state-owned enterprises are 61 to 65 percent as technically efficient as private, for-profit firms. Alternatively, *ceteris paribus*, with the same level of input, output could be increased by 55 percent to 63 percent, or for the same level of output, costs could be reduced by a similar amount by converting state owned enterprises into private, for-profit firms. Given the enormous resources utilized in the petroleum industry the relative technical inefficiency of SOE is hardly a trivial problem." (Al-Obaidan and Scully, 1991). The definition of the variables and the fact that their data base covers the period 1979–82—the height of the "second oil shock"—may have affected the measure of relative efficiency, but their conclusions appear to agree with more recent research.
4. Their results, although based on high level operational and financial data covering a short period of time (2002 to 2004), are in line with the theoretical predictions developed by Harley and Medlock (2007).
5. The authors select Pemex, PetroChina, CNOOC, Petrobras, and Statoil for the data availability (all companies provide easily accessible, good quality, and comparable data in their annual filings of the US Securities and Exchange Commission) and use of comparable accounting principles. The sample also permitted the authors to do a preliminary analysis of the effects of countries' economic structures on NOCs' performance (CEE-UT 2007).
6. As defined in the study, national goals include oil wealth redistribution to society at large, wealth creation for the nation, industrialization and economic development, energy security, foreign and strategic policy and alliance building, and participation in national level politics.
7. On average, for the sample of NOCs analyzed, those that both are fully government-owned and sell petroleum products at subsidized prices are only 35 percent as technically efficient as a comparable firm that is privately-held and has no obligation to sell refined products at discounted prices. While firms vary in efficiency, on average the efficiency of government held firms is only 60 to 65 percent that of the privately held international oil majors (Eller, 2007).

Exploratory Statistical Model

Data Limitations and Issues

VCI Data Limitations and Issues

In calculating the VCIs we faced challenges due to missing data. Initially, the period of analysis was to cover 10 years. But lack of data forced us to restrict the sample to 5 years. Even so, only 84 percent of the necessary data could be found. Most of the missing data relate to measures of national mission performance. In particular:

- Data necessary to calculate the Reserves Replacement Ratios (RRR) could not be found for OGDCL, and QP. For PTT and Sonatrach, the RRR could only be calculated for one year.
- There are several missing values on share of nationals in company workforce and other employment criteria but every NOC had at least some of these data.
- Data on non-commercial expenditures could not be found for OGDCL, Petronas, PTT, QP and Sonatrach.
- Data on non-core and noncommercial activities could not be found for ENI, KMG, OGDCL, PdVSA, Petro SA, Petrobras, Petronas, and Statoil. This might be due to the fact that these NOCs do not have non-commercial or non-core activities. In contrast, some NOCs specifically note the absence of non-core and noncommercial activities in their reports (CNOOC, Ecopetrol, ONGC, Pemex, Petrochina and Sinopec).
- No data on subsidies borne by OGDCL and QP could be found. Subsidies were assumed to be zero for CNOOC, ENI, Gazprom, GDF, KMG, Rosneft and Statoil based on country policies or given the clear information provided in company publications.
- Local content data could only be found or estimated reliably in some years for a handful of NOCs: Ecopetrol, ENI, Gazprom (one year), GDF, KMG (one year), Petro SA, Petrobras, Petrochina, Rosneft (one year) and Statoil.

VCI Driver Data Limitations and Issues

Chapter 3 table 3.1 lists the five value drivers and the proxy variables used to measure them. As previously noted, proxy variables were used extensively due to the lack of publicly available data and/or available measures. To create a driver variable, each of its underlying proxy variables is standardized, and the driver variable is the result of the average of the standardized proxy variables for each NOC-year with a complete set of data.

Several potentially useful proxies were excluded due to a lack of data. The Fraser Institute's survey results on fiscal systems, regulatory compliance, regulatory uncertainty and environmental regulation were considered as proxies for the *NOC sector strategy and*

behavior driver, but the survey data were available for only two years of our study period and did not cover all countries. The share of domestic production operated by the NOC was not included in the *NOC sector strategy and behavior* driver, since it was only available for 50 percent of our sample.

Missing data for certain NOCs also affected driver creation. PTT has no data on NOC upstream equity production as percentage of total NOC refining throughput. QP, ONGC, and PetroSA have no data on capital expenditures. About 15 percent of the sample has missing data on NOC international revenues as percentage of total NOC revenues. While enough proxies are included in each category to warrant the creation of each driver group, these data difficulties have led to less than ideal measurements of the drivers of NOC value creation.

APPENDIX 5

Relevance of Government Support to the Credit Rating of NOCs

Company	Very important	Somewhat important	Not very important	Not rated
CNOOC	√			
Ecopetrol		√		
ENI			√	
Gazprom		√		
GDF		√		
KMG EP	√			
OGDCL				√
ONGC				√
PDVSA	√			
PEMEX	√			
Petrobras		√		
PetroChina				√
Petronas	√			
PetroSA				√
PTT	√			
QP	√			
Rosneft		√		
Sinopec	√			
Sonatrach				√
Statoil		√		
Total	8	6	1	5

Source: CEE-UT, University of Texas, based on data from Standard & Poor's Global Credit Portal Ratings Direct.

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National Oil Companies (NOCs) directly or indirectly control the majority of oil and gas reserves. As such, NOCs are of great consequence to their country's economy, to importing national energy security, and to the stability of oil and gas markets. The paper analyzes the available evidence on the objectives, governance, and performance of 20 NOCs from both net importing and net exporting countries, and draws conclusions about the design of policies and measures that are more likely to lead to social value creation. The paper attempts to provide practical information to policy makers on the advantages and disadvantages of various institutional and management practices that are commonly observed among NOCs.

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