THE PERFORMANCE AND VALUE CREATION OF NATIONAL OIL COMPANIES: AN ANALYTICAL FRAMEWORK

WORKING DRAFT – NOT FOR CITATION. The Oil, Gas and Mining Policy Division of the World Bank is undertaking a Study on NOCs and Value Creation, and this draft version of Chapter 4 of the Study has been published to inform the public on progress and invite dialogue. A revised version of the methodological framework, including lessons learned from its practical application to case studies, will be included in the Study which is expected to be completed by June 2010. For further information on the Study on NOCs and Value Creation please visit our website http://www.worldbank.org/noc.

June 2009
This paper is a working draft of the introductory part of Chapter 4 of the *Study on National Oil Companies and Value Creation* (the “Study”). An updated version of this paper will be included in the *Study* launched in March 2008 by the Oil, Gas, and Mining Policy Division of The World Bank, and expected to be completed by June 2010. The manuscript of this paper has not been prepared in accordance with the procedures appropriate to formally edited texts. Some sources cited in this paper may be informal documents that are not readily available.

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Acknowledgments

This *The Performance and Value Creation of National Oil Companies: An Analytical Framework* is intended as a contribution to the *Study on National Oil Companies and Value Creation* (launched in March 2008) by the Oil, Gas, and Mining Policy Division of The World Bank.

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“In God we trust, all others bring data.”
(William Edwards Deming)

1 Introduction

This chapter sets out a preliminary analytical framework for assessing the performance and value creation of national oil companies (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. Because the petroleum sector is of significant importance to many countries around the world, the attempt of identifying, measuring, benchmarking and improving NOC value creation is vital for the broader effort of improving standards of living in these countries. The aims of the framework are as follows:

- To provide a conceptual model of the different ways in which value can be created within a national petroleum sector.
- To propose a quantitative measure of NOC value creation that facilitates the benchmarking of NOC performance.
- To suggest different approaches to rank and/or quantify the importance of various drivers of value creation.

In developing the analytical framework, this chapter builds on existing literature, including “A Methodology For Assessing The Performance Of National Oil Companies” (Stevens 2008), “A Citizen’s Guide To National Oil Companies” (WB-CEE 2008a), and the research framework and preliminary results of the Stanford University/PESD study on National Oil Companies.

Since some of the key terms used in the Study, including performance, value creation and value capture, are sufficiently generic to be open to differences in interpretation, Section 2 clarifies and discusses these terms, and their relationship to NOCs and the broader petroleum sector.

Section 3 sets out a conceptual model of the various socio-political, economic and managerial variables that are likely to affect value creation within a national petroleum sector. The model describes the linkages between initial conditions (e.g. economic or political context), human and organizational agency (specific objectives, choices and behavior), and the outcome variable of value creation. Together the context and agency variables constitute the drivers of value creation. In this section
we also propose a taxonomy of NOCs – categories of NOCs based on variations in key variables – to improve the validity of inter-NOC (or NOC vs. privately-owned companies) comparisons.

Section 4 proposes a quantitative measure of value creation: the composite NOC value creation index can be used to benchmark the performance of different NOCs. The overall indicator consists of three sub-indices, capturing NOC operational performance, financial performance and delivery on the national mission.

Section 5 suggests four approaches towards a more detailed assessment of the relationship between the drivers of value creation (as described in Section 3) and the extent of value creation (as measured by the composite index proposed in Section 4). This assessment shall include a ranking and/or quantification of the relative importance (weighting) of value drivers. The four approaches are: (i) qualitative “comparison and contrasting” of value drivers with respect to the value creation index; (ii) multivariate regression analysis, using the value creation index as dependent variable and the value drivers as independent variables; (iii) direct estimation of factor weightings from expert opinion using Analytical Hierarchy Process (AHP); (iv) estimation of implied factor weightings from expert opinion using regression analysis. While a generally valid ranking (or weighting) of influence factors might ultimately be elusive, these approaches in concert will be able to provide useful perspectives on the underlying issue.

Section 6 summarizes and concludes.
2 Performance and value creation

Value in the context of the Study refers to social value at the country-level rather than private shareholder value. When considering the value creation of NOCs, two of the key questions therefore are:

- How and to what extent can NOCs contribute to overall value creation in the national petroleum sector?
- What are the alternative arrangements and their implications for value creation?

Performance is a widely used term, but there exists no single generally accepted definition of its meaning.¹ In the financial literature, for instance, one frequently finds a narrow meaning of performance that focuses on financial accounting items such as net income, return on assets, or on share price performance. Others understand performance to be much broader in scope, including all aspects of operations and finances, whether focused on inputs, processes or outcomes.² It is clear in any case that performance as a concept can only be meaningful relative to a given objective function. So if we understand performance very generally to be “what an organization does when faced with a task”, and if we define the task at hand to be the creation of value for society, then a „good” performance in the context of our Study simply refers to economic behavior (by the NOC or other actors within the national petroleum sector) that is conducive to overall value creation.

Value creation implies some kind of process where the value of aggregate outputs exceeds the value of aggregate inputs on a sustainable, i.e. long-term, basis. If in addition to the value created by a particular decision we also consider its opportunity cost (which might include the value created under a counterfactual alternative and/or the scarcity value of funding, among others),³ then we are able to assess the net value created, or value added. At the individual firm-level, an example of a well known application is the Economic Value Added (EVA) developed by consultants Stern Stewart.⁴

At the societal level, we can equate net value creation to net social benefits (or social welfare) resulting from a thorough social cost-benefit analysis (SCBA). SCBA is a well established methodology in public and welfare economics, which has its roots in the project appraisal literature for developing nations (Dasgupta et al. 1972; Little and Mirrlees 1974; Squire and van der Tak 1975; Boardman et al. 2006). It attempts to capture the impact of individual projects or choices on the social welfare of all stakeholders involved (i.e. producers, consumer, government, as well as employees, direct competitors etc.). Aggregate value creation is then defined as the

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¹ This might be explained by the apparent common-sense nature of the term, by the fact that it is more frequently used in applied management than in formal economics, or by the fact that within the management field there are different disciplines using the term in different ways (Neely 2007).
² A theoretical nuance is the question whether one thinks of these as genuinely different, independent dimensions of performance, or whether performance in the broadest sense is one latent variable for which there exist many imperfect and interdependent indicators.
³ The inclusion of opportunity costs is a key difference between economic costs (and profits) and accounting costs (and profits). Because the petroleum industry is based on the exploitation of a natural resource, another opportunity cost not mentioned above relates to the alternative of leaving the resource in the ground and preserving its intrinsic value for future generations, but this is difficult to measure.
⁴ EVA is defined as [(ROIC – WACC) x CE], where ROIC is the Return on Invested Capital, WACC is the Weighted Average Cost of Capital, and CE is the Capital Employed.
sum of values created for these different stakeholders, possibly adjusted for shadow welfare weights of the individual components. An example of an SCBA in the context of the petroleum sector can be found in Wolf and Pollitt (2009). But because cost-benefit analysis tends to be very detailed, it is really only a practical option for well-defined individual projects or decisions. It is not feasible to analyze all options for institutional arrangements within a national hydrocarbon sector using detailed SCBAs. Nevertheless, this methodology provides valuable perspectives for our understanding of value creation.

NOC usually create value as operators of petroleum installations, where they have control over costs and efficiency, or by virtue of their national mission (Stevens 2008). There are other avenues for value creation. For example, NOCs may be involved in sector regulation, or they may be “passive” equity investors (rather than operators), where they provide private value to the project operator in terms of financing and risk diversification, and social value through higher investment, higher taxes, and so on.

However, in some cases the value generated may not be enough to offset the economic costs, so that net value creation is negative. Clearly, commercial petroleum projects which fail to generate a positive pre-tax net present value (NPV) are unlikely to create net social value. But even investments related to non-commercial objectives, or the national mission, must satisfy comparable welfare criteria in order to be deemed value-adding. Mandated NOC spending on local content, for example, supports domestic suppliers in building technical and commercial expertise, but, at least in the short term, there may be substantial economic costs in the form of higher procurement prices, lower product quality, and the opportunity cost of funding. For re-distributive or social expenditure programs to be undertaken by the NOC, it should be established that no greater benefit can be obtained by alternative public delivery mechanisms. For example, excess NOC employment that does not result in incremental productivity can be considered, at best, a value-neutral transfer of funds from the state to the employees. But the net social welfare impact is negative if the recipients of these transfers are not the poorest members of society, and if the state could have engaged in alternative re-distributive measures to reach those with higher implied welfare weights.

Besides NOCs there are other players who are able to create value within the national petroleum sector. One of the appealing aspects of privately financed oil operations, and foreign privately financed operations in particular, is that net new money is brought to the table (direct foreign investment). In contrast to state funding of the petroleum sector, private funding does not typically crowd out state investment or social welfare spending in other areas and thus, ceteris paribus, reduces the social opportunity cost and increases the net benefits of any investment.

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5 NOCs’ missions and objectives are a function of their shareholders”, but in general terms the national mission usually includes one or more of the following dimensions: (i) to protect national hydrocarbon wealth. This requires maximizing the recovery factor on fields and “optimizing” resources, and concerns a country’s depletion policy; (ii) to promote economic development. This 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. This is more difficult to define and the role of “national champion” more controversial (Stevens 2008).

6 NOC employees often have some form of formal education and/or are personally connected (or through their family, tribe etc.) in order to have obtained the job in the first place.
Finally, the value captured by the state refers to the share of net welfare gains that accrue to the state rather than private investors, competitors, consumers, employees etc.\(^7\) A frequently used indicator for state value capture is the petroleum rent captured by the state (in its roles as tax collector and NOC shareholder).\(^8\) Based on our discussion above, this is directionally correct, but not entirely exhaustive. Consider the case of a monopolist NOC wholly owned by the state. Let us now add one private operator which does not pay any taxes, so there are no additional direct government funds. But if the private firm procures some products locally, or employs local staff, then there are tangible benefits to the state in terms of GDP growth, employment generation, etc., which either provide incremental secondary state revenues or represent savings on social spending.\(^9\)

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\(^7\) If the welfare gains made by any of these groups (consumers and employees in particular) reduce the necessity for state social support, then this would also count as a net benefit to the state.

\(^8\) Economic rent very generally is the excess distribution to any production factor above that which is required to induce the factor’s use within the production process or to keep the factor in its current use. Petroleum rent could thus be approximated by the difference between market price and marginal costs. This surplus can then be shared between the land owner and the licensee (investors).

\(^9\) An important consideration is the potential trade-off between near-term state rent capture and longer-term value creation. Given the uncertainty that characterizes petroleum exploration and production activities, maximizing the NPV of rent capture might discourage longer-term investment, which in turn forms the basis for future rents to be created.
3 A conceptual model of NOC value creation

3.1 The model

Many variables can be assumed to affect the extent of value creation within a national petroleum sector. Broadly speaking these can be grouped into (i) variables describing initial conditions and context (e.g. economic situation, political history and ideology, international obligations, natural resource endowment); and (ii) variables describing human and organizational agency (specific objectives, choices and behavior, such as NOC objectives, sector and corporate governance choices, and NOC strategy). Together, the context and agency variables constitute the drivers of value creation. The conceptual model presented in this section identifies the key drivers and describes their linkages with each other to influence the creation of value. The model is preliminary and will likely be revised to incorporate lessons learnt from its application to case studies.

A simplified version of the model is shown in Figure 1a. Figure 1b provides a more detailed account, with the summary headings broken down into constituent variables.

Figure 1a: Petroleum sector value creation (simplified)

Source: Author

10 For some variables this classification is dependent on the time horizon of the analysis. Over the mid-to long-term international obligations, for example, can be revoked or renegotiated, but for any short-term decision they are essentially exogenous.
Figure 1b: Petroleum sector value creation (detailed)
In our model we assume that three key institutions generate the vast majority of direct value in any national petroleum sector: the NOC, the privately-owned oil companies (POCs), and the sector organization and governance. NOCs and POCs (“the companies”) have certain levels of economic efficiency and make strategic and operational choices, which translate into commercial and non-commercial performance and value creation. But the companies’ ability and willingness to perform well are embedded within, and affected by, matters of sector organization and governance, including the fiscal regime (which often delivers the greatest share of state monetary benefits), industry structure (monopoly vs. competition), regulatory responsibilities and capacity, and pricing mechanisms.

Any national petroleum sector around the world requires (and has) a set of implicit or explicit rules and procedures, but the state has ample discretion regarding its substance. Additionally, the state – as the resource owner – has a fundamental choice with respect to petroleum operators and investors between NOCs, POCs (national or international), or a combination of the two. Both decisions – on sector governance and on sector participation – are fundamentally interconnected and jointly have a significant bearing on 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 country’s geology, geography, and existence of infrastructure, as well as the goals and objectives of the state with regard to energy/petroleum policy, which in turn is determined by the nation’s historical, political, financial and economic context. The NOC’s objectives influence both the firm’s corporate governance provisions (which are also driven by the general sector regime) and its strategy and behavior in the marketplace. These two factors are suggested as the most immediate drivers of NOC performance and value creation. Governance provisions – both on the corporate level and the national sector level – are thus central to NOC value creation, but governance itself needs to be understood and analyzed in the context of other important decisions and variables.

The model suggests a feedback from the total value created within the petroleum sector to the country’s financial, economic and political context, which is self-evident. A feedback towards “geology, geography, and infrastructure” is also indicated, but this applies to issues of infrastructure and access to markets (pipelines, storage, established sales channels, off-take agreements etc.) rather than the resource base or geography.

Any model is a simplification of reality. Therefore some possible variables and many possible linkages between variables have not explicitly been acknowledged. For example, there probably are direct links between state capacity and NOC corporate

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11 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, which influence socio-economic behavior.

12 The model focuses on the variables within the state’s influence and control, and other factors which influence POC strategy, behavior and efficiency are not explicitly considered.

13 Regarding participation it is worth emphasizing that non-commercial objectives or national mission expenditure need not be restricted to the NOC. License agreements and/or sector regulation are frequently used tools to impose such expenditures on POCs. Additionally POCs may voluntarily fund Corporate Social Responsibility (CSR) programs.

14 The reserve base (rather than resource base) could also benefit from strong operational performance, as technical capabilities can, for example, improve the recovery factor.
governance, or between sector organization/governance and NOC behavior, but these are omitted because the variables are already linked indirectly. In many cases two-way relationships between variables can be found in reality, but the model only reflects those which are assumed to be primary ones. Furthermore, it is important to underline that variables that are exogenous from the NOC perspective might well be endogenous for the state. NOCs and POCs might face different exogenous constraints as well. For example, POCs over the long-term have full flexibility as to where they operate and thus can be held accountable for all their operating decisions; NOCs might not be in the same position.

3.2 NOC classification

Having established the key variables involved in NOC value creation, it is now possible to suggest variables which effectively distinguish between different categories of NOC. Performance comparisons within these categories then will have greater validity, and comparisons between them will provide additional insights into the dynamics of value creation.

Based on a review of the literature and the value creation model set out above, the following variables have been considered as primary dimensions of classification:

- the business model: NOCs operating petroleum assets vs. NOCs acting as financial holding companies or investors (or degrees thereof);
- the degree of domestic competition: monopolistic vs. competition (or degrees thereof);\(^{15}\)
- the degree of commercialization: commercial vs. non-commercial objectives of the NOC (or degrees thereof);
- the position along the value chain: integrated vs. specialized upstream or downstream operations (or degrees thereof);
- the degree of internationalization: revenues from domestic operation vs. international operations (or degrees thereof);
- the degree of export orientation: domestic market supplier vs. export focus (or degrees thereof);
- the degree of regulatory involvement: NOC with vs. without regulatory powers over the sector (or degrees thereof).

For any classification roster, there exists a fundamental trade-off between accuracy and comprehensiveness on the one hand – which calls for more criteria over less – and parsimony and sufficiently large sub-groups of companies on the other. Even if only four of the above dimensions were selected, with each defined to have only two possible values (low/high), we would still obtain \(2^4=16\) distinct types of NOCs. Therefore, a certain level of judgment is required beforehand to select those variables that are likely to be relevant to value creation, as well as able to distinguish between different types of NOCs (sufficient range and standard deviation of values).

If a traditional 2x2 matrix is preferred, a plausible choice of variables is the degree of domestic competition and the degree of commercialization. Color-coding can provide further information on the individual entries without necessitating additional NOC categories. In Figure 2, imaginary companies are grouped according to these

\(^{15}\) The competitive environment in the up- and downstream can be distinguished where appropriate.
two criteria, with additional information on their business model, position along the value chain, and degree of internationalization.\(^\text{16}\)

**Figure 2: Generic example of 2x2 NOC classification matrix**

<table>
<thead>
<tr>
<th>Degree of commercialisation</th>
<th>Degree of competition</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

- **Company A**: 100%
- **Company B**: 35%
- **Company C**: 87%

**Legend:**
- Primarily operator
- Primarily investor
- Integrated
- Primarily upstream
- Percentage of revenues from home country

Source: Author

In addition to the primary classification variables set out above, others (secondary) might still be of interest, although they do not provide incremental information on the nature of the NOC. They can, however, serve as proxies for the primary variables and/or describe the national context for NOC objectives and strategies:

- **the degree of state ownership**: wholly owned vs. partially owned by the state;
- **the level of national development**: socio-economically developed vs. under-developed nations (measured by Human Development Index (HDI)); and
- **the degree of economic dependence on petroleum**: high vs. low national dependence on petroleum sector (as share of GDP).

State ownership is presented as a secondary rather than a primary variable. The rationale is that in the absence of more detailed information, state ownership is a useful proxy indicator for variables such as political influence, non-commercial objectives or monopolistic powers, but it loses much of its descriptive power once these underlying categories are explicitly considered. The two country-level variables listed above are linked to the notion of the national mission and non-commercial objectives, but also to sector regulation and vertical integration. It can be hypothesized that the lower the stage of socio-economic development and the higher the national dependency on the petroleum sector, the more important the national mission becomes. Moreover, in these circumstances, it is likely that little human and

\(^{16}\) Because the focus of the Study is on the upstream, all NOCs under investigation will be active in this segment. The distinction then is between „upstream only” and „integrated”.  

14
financial capital would be available to run more than one sector organization competently. This often results in a single organization *de facto* in charge of large parts of the value chain, where the boundaries between policy, regulatory, and commercial responsibilities become blurred. In a developed and economically diversified economy, on the other hand, firms typically do not need to explicitly consider the national mission, and there are little constraints on human capital for designing the institutional framework.

Initially, data will be collected on the primary and secondary classification dimensions for the 49 NOCs listed in Appendix A. Statistical techniques will then be applied to empirically identify the most suitable classification system, such as factor analysis (to reduce the number of underlying classification variables), and cluster analysis (to identify logical groupings of NOCs based on a given classification system).

4 NOC value creation index

This section introduces a composite indicator to measure NOC value creation. 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, p.7).

Composite indicators are popular for a wide range of applications due to: (i) their ability to condense large amounts of information into easy-to-understand formats; (ii) their ease of application; and (iii) their convenience as a communication and benchmarking tool. Some of the most “successful” composite indicators currently available in the public domain include UNDP’s Human Development Index (HDI), Transparency International’s Corruption Perceptions Index, the World Bank’s Worldwide Governance Indicators, and the World Economic Forum’s Global Competitiveness Index. The “law and finance” literature (named after La Porta et al. 1998), which has produced some of the most heavily cited economics articles of the past decade, also relies to a considerable extent on purpose-built composite indices, such as the creditor rights index; these also feature in the World Bank’s Doing Business reports.

Critics find many composite indicators to be redundant at best, and misleading and easily manipulated at worst, due to a frequently observed ad hoc approach to important methodological issues – such as variable selection, dealing with missing values or weighting. Stevens (2008) echoes some of these concerns.\(^\text{17}\) In order to address them, composite indicators need to be as transparent as possible, and provide detailed information on methodology and data sources (Nardo et al. 2005).

The index presented in this section is not meant to capture all intricacies of NOC value creation in individual countries, and should be supplemented by additional information and alternative (qualitative) approaches. But the index provides a useful measure of key aspects of NOC value creation, and represents a convenient starting point for further analysis.

\(^{17}\) WB-CEE (2008a, p.31) advocate developing a composite index for the Study since “a composite indicator could facilitate analysis of NOCs by providing a concise independent variable.”
4.1 Index structure

Very generally, our composite index is additive in nature\(^\text{18}\) and calculated as:

\[
I = \sum_{i=1}^{m} w_i N_i
\]  

(1)

where \(I\) is the composite index, \(N_i\) is a normalized variable, and \(w_i\) is the weight of the normalized variable (\(\sum_{i=1}^{m} w_i = 1, \quad 0 \leq w_i \leq 1\)).

As illustrated in Figure 1b, three sub-indices of value creation are considered: operational performance, financial performance, and national mission performance.\(^\text{19}\) These are then summarized in a composite indicator. This approach requires a two-step weighting procedure. First weights are assigned to each indicator within a given sub-index. Then, an overall index is calculated by assigning weights to each sub-index. The proposed procedure is quite intuitive, and allows to formally separate the two weighting decisions, and to easily carry out sensitivity analysis at the sub-index level. Another benefit of the two-step approach is that it avoids overestimating (or underestimating) those components for which more (or fewer) indicators are available (Freudenberg 2003).

Weighting will be discussed in more detail below, but at this stage of the Study we are not in a position to suggest specific weights for the three sub-indices, in part because it is plausible that these weights should differ between different categories of NOCs. The index can easily be applied to POCs which allows us to make direct NOC-POC performance comparisons.\(^\text{20}\) Similar to NOCs, the weighting of the three sub-indices is likely to differ among POCs, depending on their strategy and countries of operation.

The value creation index can be calculated on an annual basis, but in order to smooth out short-term volatility and random influences, a 3-year rolling average will be used. This will allow us to focus on longer-term levels and trends rather than short-term fluctuations.

4.2 Variable selection

For any index in general, the underlying indicators should be selected on the basis of their analytical soundness, measurability, data quality, relevance to the phenomenon being measured, and relationship to each other.\(^\text{21}\) As there is no single definitive set of indicators for any given purpose, the selection of variables to incorporate in a composite index needs to be properly justified. Furthermore, one might be tempted to include as many variables as possible, but not only will the

\(^\text{18}\) This approach implicitly assumes the substitutability of the individual components, which might not be strictly true or applicable in all circumstances.

\(^\text{19}\) A similar approach is suggested by Stevens (2008).

\(^\text{20}\) Subject to certain assumptions or small index alterations, as discussed in due course.

\(^\text{21}\) There are frequent issues of data quality, incl. Data that is missing, poor, or inappropriate for the purpose. Several „standard“ approaches exist to deal with data quality: data deletion, mean substitution, regression, multiple imputation, nearest neighbor, or to ignore missing entries (Nardo et al. 2005).
incremental benefit of additional variables beyond the conceptual „core“ be limited, too many indicators might also introduce double-counting and bias, and make the composite index harder to audit. For these reasons a maximum of five indicators have been chosen for each of the three sub-indices (see Figure 3).

Figure 3: NOC value creation index

<table>
<thead>
<tr>
<th>Operational performance</th>
<th>Financial performance</th>
<th>National mission performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>• E&amp;P production growth (%)</td>
<td>• EBRTN / revenues (%)</td>
<td>• Share of local content (%)</td>
</tr>
<tr>
<td>• Reserve replacement ratio (%)</td>
<td>• EBRTN / total assets (%)</td>
<td>• Domestic output use (%)</td>
</tr>
<tr>
<td>• Refinery utilization (%)</td>
<td>• Capex / depreciation (%)</td>
<td>• Share of domestic labour (%)</td>
</tr>
<tr>
<td>• Output / total assets (boe)</td>
<td></td>
<td>• Gas flared / lifted volume (%)</td>
</tr>
<tr>
<td>• Output / employees (boe)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: „EBRTN“ is Earnings Before Royalties, Taxes and Non-Commercial expenditures

Source: Author

The proposed index deliberately focuses on performance indicators that describe the final outcome of value creation. There are other interesting and essential aspects of good NOC performance, such as human resources and skill base, technological competence, or the ability to effectively create and sustain industrial partnerships. However, these are intermediate skills and abilities that support and enable the creation of value. They are, in the terminology of our conceptual model, drivers of value creation rather than indicators of value creation. One of the principal aims of the Study is a better understanding of the relationships between value drivers and value creation (Section 5 will examine possible approaches in this regard). Therefore the coverage of the value creation index must not overlap with these drivers.

The indicator selection was also guided by the limited availability of data for many NOCs. In fact, in order to compare NOCs, the chosen indicators should either be available (i.e. recorded and disclosed) for most NOCs, or amenable to estimation by knowledgeable company observers.

Finally, it is worth noting that non-commercial expenditure and fiscal contribution to the state are taken into consideration in the calculation of (adjusted) financial performance, rather than used as indicators of national mission performance.\textsuperscript{22} This approach is taken to allow direct financial comparisons between NOCs in spite of significant differences in non-commercial objectives and tax rates. Governments capture the value created by their fully state-owned NOCs in a variety of ways –

\textsuperscript{22} Both approaches are possible, but mutually exclusive to avoid double-counting. Either option requires non-commercial expenditure and taxes variables to be quantified by factual data or estimation.
through direct or indirect taxation, social expenditures of the firm, dividends or other payments to shareholders – but *how* exactly such value is transferred from the company to the state is irrelevant to the amount of total value created.\(^{23}\) Including the share of taxation (as percent of revenues) within the nation mission performance would favor NOCs with high marginal tax rates over those with high net profits, which is inappropriate as the beneficial owner of both monetary streams is the state.

For direct comparisons between NOCs and POCs there is a case for including indicators of total tax payments and non-commercial expenditure as part of the national mission, if there exist substantial differences between firms.

### 4.2.1 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 implicitly captured by the RRR. For OPEC countries production growth might not always be an appropriate metric (for example where the quota allocation acts as an artificial production ceiling), but this can be mitigated by classifying/clustering NOCs, or during the interpretation of the results.\(^{24}\)

Refinery capacity utilization was chosen to measure downstream performance. Installed refining capacity might reflect the size of the domestic market, while capacity growth might reflect investment into idle capacity.

The two operational ratios of output/total assets and output/employees reflect capital and labor efficiency, respectively, and complement the operational effectiveness measures above.\(^{25}\) However, these indicators may be perceived as redundant, as the indicators for financial margin and financial return on assets (see below) already capture the firm’s performance in these areas, amongst others. Furthermore, the ratio of output over total assets relies on currency conversion – typically into U.S. Dollars. Consequently, index sensitivity tests will verify the robustness of the ranking order to the deletion of these two indicators.

### 4.2.2 Financial performance variables

The oil and gas industry is among the most heavily taxed industries. From the viewpoint of POCs’ shareholders the reduction or avoidance of tax is desirable as it creates private value. 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. This Study, however, examines social value creation by NOCs. In this context, after-tax measures may be less appropriate because: (i) tax is not a loss of value, it simply accrues to the government; and (ii) tax

\(^{23}\) An obvious exception is significant rent-seeking by NOC managers, which prevents government from accessing the value created. In this case of ineffective government control over the NOC the choice of distributive mechanism might well influence social value creation.

\(^{24}\) It is unclear to what extent OPEC quotas represent an effective production ceiling, given the persistent lack of compliance by many members of the cartel.

\(^{25}\) For the purpose of this index, output is defined as the sum of upstream production and refined products, both expressed in millions of barrels of oil equivalent (mmboe).
is not usually within the influence sphere of the NOC, which is unable to relocate domestic operations. Similar considerations apply to a NOC’s non-commercial expenditure. Therefore, in order to benchmark performance, a more appropriate measure of profitability is earnings before royalties (and other production taxes), income taxes, and non-commercial (and other non-core and non-operating) expenditures. In short we will refer to this as the earnings before royalties, taxes and non-commercial expenditures (“EBRTN”), which is much closer to operational realities. EBRTN allows us to benchmark the financial performance and value creation of NOCs, irrespective of how they pass on that value to the government – whether in the form of taxes, social expenditure and/or profits and dividends. Two ratios based on EBRTN are included in the financial performance sub-index: the EBRTN margin as a percentage of revenues, and the EBRTN return on total assets.

The presence of non-commercial objectives may distract management and thus (indirectly) impact on efficient operations elsewhere; such costs are difficult to separate out, but are automatically accounted for in EBRTN.

The third financial indicator selected for the index is the ratio of capital expenditure (or investment) over the regular depreciation charge, because only positive net investment will form the basis for long-term value creation.

A number of other financial indicators were considered for inclusion but dismissed. For example, upstream finding and development cost or lifting cost per barrel per se are suitable indicators of financial performance, but implicitly are already covered by the EBRTN margin. They also would introduce an upstream operations bias to the index, which is not always warranted.

For any comparison based on financial accounting data the usual disclaimers apply:

- the accounting literature has shown that companies can manipulate their disclosure even in developed capital markets and jurisdictions, let alone in developing ones;
- differences in accounting standards between countries (and within countries over time) can reduce the comparability of data;
- irrespective of accounting standards, the actual 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 (capital expenditure, for example, might be reported including or excluding acquisitions, based solely on additions to property, plant and equipment (PP&E) or on a wider range of assets, etc.);

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26 Expenditures on non-core assets need to be offset against the revenues derived from these assets.
27 One could think of alternative labels for the same item, such as „operating profit before royalties“. Royalties should include the monetary equivalent of any in-kind payments.
28 If sufficient accounting details are available for all firms, then instead of total assets alternative balance sheet items could be used, e.g. capital employed.
29 Although only aggregate EBRTN margin is used in the index, it is nevertheless informative to break this down into the three constituent parts: net profit margin, tax and royalties margin, and non-commercial expenditure margin (all as % of revenues).
30 Capital expenditure (capex) should be net of merger and acquisition (M&A) activities. Depletion, depreciation, and amortization (DD&A) should be net of any one-off charges and write-downs.
there are also petroleum-sector specific accounting issues to consider, such as different approaches to treating exploration expenditure (“full cost” vs. “successful efforts”).

4.2.3 National mission performance variables

The share of local content (percentage of all input values) captures backward linkages of the NOC to the domestic economy.

“Domestic output use” means the percentage of output (sum of upstream production and refined products) that is sold domestically rather than internationally. A high share indicates domestic value-added processing of crude oil (either in refineries or in industries further downstream) or supplies to domestic consumers. Domestic supply often comes at a financial cost, as exports would maximize revenues, but indicates stronger forward linkages to the domestic economy.

The third national mission indicator is the share of domestic labor in the workforce (rather than absolute workforce, which – as was shown in Section 2 – does not usually create social value). 31

The fourth indicator is flared gas as a percentage of total gas volumes lifted. 32 We consider this indicator to be a proxy for (i) the general level of wastefulness with national resources, and (ii) longer-term environmental performance. 33 Additional corporate health, safety and environment (HSE) indicators - e.g. data on injury frequency or oil spills - might be useful indicators, but these data are usually not available for NOCs, and are difficult to estimate.

All four proposed indicators are firm-level rather than country-level attributes, because not all NOCs are monopolists and congruent with the national petroleum sector. For a specific group of monopolist NOCs alternative or additional indicators can be considered. In particular, domestic output use might be replaced by the national self-sufficiency in oil products (measured by the ratio of imports to total consumption), and domestic fuel poverty might be added as an indicator, although it is as much influenced by the general economy and social policies as by any petroleum-specific factor. 34 To specifically examine NOCs with regulatory responsibilities, additional indicators may include the level of international interest in upstream licensing rounds, or country-level HSE metrics.

As discussed above, the inclusion of indicators for fiscal contribution (taxes) and non-commercial expenditure is not warranted for comparisons of fully state-owned NOCs. For NOC-POC comparisons, however, this might be considered if there exist substantial differences between firms.

31 The share of domestic labor as an indicator is not without problems either: it may simply represent the ability of the NOC (and pressures on the NOC) to employ nationals rather than making any contribution to the economy (Stevens 2008).
32 The metric will be re-oriented for the purpose of aggregation, so to indicate the absence of gas flaring. All individual indicators need to have the same orientation, in this case “more is better”.
33 Geological and economic reasons – reservoir characteristics, lack of domestic market, insufficient reserve quantities in remote location etc – can support limited gas glaring from associated fields, but this still remains a waste of resources which in the future might have a significantly higher value.
34 Self-sufficiency in upstream production makes little sense as a performance indicator because it is largely dependent on the country’s exogenous natural endowment.
It is worth noting that alternative approaches (other than the index) could be used to evaluate national mission activities. One option could be to benchmark the NOCs as if they were fully commercial entities, and interpret the (likely) underperformance as the shadow price of non-commercial obligations (see Wolf and Pollitt 2008; Wolf 2009). Quantitative and qualitative analysis can then reveal whether the expenditure is justified in light of the non-commercial goals and achievements. A different approach would be to use frontier analyses, e.g. Data Envelopment Analysis (DEA), which are widely used for efficiency measurements in non-profit organizations (Coelli et al. 1998).

4.3 Standardization and normalization

The only individual indicator in our selection that needs to be re-oriented is gas flaring. It is re-stated as „absence of gas flaring” (calculated as 1 minus the percentage of gas flared), so that for all metrics “more is better”. Before normalizing the data, the distribution of each indicator will be analyzed to identify any extreme outliers, which might be a sign of poor data quality. Some form of data truncation may need to be applied, e.g. through “winsorization”.

Normalization is necessary to aggregate the different individual indicators, which are measured on different units and which have very different ranges and distributions. Normalizing also avoids the dominance of extreme values (even without data truncation as described above). However, this benefit is greater if a z-score transformation is used. There exist a large number of different normalization techniques, including ranking, categorical scale/scoring, standard deviation from the mean (z-score transformation), distance from the group leader, distance from the mean etc. (Freudenberg 2003; Nardo et al. 2005). For the purpose of the NOC value creation index we will use the distance from the best and worst performers, where positioning is in relation to the global maximum and minimum and the index takes values between 0 (laggard) and 1 (leader):

\[
N_{i} = \frac{X_{i} - X_{i}^{\text{min}}}{X_{i}^{\text{max}} - X_{i}^{\text{min}}}
\]

where \(N_{i}\) is the normalized value, \(X_{i}\) is the original value, and \(X_{i}^{\text{min}}\) and \(X_{i}^{\text{max}}\) are the minimum and maximum values of the distribution.

35 It can also be used conceptually to reduce the ability of firms to use exceptional performance in one area to make up for poor performance on other indicators.
36 Winsorization essentially involves setting values falling below a tail percentile of the data distribution equal to that percentile value, and observations above the corresponding upper tail percentile equal to that percentile value. An example of a decision rule, as applied for Yale’s Environmental Performance Index (EPI), is as follows: if the ratio of the 97.5 percentile value to the 95 percentile value (or the 5.0 percentile value to the 2.5 percentile value) was greater than 5, indicating a large spread between them, the data is winsorized at the 5.0 or 95.0 level.
37 z-score transformations are based on the standard deviation of the distribution, whereas most other approaches are based on the data range. z-score transformation has some very useful properties for aggregation, but imposes a standard normal distribution, which might not be appropriate.
Two approaches are possible: (i) use maximum and minimum actual values in the sample of NOCs; or (ii) define maximum and minimum possible or desirable values for the distribution (Kaufmann et al. 1999; UNDP 2008). The second option has the advantage that index values over time can be compared more easily, and is therefore the preferred route for the NOC value creation index.

4.4 Weighting

For each of the two steps outlined above – that is: (i) aggregating individual indicators into the three sub-indices for operational performance, financial performance, and national mission performance; and (ii) aggregating these sub-indices into the overall NOC value creation index – we need to decide on relative weights. The weights can heavily influence the outcome of the composite index, and sensitivity analysis will be carried out to test for the robustness of the results.

Ideally, the weight of variables should be determined by reference to theory or empirical analysis (e.g. regression, principal components or factor analysis). If neither is available, however, frequently all the variables are given equal weights. While an equal weighting is somewhat arbitrary, it is a straight-forward and transparent hypothesis, and a convenient basis for sensitivity checks.

For the NOC value creation index, because there is no theoretical or empirical basis to decide otherwise, the individual indicators within the three sub-indices will all receive equal weighting. As indicated earlier, it would also be premature to suggest a definitive weighting of the three sub-indices at this stage, in part because these weights will plausibly differ for different categories of NOCs. For POCs, the weighting of the three sub-indices might be different for different countries of operation, in part reflecting the extent of non-commercial obligations as part of the upstream license conditions.

4.5 Testing for robustness

Sensitivity tests will be conducted to analyze the impact on the composite index results of including or excluding various variables, using different standardization techniques, changing weights, and so on. Furthermore, because of the more general conceptual drawbacks of composite indicators, one of the robustness checks will involve cross-checking the results with alternative methodological approaches such as careful qualitative case study analysis. This analysis may include an assessment of the individual NOCs’ track record of meeting corporate targets (Stevens 2008).

Another possible sensitivity test – contingent on a sufficiently large data history – is the calculation of 3-year average index values in different oil price environments (e.g. 1998-2000 for relatively low prices, 2004-2006 for relatively high prices), although obviously many driver variables other than oil prices will have changed as well.

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38 The definition of maximum and minimum values is straightforward in case of percentage numbers. For other scales judgment will be required.
39 Some of the most successful indices mentioned at the start of the section, including the HDI and La Porta et al.’s “Law and Finance” indices, are based on equal weighting of individual indicators.
Although not explicitly detailed in this framework there exists several alternatives to using a composite indicator for the estimation and benchmarking of NOC performance. One of these is efficiency frontier analysis, with its two most widespread variations being non-parametric Data Envelopment Analysis (DEA) and parametric Stochastic Frontier Analysis (SFA) (Pollitt 1995; Coelli et al. 1998; Kumbhakar and Knox Lovell 2003). Both allow multiple-input multiple-output formulations, as well as the control for exogenous variables (Stevens 2004; Yang and Pollitt 2007). Frontier analysis is methodologically appealing and might therefore be considered as an alternative or cross-check of results. However, it makes somewhat stricter assumptions (firms are assumed to be overall optimizers, i.e. output maximizing for a given input, or cost minimizing for a given output), and the resulting efficiency score cannot be broken down into commercial and non-commercial components of performance (unless they are estimated separately, which requires detailed input and output data for both).

5 The relative importance of value drivers

Section 3 introduced a conceptual model that identifies key variables (and groups of variables) influencing petroleum value creation in general, and the NOC contribution to value creation in particular; Section 4 proposed a value creation index to measure the extent of NOC value creation. This section discusses four alternative approaches, which can assist in assessing the relative importance of value drivers. At this stage, it is unclear, whether a definitive answer exists, or if it does, whether it could be ascertained given the data limitations on many NOCs.

5.1 Methodological issues

The index proposed in Section 4 measures value creation, but even this apparently straightforward task raises a number of methodological issues, which were discussed earlier. A ranking (or even quantification) of the various causal determinants of value creation is a significantly more complex endeavor, as a number of considerations illustrate:

- Figure 1b contained more than 50 variables with plausible effects on NOC value creation. This broad range of possible drivers, together with a finite number of NOCs available for analysis, raises the specter of underdetermined causality analysis (or, in a regression context, of insufficient degrees of freedom).
- An absolute order of criteria is – from a decision-theoretical point of view – rather meaningless unless the specific trade-offs (the degrees of importance) are specified. “Variable X is preferred over Y” is an implausible statement. “An increase of A units/ percent in X is preferred over an increase of B units/ percent in Y” makes more sense, but requires an even more detailed judgment.
- Causal explanations of micro-economic phenomena (such as market success, high profitability etc.) are notoriously difficult to make or to prove, particularly if the number of observable instances is limited (Runde and de Rond 2007). One of the most famous controversies in the strategic management literature revolves around the drivers of success for Honda in the 1970s U.S. motorcycle market. Despite the company and the market in question being well-understood, the analysis benefiting from full data transparency and disclosure, and the question at hand
apparently being simple and narrow, there still is no generally agreed view as to
the underlying reasons of success (Mintzberg et al. 1996).

- As was highlighted by anecdotal evidence in Chapters 1 and 3, there often is more
  than one path towards good NOC performance, due to differences in the broader
  institutional and political context. One of the conclusions of the Chatham House
  NOC governance project is “that there is no single optimal model for oil sector
  governance” (Myers et al. 2005, p.6). As an example, both Statoil and Petronas
  are generally considered to be among the more successful NOCs, but their sector
  governance context could hardly be any more different. “Norway separates policy
  (Ministry), regulation (National Petroleum Directorate, Petroleum Safety
  Authority, State Pollution Authority) and operations (NOC) into separate entities.
  In contrast, the Malaysian model has no ministry. Policy, regulation and
  operations are housed in separate departments of a single national oil company
  whose head reports directly to the Prime Minister” (Myers et al. 2005, p.10).

- On a more general level, the argument about whether any single institutional
  context can be considered particularly favorable has not been settled. For example
  in the debate about appropriate institutions for developing countries, a number of
  authors claim that there is no unique mapping between markets and the non-
  market institutions that underpin them, as can be observed in the wide variety of
  institutions in today’s advanced industrial societies, including the US, Europe (and
  the many differences therein) and Japan. Rodrik (2000) argues that there is no
  single optimal set of institutions. There are many ways of achieving the same
  objectives, and the interactions between institutions mean that the package needs
  to be considered as a whole rather than piece by piece. He also argues for the
  importance of “local knowledge” in building institutions, and insists that evolution
  by trial and error has its intrinsic benefits, even though this takes time and can
  involve mistakes. In the power sector, for almost a decade since the mid-1990s
  there seemed to exist what Littlechild (2005) called the “standard model” for
  sector reform, but recently this view also has been increasingly challenged
  (Gratwick and Eberhard 2008).

These issues raise the possibility that a definitive ranking of value drivers might
not exist because of individual context-dependence, and because even within the same
context multiple combinations of institutional arrangements might lead to comparable
results. And even if such a generalized ranking existed, it is unclear whether the data
quality and quantity within the petroleum sector is sufficient to ascertain it. On the
other hand there has been no conclusive proof as to the absence of such generalizable
insights either, so it would be premature to abandon the project without a more
detailed examination.

Following are brief characterizations of four different methodological approaches,
which could help to assess the relative importance of value drivers. At the very least, a
combination of these can indicate a range of (individually imperfect) results, which in
turn could indicate the presence (or absence) of a common core to these results. For
all of the approaches set out below it is essential that throughout this analytical
framework a conceptual distinction between the drivers of value creation and the
outcome of value creation (as measured by the value creation index) be maintained.
5.2 Qualitative ‘compare and contrast’

Based on the quantitative NOC value index as dependent variable and the qualitative, conceptual model introduced in Section 3, it is possible to compare and contrast the various country/NOC circumstances with regard to their potential contribution and importance. Such research would need to follow standard procedures and validity tests for qualitative research (Bogdan and Taylor 1998), but because it is impossible to escape the dilemma of a limited number of cases and a large number of plausible explanatory variables, any answer will have to rely to some extent on arguments of plausibility and conjectures.

One of the benefits of qualitative research is that it usually enables more succinct and fine-grained analysis. Many quantitative approaches, and regression/econometric analysis in particular, assume rather simplistic functional forms (linear, quadratic, log, etc.) between dependent and independent variable, which for complex phenomena such as governance might not be appropriate.

5.3 Regression analysis

The quantitative equivalent to the above is a multivariate regression analysis with the NOC value creation index as dependent variable, and quantitative measurements of the various value drivers as independent variables.\(^{40}\) This conventional econometric approach promises important insights, but degrees of freedom are a key issue, given the large number of plausible explanatory variables. To mitigate this, the individual indicators set out in Figure 1b could themselves be aggregated into composite indices, either through standardizing observed data as explained in Section 4 or through a scoring system (see for example WB-CEE 2008a). Furthermore, an econometric modeling approach can be used where the number of explanatory variables gradually is reduced until only statistically significant ones are left in the econometric model.\(^{41}\) The reduction in model complexity usually involves a number of iterations and testing of alternative model specifications, as the final version of model might be very sensitive to initial selection choices (Dougherty 2002).

5.4 AHP weightings based on expert opinion

Expert opinion (in the form of the so-called Delphi method) could also be used to establish the importance of the various value drivers of NOCs (Stevens 2008). But relying on expert opinion creates its own challenges, including finding a sufficient number of knowledgeable experts, bounded human rationality and decision-making powers, and potential serious biases in their responses (issues of group think, common knowledge/perception vs. reality, undue generalization from personal experience etc.). So asking a panel of experts directly and very generally about what they perceive as

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\(^{40}\) The agency variables identified in the conceptual framework are decision variables, and the context variables are treated as control variables.

\(^{41}\) This approach is usually known as general-to-specific modeling (for an overview see Hendry 1993), which starts the empirical analysis with a general statistical model that captures the essential characteristics of the underlying dataset. Then, “that general model is reduced in complexity by eliminating statistically insignificant variables, checking the validity of the reductions at every stage to ensure congruence of the finally selected model” (Campos et al. 2005, p.3).
the most important value drivers is unlikely to provide valid responses. The two approaches outlined in this and the next sub-section address some of these concerns.

One option is to estimate the factor weightings based on expert opinion, but using a methodology called Analytical Hierarchy Process (AHP). The AHP, proposed by Saaty (1980) is a multi-criteria approach that uses a hierarchic structure to evaluate and prioritize a set of alternatives on multiple dimensions (Saaty 1990). Evaluation of the criteria and the alternatives is achieved by constructing pairwise comparison matrices, which provides several advantages compared to traditional ranking and scoring methods. Most importantly they allow the individual making the comparison to focus only on two objects, eliminating the influence of extraneous factors, and improving response consistency.

Ruf et al. (1998, p.125) provide a good example of how AHP can be used to build an aggregate indicator of social performance, where the key problem is the relative importance of different dimensions of social performance. “Individuals are asked: “In assessing corporate social performance, which of the two criteria is considered more important? What is the relative importance of the selected criteria over the other?” The response is gathered on the scale suggested by Miller (1956) ranging from "They are of equal importance" to "One is absolutely more important than the other". The responses are then translated into a numerical scale ranging from 1 (equal importance) to 9 (absolute importance).” The comparisons are reciprocal in nature, which reduces the number of comparisons in half: with k different criteria to be ranked, k(k-1)/2 comparisons are required. Different from a traditional AHP, we would only want to evaluate the different criteria (value drivers) through pairwise comparison, and ignore the comparison of the alternatives (NOCs). This comes back to the concern that very few experts (if any) are equally well informed about a large number of companies. It is also a practical issue of manageability, as the number of comparisons involved would quickly get out of hand. The relative importance weights of the different value drivers are then calculated using the normalized eigenvector of the pairwise comparison matrices. Several software packages are available to perform the necessary calculations.

AHP is methodologically very sound, but in its original formulation is used to assess and structure subjective priorities. In our suggested application we will use it to assess subjective perceptions of facts and causalities.

5.5 Regression analysis based on expert opinion

A final option involves regression analysis based on expert opinion. Here experts are asked to score any number of NOCs (dependent on their personal expertise) on selected dimensions of performance such as production management, technology or human resources (for an example see Middle East Economic Digest, May 18-24 2007). If the experts are also asked to rate the overall performance of the NOCs in question, then regression analysis can be used to identify the implied significance of the various dimensions of performance in determining overall performance.42

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42 Obviously each expert would need to be briefed beforehand on the meaning of „performance” in this context, and on the agreed objective function of the NOC (since performance can only be measured relative to an objective function, as discussed earlier in this chapter, and each of the experts should assume the same objective function for consistency).
Such an approach has some obvious advantages. For once, only NOC-internal scoring validity is required, so that any expert would be free to score as many (or little) NOCs as he/she is qualified to do. Furthermore, provided a sufficient number of expert opinions can be solicited for each NOC, both aggregate regression results and results by NOC could be generated. A cross-comparison of the individual coefficients might then provide some interesting insights as to the possible range of outcomes.

It is important to note that the underlying questions asked of the experts in this approach fundamentally differ from those in the AHP process described above. There the experts consider the relative importance of variables, irrespective of specific examples. Here the experts are asked to assess firm performance on the basis of specific data points, and this gives an indication as to which regulatory set-ups, corporate strategies etc. are perceived to work, and which don’t. These essential differences need to be taken into account when comparing and interpreting the results. To avoid any confusion on the part of the respondents, the two expert-based approaches outlined here will not draw on the same group of experts, or at least not without a meaningful time lag between the two sessions.

6 Conclusion

This chapter outlined an analytical framework for the understanding and analysis of social value creation in the petroleum sector, and of the NOCs’ contribution to it.

A conceptual model of value creation was introduced, which links principal value drivers, such as the national economic context or NOC governance, to aggregate value creation. Three key institutions were considered to contribute to social value creation: NOCs, POCs (or a combination thereof) and the petroleum sector’s organization and governance. But the relative efficiency and effectiveness of each of these contributors varies considerably dependent on its exact specification, which for all three is embedded within a wider network of interrelated factors.

A classification system for NOCs was proposed. Seven primary classification dimensions were discussed, two of which (degree of commercialization and degree of competition in home market) were chosen as the basis for a preliminary 2x2 classification matrix, subject to further empirical corroboration.

A composite value creation index was developed which can be used to benchmark the value creation of different NOCs (or of NOCs and POCs). The aggregate index consists of three sub-indices to measure the operational, financial and national mission performance of petroleum companies. The aggregate index will not be able to capture all intricacies of NOC value creation in individual countries, but when used in combination with additional information and alternative (qualitative) approaches, it will prove a useful measure and a convenient starting point for further analysis.

Different qualitative and quantitative approaches were suggested to estimate the relative importance (ranking) of value drivers in determining social value creation. In this context, methodological triangulation is important because the existence and measurability of a generalized result is unclear at this stage.

Within the wider context of the Study, the framework proposed in this Chapter will serve as the basis for initial data collection and NOC case studies. However, we expect to adjust the framework dependent on its practical validity and on lessons learnt from case studies. As an initial test, the analytical framework, and in particular
the calculation of the value creation index, is illustrated in Appendix B for the case of the Norwegian NOC, Statoil. In this case the index methodology appears to work reasonably well, and all of the required data can either be sourced directly from company reports or be estimated with a high degree of plausibly.

The methodological framework described in this Chapter will be applied to the 49 NOCs listed in Appendix A. In particular, data will be collected (and estimated, where necessary) in order to (i) calculate each NOC’s value creation index and (ii) establish each NOC’s position along each of the primary and secondary classification variables. Once the empirical data has informed a suitable classification system (potentially involving statistical tools such as factor and cluster analysis), selected NOCs from one or more classification categories will be analyzed in more detail regarding their drivers of value creation.
### Appendix A – NOCs covered in Study data directory

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</table>

Source: WB-CEE (2008a)
Appendix B – Case illustration: Norway’s Statoil

In this Appendix the analytical framework is applied to Norway’s Statoil for illustration purposes, and in order to test its applicability.43

The case of Statoil was not chosen on the basis of perceived quality of petroleum sector management but for pragmatic reasons. In the absence of case-specific fieldwork, Statoil offers good disclosure levels due to its stock market listing, and a number of detailed and recent academic treatments are available of both Statoil and the Norwegian petroleum sector more generally (see e.g. Al-Kasim 2006; Gordon and Stenvoll 2007; Thurber and Istad 2009; Wolf and Pollitt 2009). Data disclosure by the Norwegian petroleum regulator is also comprehensive (see e.g. NPD 2005b; NPD 2008). In addition, information on many of the variables identified in the conceptual model was drawn from WB-CEE (2008b). We anticipate that a combination of secondary sources and fieldwork will be necessary with respect to most NOCs listed in our sample (see Appendix A).

Statoil was also chosen because of its dynamic history. Since its inception in the early 1970s, Statoil’s role and objectives within the national petroleum sector have evolved considerably, to a large extent reflecting changes in geological, economic, institutional, and managerial circumstances. Statoil has been both the result and the driver of institutional change in Norway’s petroleum sector. Using the NOC classification matrix presented in Section 3, Statoil has over time changed its relative position on the grid. This evolution is summarized in paragraph (i) below. Paragraph (ii) recapitulates the main value drivers to be examined in detail in the case study. Paragraph (iii) illustrates the calculation of the value creation index for Statoil for the years 2004 to 2006. Preliminary conclusions are drawn in paragraph (iv).

(i) Company and sector evolution over time

The beginnings of the Norwegian petroleum sector in the 1960s resemble those in many other countries: following a surprisingly large reserve discovery (Ekofisk in 1969) made by a private operator, the state quickly asserted its authority over the sector to ensure comprehensive control over development. But two important details need to be highlighted. First, a number of Norwegian bureaucrats showed remarkable foresight and initiative in familiarizing themselves, since the early 1960s, with the regulatory frameworks of the petroleum sector elsewhere. This gave the administration a valuable head-start relative to prospective operators, but also relative to Norwegian politicians – both of which only started to become seriously interested after 1969 (Thurber and Istad 2009). Second, Norwegians at that time already enjoyed a reasonably high standard of life, with a successful private industry e.g. in shipping and fishing, and in contrast to the UK on the other side of the North Sea, the Norwegian government did not need petroleum revenues to balance its budget (Grayson 1981). Having witnessed the macro-economic distortions that oil created elsewhere in the world (Auty 1993; Stevens 2003; Humphreys et al. 2007) and worrying about the industry’s intrusion into the traditional way of life in coastal communities (Al-Kasim 2006), Norway decided to pursue a “go-slow” policy with

43 Since the acquisition of Norsk Hydro’s upstream assets in 2007 the company is called StatoilHydro. But because we calculate the value creation index for the years 2004-06, i.e. pre-acquisition, we will refer to it simply as „Statoil“ throughout most of this chapter.
regard to petroleum development (Dam 1974). It was deemed that comprehensive state control over the sector was the best way to guarantee an appropriate pace of development, to ensure that industrial expertise was built domestically rather than abroad, and to develop state expertise in the petroleum sector; state participation in strategic industries also had a long tradition in Norway, in line with social-democratic policies elsewhere in Scandinavia.

In 1971 the Storting (Norwegian parliament) passed the so-called “ten commandments” of petroleum policy, which captured a wide consensus within Norwegian society. Amongst others they called for: (a) national steering and control of all operations on the Norwegian Continental Shelf (NCS); (b) the state to be an active player coordinating Norwegian interests; (c) the development of a successful petroleum-based industry onshore; (d) petroleum development to occur with due regard to existing livelihoods and the environment; and (e) the creation of a national oil company to take over the state’s business interests and to cooperate with other Norwegian and foreign oil companies. Because the semi-private conglomerate Norsk Hydro was not considered an appropriate vehicle to implement national petroleum policy, a new fully state-owned company was set up in 1972 called “Den norske stats oljeselkap a.s.” (“the Norwegian State Oil Company”), which was later shortened to simply “Statoil”. 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 (MPE) was of the opinion “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, p.48). The first assets were assigned to Statoil in May 1973, and at the end of that year the company had 54 employees, led by Managing Director Arve Johnsen (Grayson 1981).

Despite the apparent focus on state control, neither the Norwegian public nor the politicians considered a state monopoly in the petroleum sector, recognizing the benefits of private investors and operators in terms of technical skills and effective competition. As part of the initial “set-up” of the domestic petroleum sector, there were three Norwegian players – fully state-owned Statoil, partially state-owned Norsk Hydro, and fully private Saga Petroleum – reflecting the desired mix between the domestic public and private sector, in addition to many international POCs such as Shell, Total and Eni.

The so-called „Norwegian model” of petroleum management included important features other than the relative power balance between the NOC, private Norwegian companies, and POCs. Most frequently cited is the strict separation of responsibilities between Ministry, Statoil, and the independent sector regulator (Norwegian Petroleum

45 The state owned 51 percent of Norsk Hydro since the end of World War II, but the private shareholding was very international and the company was listed both in Oslo and in Paris.
46 At year-end 1979 there were 710 employees in Statoil, and by the end of the 1990s this number had increases to over 18,000.
47 As set out in a parliamentary resolution in 2001: “A principal feature of the Norwegian oil policy which has proved effective so far is that active competition between several competent companies helps to ensure the best possible use of resources. In this way, we ensure that they sharpen themselves against each other” (Storting Proposition No. 36, Ownership of Statoil and Future Management of the SDFI [English translation], Page 10).
Directorate, NPD), which oversees all sector participants including the NOC, and which has established a reputation for unbiased decision-making based on technical and commercial merit. There is also a focus on openness and transparency in procedure, and on corporate governance and HSE for all participants. In addition, a petroleum fund was established in 1990 after a decision by the legislature to counter the effects of the expected decline in income and to smooth out the disrupting effects of highly fluctuating oil prices.

During its first decade of operations, Statoil benefited greatly from three key privileges assigned to it by the state: (i) Statoil was granted a minimum participation of 50 percent in all petroleum licenses, implying a veto power on all development decisions; (ii) the company was carried through the exploration phase by the private co-investors in the respective licenses, i.e. it only had to pay its share in exploration expenses retroactively when a commercial discovery had been made; and (iii) once a discovery was declared commercial, Statoil’s interest could be increased further by up to 30 percent (to a total of 80 percent) based on a sliding scale linked to production levels. In return for these privileges Statoil was not only bound by the commercial duties of the Companies Act, but also had to respond to the political and social aims of the government.

By the mid-1980s Statoil had grown materially, was highly profitable and continued to enjoy full state backing. But increasingly there were worries about the unduly large influence of Statoil on the domestic economy and (potentially) domestic politics. In 1984 the Storting (Report No.73, 1983-84) made a number of important changes to the company’s position. First, Statoil’s license interests were split into two parts, the bigger part of which was transferred to the state (the “State Direct Financial Interest”, SDFI). Although Statoil still managed those assets on behalf of its owner, their revenues now went directly to the public treasury. Second, the special privileges outlined earlier were withdrawn from Statoil and henceforth applied to the state instead. A few years later, in order to increase the attractiveness of the Norwegian petroleum sector to investors, most of these stipulations were lifted altogether. Third, Statoil could not use its existing controlling interests in existing licenses to single-handedly take or veto decisions within a license group, unless such voting was authorized by the Storting on grounds of national interest. And fourth, a “Gas Negotiations Committee” (“GFU” in Norwegian) was established, comprising Statoil, Norsk Hydro and Saga Petroleum. Its task was the centralized export marketing of NCS gas, which previously had fallen exclusively to Statoil as the majority owner in all petroleum licenses.

In 1985-86, both the oil price and the Norwegian Kroner fell sharply, and shortly thereafter Statoil faced severe cost overruns at the Mongstad refinery upgrading project, triggering the resignation of Arve Johnsen in January 1988. He was replaced by Harald Norvik, who remained CEO until 1999. During his time in office, Statoil continued to develop towards a (predominantly) commercially oriented business, and the relationship with the state became increasingly arm’s length. Two factors in particular supported such developments. Although Norway is not an EU member it

48 See Al-Kasim (2006, p.241-246) for a discussion of the main attributes of this „Norwegian model”.
49 The then Prime Minister Kaare Willoch later wrote in his memoirs: “The aim was to prevent Statoil from growing beyond reasonable limits and exercise disproportionate influence” (cited in Claes 2002).
50 Statoil, like the other domestic oil companies, was still likely to receive priority allocations in future licensing rounds, but this was now at the discretion of the Ministry.
joined the European Economic Area in 1994, which included adherence to a 1992 directive on the non-discriminatory granting of licenses for prospection, exploration and extraction of hydrocarbons.\footnote{See Directive 94/22/EC.} State favors for Norwegian companies were therefore more difficult, and competition from foreign companies in Norway was bound to become tougher (Claes 2002). Furthermore, Statoil and Norsk Hydro were increasingly looking to compete internationally, outside the NCS. To do so, they needed to improve their efficiency, and not be seen as being politically directed. The companies’ international expansion was supported by the government.\footnote{The former NPD Director of Resources states: “There is no doubt that the policy of supporting the Norwegian offshore industry (...) had added to the cost of operations. In return for this additional cost, the expertise that had been developed could bring new values to Norway based on resources outside the Norwegian Continental Shelf” (Al-Kasim 2006, p.114).}

**Figure A.1: Cumulative reserve discoveries on NCS**

![Cumulative reserve discoveries on NCS](image)

Source: Gordon and Stenvoll (2007)

One key driver for international ambitions at Statoil undoubtedly was the increasing maturity of the NCS, which – combined with its strong domestic market position – limited the firm’s growth potential. Figure A.1 plots the cumulative petroleum discoveries on the NCS against key events at Statoil. As part of that effort towards greater internationalization and greater commercialization, Statoil in 1990 entered into an international E&P alliance with BP, which over time enabled Statoil to participate in key international assets – such as Angolan deep offshore blocks, and the Azeri-Chirag-Guneshli (ACG) development in Azerbaijan.

The tenure of CEO Harald Norvik ended under similar circumstances as that of his predecessor. The oil price crash in 1998 had weakened the overall profitability in the industry, and the pressures on Statoil were compounded by significant cost overruns at the giant Asgard field. In April 1999 the MPE replaced the entire board of the
company, triggering the resignation of Norvik, but not before he had for the first time publicly raised the issue of state ownership in Statoil, calling for a review in view of the heightened competition in the industry.

As the public reaction was mixed, if not positive (Lismoen 1999; Noreng 2000), the center-right government asked the new board of Statoil and its new CEO Olav Fjell to prepare recommendations for the future development of the group and the SDFI. In August 1999 Statoil management responded with an ambitious plan, in which the company was to be strengthened through the transfer of all or a significant part of the SDFI, prior to a partial privatization and stock market listing (PIW 1999; Statoil 1999). In July 1999 the MPE also appointed its own financial and legal advisors on the available restructuring options (MPE 1999), and planned to submit a white paper to parliament in the spring of 2000.

The possible privatization of Statoil and SDFI restructuring were considered together, because the Norwegian state at the time derived its petroleum revenues through four different channels: the SDFI (accounting for more than 40 percent of total NCS reserves), tax revenues from all non-SDFI participants on the NCS, its 100 percent ownership interest in Statoil, and a 44 percent ownership of Norsk Hydro. The composition and evolution of the state revenues from the petroleum sector is provided in Figure A.2. Statoil argued that receiving a substantial part of the SDFI prior to privatization would strengthen the firm’s competitive position and hence valuation levels. Statoil also wanted to be in a position to swap NCS licenses versus international assets. Because Statoil operated the SDFI on behalf of the state, any efficiency gains at the company would have a double positive impact on sovereign value creation. On the other hand, any efficiency-enhancing restructuring of the SDFI outside of Statoil (i.e. through sale or exchange of license interests with other NCS participants) could also reduce operating costs, increase taxation, and attract additional investment to the country.

Figure A.2: State revenues from petroleum resources

![Figure A.2: State revenues from petroleum resources](image)

Source: NPD (2007)

53 In 1999 Norsk Hydro had acquired Saga Petroleum, which diluted state ownership from 51%. Statoil, which had owned 20% of Saga, also received some of the assets in a three-way deal.
Despite a change in government, the privatization plans were presented to parliament in December 2000 (MPE 2000), which approved them – with some small modifications – on 26 April 2001. The key elements of the privatization and restructuring were (Statoil 2001):

- **Sale of 15 percent of SDFI assets to Statoil** (paid for in cash, infrastructure assets and subordinated debt). As a result Statoil’s net proven reserves on the NCS increased by 54 percent to 3,787 million barrels of oil equivalent, and NCS production increased by 60 percent to 936,000 barrels of oil equivalent per day.

- **Partial privatization of Statoil.** 19.2 percent of Statoil was sold and listed on the Oslo and New York Stock Exchanges in June 2001, valuing the company at approximately US$16.4 billion. Almost exactly half of the shares being offered were primary shares issues by the company, with the other half being secondary shares sold by the government. But because the new cash raised by Statoil was used immediately to repay outstanding debts to the MPE (arising from the SDFI sale), the Norwegian state was effectively the sole recipient of funds.

- **Establishment of a state-owned company (Petoro) to take over the administration of the remaining SDFI assets from Statoil.** Under a special instruction, Statoil nevertheless continues to market the SDFI output on behalf of the state.

- **Establishment of a state-owned gas infrastructure company (Gassco) to take over operatorship of some NCS gas pipelines previously operated by Statoil.**

- **Sale of 6.5 percent of SDFI assets to third parties.** Executed in March 2002, SDFI assets were auctioned to Norsk Hydro and others to improve license allocations, strengthen competition and investment incentives.

The 15 percent share of SDFI assets sold to Statoil was clearly less than the company had hoped for, but parliament allowed a further reduction in state ownership down to 67 percent in order to accommodate possible strategic alliances or share-based acquisitions. When no such transaction was forthcoming in the three years following the IPO, the Norwegian government took advantage of the favorable oil price environment. In July 2004 and February 2005 it sold two further installments of Statoil shares (approximately 5.4 percent each), reducing the level of state ownership to 70.1 percent as of year-end 2005.

Because Statoil had been allocated a much smaller part of the SDFI assets than the company had envisaged, shortly after the IPO speculation started as to whether Statoil would be interested in acquiring Norsk Hydro’s petroleum assets (PIW 2002). Following a change in Statoil CEO from Olav Fjell to Helge Lund in 2003/04, and against the backdrop of ongoing global industry trends towards consolidation, technically complex and investment-heavy upstream projects, and the growing international importance of state-controlled petroleum companies from emerging economies, the benefits of cooperation were re-considered, and in December 2006 the merger of Statoil with Norsk Hydro’s petroleum division was announced. State ownership was initially diluted to 62.5 percent, but since then the government has - through share purchases on the open market – brought its ownership stake back up to over 67 percent.

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54 This was done to prevent conflicts of interest between a part-private Statoil and other NCS operators.
The ultimate outcome of just one surviving Norwegian oil company is not a surprise given the industrial dynamics of the petroleum sector. In fact, as early as 1971 the government had written in a report to the Storting: “In the opinion of the Ministry the character of the petroleum industry is such, involving heavy risks and heavy investments, that it is barely possible for more than one, or at the most two Norwegian groups to go to the full extent towards becoming an oil company on an international scale” (Al-Kasim 2006, p.56). Contrary to the Statoil part-privatization, however, the Statoil-Hydro merger attracted a fair share of domestic criticism, largely due to the further increase in concentration on the NCS, and the potential loss of competitive pressures and incentives (Osmundsen 2007).

(ii) Overview of value drivers

A detailed analysis of the value drivers for the specific case of Statoil is beyond the scope of this appendix. Much of the information is available in the NOC data directory (WB-CEE 2008a), the academic literature cited above, and the detailed corporate and regulatory disclosures. It is important to emphasize that both qualitative and quantitative data will need to be collected and recorded in respect of each value driver for all NOCs in the Study.

Economic, political and geological/ context

In our conceptual model, the following are some of the key variables that have been chosen to assess the economic, political and geological context:

- Political system
- Ideology, culture
- International obligations (e.g. WTO, OPEC, EU)
- State of the general economy: stage of economic development, fiscal/budget position, skill base (education, R&D)
- Role of petroleum industry: importance for overall economy
- Resource endowment: size and quality of resource base, ease of access
- Access to markets (geographical proximity, off-take agreements etc.)
- Infrastructure: pipelines, railroad, roads, ports etc.
- Import/export status with regard to crude oil, natural gas, and oil products

The state: capacity, goals and objectives

- General governance principles and governance levels in the state sector
- National regulatory capacity (across industries)
- National regulatory credibility (across industries)
- National energy and petroleum policy
- Economic development policy, including fuel poverty alleviation

55 For the sake of simplification the categories of state capacity on the one hand, and state objectives on the other are grouped together here, but as discussed in Section 3, state capacity can be assumed to be fixed in the short-term (and thus an exogenous variable to decision-making) whereas state objectives are largely endogenous even over shorter time horizons.
- Energy security policy

_Petroleum sector organization and governance_
- Oil sector structure, incl. openness and degree of competition
- Institutional responsibilities (and clarity and cohesion thereof)
- Regulatory capacity and credibility (petroleum-specific)
- Laws and regulations
- Fiscal regime
- Pricing mechanisms
- Depletion policy

_NOC corporate governance_
- Ownership structure and organization
- Role, composition and appointment of board of directors
- Hiring/retention of key executives
- Decision-making process
- Sources of capital
- Budgeting process (incl. budgetary autonomy)
- Human Resources policies
- Disclosure and transparency policy

_NOC (and POC) strategy and behavior_
- Asset portfolio
- Investment focus
- Vertical integration
- Domestic versus overseas operations
- Competitive behavior, partnerships
- Investment, technology, R&D
- Skill base, training
(iii) Statoil’s value creation index (2004-06)

Table A.1 contains the actual values of underlying performance indicators, as well as the three-year averages 2004-06.56

<table>
<thead>
<tr>
<th>Table A.1: Statoil values (2004-06) for underlying indicators</th>
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<tr>
<td></td>
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<tr>
<td><strong>Unit</strong></td>
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<tr>
<td>Production growth</td>
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<tr>
<td>3-year average</td>
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<tr>
<td>RRR (ex M&amp;A)</td>
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<tr>
<td>3-year average</td>
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<tr>
<td>Refinery utilisation rate</td>
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<tr>
<td>3-year average</td>
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<tr>
<td>Output/assets</td>
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<tr>
<td>3-year average</td>
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<tr>
<td>Output/employees</td>
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<td>3-year average</td>
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<tr>
<td>EBRTN/revenues</td>
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<tr>
<td>3-year average</td>
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<tr>
<td>EBRTN/total assets</td>
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<td>3-year average</td>
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<tr>
<td>Capex/depreciation</td>
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<tr>
<td>3-year average</td>
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<tr>
<td>Share of local content</td>
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<tr>
<td>3-year average</td>
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<tr>
<td>Domestic output use</td>
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<tr>
<td>3-year average</td>
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<tr>
<td>Share of domestic labour</td>
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<tr>
<td>3-year average</td>
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<tr>
<td>Gas produced / lifted</td>
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<tr>
<td>3-year average</td>
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</tbody>
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Source: Statoil Annual Reports (Form 20-F), NPD (2005a), author estimates

The following provides additional information on the assumptions and calculations made to determine the performance indicators listed in Table A.1:

- Production growth includes some asset acquisitions and disposals, but these are largely immaterial relative to overall production volumes.
- Reserve replacement ratio (RRR) excluding acquisitions and disposals is calculated based on SFAS 69 supplementary disclosure on oil and gas producing activities57 as:

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56 The 3-year averages are based on the underlying data over three years, not just the average of the three annual indicators.
57 The supplementary information on oil and gas producing activities is unaudited, but presented in the standardized format prescribed by the U.S. Securities Exchange Commission (SEC).
changes in proven reserves due to revisions, reclassifications, discoveries and extensions, and improved recovery.

- Statoil’s annual reports provide refinery utilization rates for Mongstad refinery in Norway (79 percent Statoil-owned) and Kalundborg refinery in Denmark (100 percent Statoil-owned). Statoil also has a 10 percent stake in Shell-operated Pernis refinery in the Netherlands, for which Statoil provides no detailed data, but for which we assume – based on Shell average European refining performance – a 95 percent utilization rate.\textsuperscript{58}

- Output is defined as the sum of annual E&P production and refinery throughput, measured in million barrels of oil equivalent. Total assets, which Statoil reports in Norwegian Kroner, are translated into U.S. Dollars at year-end exchange rates.

- Earnings before royalties, taxes and non-commercial expenditure (EBRTN):
  - Net income and income tax payable are reported in Statoil accounts.
  - Reported revenues are net of royalties, for which some disclosure is available.\textsuperscript{59} Based on this information, we estimate in-kind royalties to be 12\% of the gross production at applicable oil-producing fields (these 12\% amount to 11.1 mmboe in 2004, 10.6 mmboe in 2005), valued at average annual crude market prices.\textsuperscript{60}
  - In terms of explicit non-commercial expenditures, Statoil only discloses minor amounts of “social investment” (US$8 million in 2005, US$9.5 million in 2006) in its international operations, e.g. in Azerbaijan.
  - When calculating EBRTN over revenues, revenues were not pro-forma adjusted for the estimate of in-kind royalties.\textsuperscript{61}

- Capital expenditures (capex) is supposed to be net of acquisition and disposals, and is calculated as the sum of „additions to property, plant and equipment‟ and „capitalized exploration expenditure‟ (both detailed in Statoil cash flow statements).

- Share of local content is calculated based on data contained in the Sustainability Reports, which provide the total annual procurement value (invoiced value of goods and services) and its split amongst suppliers registered in Norway and

\textsuperscript{58} We exclude Statoil’s 81.7 percent ownership interest in a methanol plant at Tjeldbergodden, and its 50 percent stake in petrochemical producer Borealis, which was sold in 2005.
\textsuperscript{59} All producers on the NCS were liable for an oil royalty from fields approved for development prior to 1986, but this obligation was abolished at the end of 2005. For 2004 and 2005, this still applied to two Statoil fields (Gullfaks and Oseberg). Royalties were paid in kind, and varied from 8 to 16 percent of the gross production. No royalty was charged on natural gas or NGL production. Statoil is also liable to royalty payments on some international assets, e.g. in Venezuela (Sincor).
\textsuperscript{60} In its Sustainability Reports 2004-06, Statoil discloses “total indirect taxes paid”, which in addition to royalties also include carbon tax, area fees, petrol duty and similar, but not value-added tax (VAT) or profit oil retained by host governments in Statoil PSA agreements. As discussed earlier in this Chapter, total indirect taxes provide a more comprehensive picture for welfare purposes than royalty payments alone, but this information is unlikely to be available for many NOCs in our sample.
\textsuperscript{61} This is a simplification and provides a slightly higher result (because the denominator is smaller), but does not matter as long as it is done consistently for all sample companies.
abroad. The share of local content thus represents the value share of Norwegian suppliers.

- For domestic output use (the share of upstream production and refined products which are delivered domestically rather than exported) only limited disclosure is available, so the following assumptions were made:
  - Natural gas: according to the EIA over the period 2004-06 Norwegian consumption was 7.7 percent of production. This percentage was applied to Statoil as well
  - Crude oil: Statoil only has one domestic refinery (Mongstad), for which we assume that the company provides its own equity crude and other feedstock. 63
  - Oil products: Mongstad delivers 45 percent of output to the “Scandinavian markets”, of which we assume 75 percent is within Norway.

- Statoil discloses no information on the breakdown of its workforce by nationality. Our estimate is based on the actual geographic split of job locations, and the assumption that 85 percent of employees in Norway and 60 percent of employees outside of Norway are of Norwegian nationality.

- Despite very detailed environmental statistics (including emissions of CO2 and NOx), Statoil does not report the actual amount or the percentage of gas flared. The sector regulator, however, has indicated that in 2004 only 0.16 percent of the total annual production in Norway had been flared (NPD 2005a); we assume this number for Statoil for all three years. 64

In order to normalize the individual indicators, we use the distance from the best and worst performers, where positioning is in relation to the global maximum and minimum and the index takes values between 0 (laggard) and 1 (leader):

\[ N_i = \frac{X_i - X_i^{\text{min}}}{X_i^{\text{max}} - X_i^{\text{min}}} \]  

where \( N_i \) is the normalized value, \( X_i \) is the original value, and \( X_i^{\text{min}} \) and \( X_i^{\text{max}} \) are the minimum and maximum values of the distribution. Instead of using the actual minimum and maximum values from the sample of NOCs, we define minimum and maximum possible values for the distribution, which can also be interpreted as

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62 Total procurement excludes petroleum products for re-sale, but includes purchases for the licenses Statoil operates, so that part of the cost is covered by Statoil’s project partners. This isn’t a problem for our purposes, though, as the proportion of local content will be the same.

63 Disclosure in the annual reports on the origins of supplies is incomplete, but about three quarters might come from Statoil fields, which is close to Statoil’s equity stake in the refinery.

64 The Norwegian Petroleum Act states: “Flaring in excess of the quantities needed for normal operational safety shall not be allowed unless approved by the Ministry”. For any new development the operator must submit an environmental impact assessment, which also includes a systematic review of costs and benefits of any mitigating measures. The impact assessment is subject to public consultation. No development plan has yet been approved without any gas injection or gas export solution.
“goalposts” (UNDP 2008). Table A.2 summarizes the goalposts used in the calculation of the Statoil value creation index.

### Table A.2: Minimum and maximum ‘goalposts’ for underlying indicators

<table>
<thead>
<tr>
<th>Goalposts</th>
<th>Unit</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production growth</td>
<td>%</td>
<td>-10%</td>
<td>10%</td>
</tr>
<tr>
<td>RRR (ex M&amp;A)</td>
<td>%</td>
<td>0%</td>
<td>200%</td>
</tr>
<tr>
<td>Refinery utilisation rate</td>
<td>%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Output/assets</td>
<td>boe/'000$</td>
<td>5.0</td>
<td>30.0</td>
</tr>
<tr>
<td>Output/employees</td>
<td>'000boe</td>
<td>5.0</td>
<td>30.0</td>
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<tr>
<td>EBRTN/revenues</td>
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<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>EBRTN/total assets</td>
<td>%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Capex/depreciation</td>
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<td>300%</td>
</tr>
<tr>
<td>Share of local content</td>
<td>%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Domestic output use</td>
<td>%</td>
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<td>100%</td>
</tr>
<tr>
<td>Share of domestic labour</td>
<td>%</td>
<td>0%</td>
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<tr>
<td>Gas produced / lifted</td>
<td>%</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Author

Some of the indicators are naturally bounded: refinery utilization rate, EBRTN/revenues, share of local content, domestic output use, share of domestic labor and gas flaring all by definition lie between 0 and 100 percent. For the others, random boundaries were picked at some distance from the actual Statoil values. Unless additional case studies are undertaken and their results combined to inform an appropriate level for the goalposts, these cannot be appropriately interpreted and the resulting normalized index values are largely devoid of meaning.

Table A.3 presents the normalized indicator values, as well as the equal-weighted sub-indices for operational performance, financial performance and national mission performance. In terms of volatility, national mission performance appears to be the most stable over time. This is consistent with our expectations, given that all four constituent indicators reflect at least mid-term business decisions and established operational and bureaucratic procedures. Year-on-year changes in the other performance categories are substantially more pronounced. With respect to financial performance, year-on-year changes are likely due to the underlying volatility in commodity prices, and to the discrete and sometimes project-specific nature of capital investment. Changes in operational performance reflect underlying technical and geological properties (i.e. reserve additions tend to be lumpy over time), but may be emphasized by the choice of indicator, that is production growth rather than absolute production levels.

Sensitivity checks to test for robustness have limited value at this point, because one of the main criteria to check is whether the rank order between petroleum firms is

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65 Refinery utilizations are sometimes reported to be in excess of 100%, but this only occurs when utilization is measured relative to nameplate capacity rather than actual capacity, or relative to the main crude distillation unit (CDU) rather than the total of installations. Earnings can exceed revenues in case of significant non-operating items, but our definition of EBRTN reflects operating earnings.
robust to changes in variable selection, standardization technique, weight schedule etc. Sensitivity checks will be carried out after the initial case studies have been completed. Only detailed case studies will be able to provide sufficiently strong qualitative evidence (including the firms’ track record of meeting corporate targets) in order to either disprove or corroborate the rank order of NOC performance provided by the composite indicator.

**Table A.3: Statoil value creation index**

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production growth</td>
<td>0.66</td>
<td>0.79</td>
<td>0.36</td>
</tr>
<tr>
<td>3-year average</td>
<td></td>
<td></td>
<td>0.60</td>
</tr>
<tr>
<td>RRR (ex M&amp;A)</td>
<td>0.26</td>
<td>0.51</td>
<td>0.37</td>
</tr>
<tr>
<td>3-year average</td>
<td></td>
<td></td>
<td>0.38</td>
</tr>
<tr>
<td>Refinery utilisation rate</td>
<td>0.94</td>
<td>0.95</td>
<td>0.95</td>
</tr>
<tr>
<td>3-year average</td>
<td></td>
<td></td>
<td>0.94</td>
</tr>
<tr>
<td>Output/assets</td>
<td>0.30</td>
<td>0.31</td>
<td>0.22</td>
</tr>
<tr>
<td>3-year average</td>
<td></td>
<td></td>
<td>0.27</td>
</tr>
<tr>
<td>Output/employees</td>
<td>0.65</td>
<td>0.64</td>
<td>0.63</td>
</tr>
<tr>
<td>3-year average</td>
<td></td>
<td></td>
<td>0.64</td>
</tr>
<tr>
<td>EBRTN/revenues</td>
<td>0.24</td>
<td>0.24</td>
<td>0.28</td>
</tr>
<tr>
<td>3-year average</td>
<td></td>
<td></td>
<td>0.26</td>
</tr>
<tr>
<td>EBRTN/total assets</td>
<td>0.29</td>
<td>0.33</td>
<td>0.38</td>
</tr>
<tr>
<td>3-year average</td>
<td></td>
<td></td>
<td>0.34</td>
</tr>
<tr>
<td>Capex/depreciation</td>
<td>0.55</td>
<td>0.42</td>
<td>0.61</td>
</tr>
<tr>
<td>3-year average</td>
<td></td>
<td></td>
<td>0.52</td>
</tr>
<tr>
<td>Share of local content</td>
<td>0.71</td>
<td>0.73</td>
<td>0.78</td>
</tr>
<tr>
<td>3-year average</td>
<td></td>
<td></td>
<td>0.74</td>
</tr>
<tr>
<td>Domestic output use</td>
<td>0.16</td>
<td>0.18</td>
<td>0.19</td>
</tr>
<tr>
<td>3-year average</td>
<td></td>
<td></td>
<td>0.18</td>
</tr>
<tr>
<td>Share of domestic labour</td>
<td>0.73</td>
<td>0.72</td>
<td>0.74</td>
</tr>
<tr>
<td>3-year average</td>
<td></td>
<td></td>
<td>0.73</td>
</tr>
<tr>
<td>Gas produced / lifted</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>3-year average</td>
<td></td>
<td></td>
<td>1.00</td>
</tr>
</tbody>
</table>

Source: Author
(iv) Conclusion

Overall, in the case of Statoil, the methodological framework and the value creation index appear to work reasonably well.

One potential issue highlighted by the Statoil case is the treatment of international operations of the NOC, given that the value creation model is calculated from the perspective of the home country. Except for possible additional profits from these operations there tends to be limited value creation for the NOC’s home country.\(^\text{66}\) Ideally one would separate domestic and international operations, and calculate separate value creation indices. Unfortunately, however, such a breakdown of data is not usually available. Moreover, in some economically integrated regions of the world, operations might be located outside the home country but service the home market.

Of course, the level of disclosure on Statoil and the Norwegian petroleum sector is excellent, and such standards are unlikely to be replicated in many other cases. When applied to the full sample of NOCs, the analysis will inevitably encounter issues of data availability and reliability, issues of accounting comparability etc., as described elsewhere in this Chapter. Some of the underlying performance indicators, such as the cost of non-commercial obligations, will have to be estimated for a majority of firms, and this will require both detailed research and balanced judgment. Any such estimates (or other issues encountered during the analysis) will be transparently disclosed and, where material in scale, subject to sensitivity analysis.

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\(^{66}\) Most taxes usually accrue to the host government. Some value might be created in the form of increased domestic energy security (although this is highly questionable), or where substantial parts of the workforce and supplies come from the home nation (e.g. CNPC in Sudan).
References


