

Measuring the performance of national oil companies in creating value Conceptual model

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Abstract: This research aimed to present a conceptual model that forms the essential basis for collecting value creation indicators by national oil companies, addressing the lack of Arab studies in this area, to the best of the researchers' knowledge. The study employed a descriptive approach and utilized procedural analysis to identify the components of the value creation index used to measure the performance of national oil companies. These components were summarized into a composite index by assigning weights to each sub-indicator. The research concluded that five categories—state context, sectoral organization and governance, national oil company strategy, national oil company governance, and geology—contribute to value creation by national oil companies. Additionally, the study highlights the importance of linking these categories to clear operational, financial, and national-mission indicators. This connection strengthens the model and enhances understanding of how different factors drive value. By doing so, the study provides a practical framework that policymakers and researchers can rely on when evaluating national oil company performance across diverse contexts. It also offers meaningful practical implications by supporting informed decision-making and creating opportunities for future research to test, refine, and expand the proposed model.

Keywords: National oil companies, Performance, Value creation index.

1. Introduction

The history of national oil companies is full of successful experiences that have effectively contributed to maximizing the revenues of national natural resources and pushing the development process forward. On the other hand, there are failed experiences in which national oil companies have caused double ineffective spending, hindered investment, depleted resources, and spread corruption and favoritism [1]. National oil companies differ greatly in their institutional environments, objectives, operations, and local and international social and economic links, which makes a comparative assessment of the value creation of national oil companies important [2].

Therefore, this research seeks to contribute to defining a conceptual model for evaluating the effectiveness of national oil companies in terms of their performance and ability to create value.

2. Importance of the Research

Despite the importance of measuring value creation to enhance and develop the performance of Arab national oil companies, and considering the political and developmental roles of these companies within their countries, much of the existing literature has been authored from outside their national contexts. This represents a shortcoming that researchers and officials in these countries, whether from governments, national oil companies, universities, or research centers, must recognize. Therefore, the significance of this research is evident from several perspectives. From a research perspective, this study

can provide theorists, researchers, and practitioners in Arab countries with a solid theoretical foundation that aids in understanding the conceptual model of value creation by national oil companies. It can also facilitate the application and benefit from this model within the scientific community. Regarding the applied aspect, it encourages stakeholders to adopt the model and develop measurement frameworks for value creation. This can support the conduction of both theoretical and procedural studies that clarify some of its elements and variables, and generate hypotheses that require testing under different conditions and environments.

3. Research Problem

Based on the previous data, and given the great and noticeable importance of the contribution of national oil companies to value creation, the research problem can be formulated in the following main question:

How and to what extent can national oil companies contribute to the creation of total value in the national oil sector?

The following sub-questions branch out from the main question:

1. What are the main parties that generate the vast majority of direct value in any national oil sector?
2. What are the categories that represent the creation of the value of the national oil company?
3. What are the value drives?
4. What are the factors that affect the role of national oil companies in value creation?

4. Research Objective

This research aims to:

1. Knowing the main parties that generate the vast majority of direct value in any national oil sector.
2. Knowing the categories that represent the creation of value for the national oil company.
3. Knowing the value drives.
4. Knowing the factors that affect the role of national oil companies in creating value.

5. Study Hypothesis

Based on the research problem, the following hypothesis was formulated:

- The five value creation drivers: (1) Geology, (2) Country context, (3) Organization and management of the oil sector, (4) Strategy and behavior of the national oil company, (5) Governance of the national oil company, contribute randomly to explaining the value creation index.

6. Research Methodology

The research relied on the descriptive approach to describe and analyze data related to the research topic, and procedural analysis was used to determine the components of the value creation index to measure the performance of national oil were presented and proposed as an attempt aimed at clarifying the conceptual model for measuring the performance of national oil companies in creating value.

7. Literature Review

7.1. The First Requirement: Performance and Value Creation

7.1.1. Performance

There are several definitions of performance, including:

- Performance is the ability to produce goods and services with great efficiency that respond to market demands (good quality, right time, reasonable price), which allows for achieving a surplus to move the economic system [4].

- Performance is: "The sum of the institution's ability to exploit its resources and direct them towards achieving the desired goals. Performance is a reflection of how the institution uses its material and human resources and exploits them in a way that enables it to achieve its goals" [5].
- The various methods and processes that the institution relies on in its quest to achieve the greatest possible amount of the set goals, under the constraint of reducing costs to the lowest possible level through the optimal exploitation of its resources, and preserving the interests of the various parties related to it, and balancing between them [6].

The term performance is usually associated with two terms: efficiency and effectiveness, because they represent either the institution's ability to achieve its goals or the ability to obtain the greatest amount of outputs through the available inputs; performance is embodied in the levels of efficiency and effectiveness achieved by the institution [4].

Thus, if performance is generally understood as "what an organization does when faced with a task," and if the task is defined as creating value for society, then "good" performance in the context of this discussion simply refers to economic behavior by the NOC or other actors in the NOC sector that leads to the creation of overall value [7].

7.1.2. Value Creation

At the level of individual firms, value creation involves the type of process, while at the societal level, net value creation equals the net social benefits (or social welfare) resulting from a social cost-benefit analysis by comparing benefits and costs in order to assess the social impact of a project, decision, or government policy [8]. Total value creation can therefore be defined as the sum of the values created for different stakeholders, perhaps adjusted according to the shadow welfare weights of the individual national components [3]. Since cost-benefit analysis tends to be very detailed, it is, in fact, only a practical option for well-defined individual projects or decisions. Not all options for institutional arrangements within the national hydrocarbon sector can be analyzed in detail using social costs and comprehensive benefits, mainly because NOCs or other actors in the national oil sector often pursue social and political goals that are not commercial, and thus lower profits do not necessarily indicate increased costs and lower technical efficiency, but rather represent social outcomes; thus, this approach provides a valuable perspective for understanding value creation [9]. The NOC typically creates value by acting as an operator of oil facilities, controlling costs and efficiency by virtue of its national mission [3]. There are other ways of creating value, for example: NOCs may participate in the regulation of the sector, or they may be equity investors (rather than operators), providing private value to the project operator in terms of financing and risk diversification, and social value through higher investment, higher taxes, etc. However, in some cases, the value generated may not be sufficient to offset the economic costs, so that net value creation is negative. Commercial oil projects that fail to generate a positive pre-tax net present value are unlikely to create net social value, and investments related to non-commercial objectives or national missions must meet comparable welfare standards to be considered value added [7]. National oil companies' spending on local content policies helps support local suppliers by building technical and commercial expertise, but only in the short term, when economic costs such as higher purchase prices, lower product quality, and opportunity costs of financing are significant. The NOC's surplus employment, which does not increase productivity, is a value-neutral transfer by transferring state funds to employees, and the social welfare impact is negative if the recipients of the transfers are not the poorest members of society. Besides NOCs, other value-creating entities within the NOC sector are private sector-financed domestic and foreign oil operations, where net new money is put on the table (foreign direct investment). The private sector does not typically finance government investment or social welfare spending, which reduces the social opportunity cost and increases the net benefits of any oil investment. Finally, the value captured by the state (for its collection of taxes and its share in the NOC) refers to the net welfare share whose profits accrue to the state rather than being distributed to private investors, competitors, consumers, employees, etc., and quite the opposite if the NOC is a monopoly and wholly owned by the state [7].

7.2. *The Second Requirement: A Conceptual Model for Value Creation*

The factors that affect value creation by NOCs can be classified into two categories: the first includes variables that describe the initial conditions and context, such as economic situation, political history, ideology, international commitments, and available natural resources. The second encompasses variables that describe human and organizational agency, such as NOC objectives, sector governance choices, and NOC management and strategy. The contextual variables and human and organizational agency together constitute drivers of value creation by NOCs, and these variables can be classified into five categories: country context, sector governance and regulation, NOC strategy, and NOC governance and geology. The proposed simplified conceptual model assumes that three main entities generate the vast majority of direct value in any NOC sector, which are: (a) the NOC, (b) private oil companies, and (c) sector governance and regulation. National and private oil companies have certain levels of economic efficiency and make strategic and operational choices that translate into commercial and non-commercial performance and value creation. However, the ability and willingness of companies to perform well is an integral part of, and is affected by, issues of sector governance and regulation, including the financial system, industry structure, regulatory responsibilities and capabilities, and pricing mechanisms. Any national oil sector has a set of implicit or explicit rules and procedures. Therefore, the state, as the owner of the resources, must decide whether to allow national oil companies or private oil companies, or a combination of the two, to operate and invest in the sector. State decisions regarding sector governance and participation are interconnected and jointly affect value creation. The conceptual model describes the creation of NOC value as the result of a number of interrelated variables and processes. It assumes that the role and objectives of the NOC are influenced by the goals and objectives of the state with regard to energy and petroleum policy, which are determined by the historical, political, financial, and economic context of the state, which is itself influenced by the resources available to the state and its geography. The objectives of the NOC are influenced by two main factors: (a) the corporate governance structure, and (b) the companies' strategy and market behavior. The model considers the above two factors to be the direct drivers of NOC performance and value creation. Any model is only a simplification of reality. Therefore, some of the potential variables and many of the possible interconnections between these variables are not explicitly recognized. For example, the model does not assume that the value created in the oil sector is in turn influenced by the financial, economic, political, and geological context of the country [7].

7.3. *The Third Requirement: Measuring the Performance of National Oil Companies: Value Creation Index*

The performance of a national oil company should be measured by reference to its objective function, and the mission and objectives vary greatly between national oil companies, depending on the policy objectives of their shareholders. These objectives often include one or more of the following:

7.3.1. *First: Protecting the National Wealth of Hydrocarbons:*

This requires the national oil company in a country to do two things:

The first issue: It is related to ensuring the production of resources to maximize the recovery factor in the fields. This is usually stipulated in the text of the upstream oil agreements and means "following good oil field practice." This concept is relatively straightforward because it is essentially a technical issue involving natural decline rates and recovery factors [2].

The second issue: It is related to "optimizing resources" in line with the country's depletion policy. This is a concept concerned with the hydrocarbon depletion policy in a country. Any policy involves the choices that a state makes as the owner of the hydrocarbons in the ground. The state's choices are to produce oil now or later. If production is deferred (1), this choice will yield a positive rate of return if the future yield per barrel is higher than it is today, either because of higher oil prices and/or lower production costs. If oil is produced today, then the choices are either to invest the revenues domestically (2) or invest them abroad (3) or both. Investing domestically will provide a rate of return and demonstrate the state's ability to use the revenues productively and avoid the attacks of the "resource

curse.” Investing abroad also provides a rate of return and demonstrates how well the fund and its portfolio are managed and whether the assets are protected from political interference by other states [3].

Optimizing depletion policy is a state choice that assumes the maximum return, given the three options. This can only be assessed ex post. Any evaluation of NOC performance must take into account the context of the government’s depletion policy. If that policy is (for example) to reduce production, many of the operational performance measures applicable to IOCs will be irrelevant. NOCs can theoretically help states optimize savings (dollars or oil in the ground) through deliberate choices in hydrocarbon development, such that the price will be higher if NOCs produce less than IOCs [3].

7.3.2. *Second: Enhancing Economic Development*

Enhancing economic development requires the NOC to maximize its financial and productive links forward and backward, linking the hydrocarbon sector with other elements of the economy and maximizing the growth of the non-hydrocarbon economy, thus making oil production sustainable. The links are of two types: financial and productive [2].

A. Financial linkages: Financial linkages are related to consumption linkages and financial linkages.

1- Consumption linkages: They are related to the way consumers spend the income generated by this sector, and this is likely to affect the pattern of domestic product and imports. However, these patterns are unlikely to be affected by the behavior of the NOC, and therefore, the size and nature of the tax linkage are what raise concern, as this is directly affected by the behavior of the NOC.

2 - Material Linkages: Refers to the ability of the national oil company to create economic rent through the production of oil and gas, and then to maximize this rent by the government in exchange for distributing it in the service of promoting development. This ability to obtain rent depends largely on how the oil sector is structured, the capacity of the players in the oil sector, how the national oil company interacts with other players in the sector, and how the financial system is formed [10]. The way in which revenues are distributed in terms of promoting development will be a major factor in the success of the oil sector’s contribution, and this is usually the responsibility of the government and not the national oil company [3].

B. Production linkages: There are two types of production linkages:

- Forward linkages: Where the sector provides inputs to the rest of the economy.
- Backward linkages: Where the sector relies on inputs from the rest of the economy. When considering production linkages, it is important to mention the term “technological alienation,” which refers to the extent to which the oil industry introduces “alien” technology to the host environment. If the gap is too wide, production linkages are unlikely to develop or at least will take a long time [3].

7.3.3. *Third: Promoting the Political Interests of the State Abroad*

The objective function of the NOC is to create value for society and develop hydrocarbon resources, as well as to achieve the broader political objectives of the state globally. In this context, performance simply refers to the economic behavior of the NOC that leads to the creation of total value. NOCs create value directly either through their role as an operator or through their national mission. It can also create value indirectly, for example, by acting as an advisor and regulator to other elements of the state (although this may lead to a conflict of interest). Therefore, the ability of a national oil company to carry out its missions and objectives is determined by its contribution to value creation [3].

7.4. *The Second Section: Measuring the Value of Creating a National Oil Company*

To measure the value of creating a national oil company, this section proposes a composite index called the “Value Creation Index”. The index is not intended to capture all aspects of value creation for a national oil company, but rather to provide a useful measure of the key aspects of value creation for

further analysis. Accordingly, the index is designed to measure short-term value creation by a national oil company. As such, considerations of long-term sustainability and long-term growth potential are not taken into account by the index (e.g., the ability of a national oil company to replace its reserves is measured, but the future flow of revenue from extracting existing reserves is not measured).

The proposed index focuses on performance indicators that directly contribute to value creation (i.e., output indicators). There are other interesting and essential aspects of good NOC performance, such as human resources, skills base, technological competence, and industrial partnerships. However, these elements support and enable value creation and are drivers of value creation, not indicators of value creation. Given that the goal is to better understand the relationships between value drivers and value creation, the value creation index should not overlap with these drivers [2]. Three categories theoretically represent NOC value creation: (1) operational performance, (2) financial performance, and (3) national mission performance. If each of these categories could be directly observed and measured, summing their values would provide the required measure of value creation. However, direct, conclusive measures are lacking. Therefore, they are estimated using proxy variables that capture the aspects of value creation that are believed to be important for each category. It is worth noting that the choice of proxy variables is affected by the availability of data from a sufficient number of national oil companies [2].

7.5. First Requirement: Proxy Metrics Used in the Value Creation Index

The following are the rationales for choosing the proxy metrics used for each component of the Value Creation Index: process performance variables, operational performance variables, financial performance variables, and national mission variables.

7.5.1. First: Operational Performance Variables

Production growth and reserve replacement rate, after each acquisition or disposal, are standard indicators of the effectiveness of the exploration department. Exploration success rate is an additional indicator of technical and geophysical expertise, and is actually partially captured by the reserve replacement rate. The use of renewable capacity is chosen to measure downstream performance, and capacity utilization growth is a proxy measure of the ability of the national oil company to meet local demand and add value. National oil companies that do not own refineries are not penalized in the data collection process. The ratios of production to total assets and employee output affect capital and labor efficiency, respectively. For the purpose of this indicator, production is defined as the sum of the production of the exploration division and refined products (where applicable), and is expressed in millions of barrels of oil.

7.5.2. Second: Financial Performance Variables

While this requirement examines the social value creation by NOCs, post-tax measures are inappropriate because taxes are not a loss of value as the government sees it. Moreover, taxes are not usually within the scope of the NOC due to its inability to transfer local operations. Similar considerations apply to the non-commercial expenses of the NOC. Ultimately, earnings before interest and dividends (and other production taxes), income taxes, non-commercial spending, and non-core business activities should allow for comparison of the financial performance and value creation of NOCs, regardless of how that value is transferred to the government, whether through taxes, social spending, or profits and dividends. Non-commercial and non-core activities are excluded from the financial performance measure, as they are included in the performance of the national mission. However, data on non-commercial and non-core activities and price subsidies are not regularly disclosed by NOCs. Without appropriate data, financial performance and national mission performance may be understated or overstated, as the case may be. The alternative measures chosen to measure resilience, financial performance, and solvency are revenues, total assets, and net cash flow from operations/capital expenditures, respectively. For the purpose of calculating this proxy indicator, net cash flow from

operations is defined as cash flow from operations minus the government portion of dividends. When using financial accounting data, the following should be considered:

- Accounting literature has shown that companies can manipulate their disclosures, even in advanced capital markets and jurisdictions.
- Differences in accounting standards between countries (and within countries over time) can reduce the comparability of data.
- Regardless of accounting standards, the detail and quality of the accounts and the audit process can vary significantly between NOCs.
- Definitions of individual financial items that are not in line with GAAP may vary between NOCs (e.g., capital expenditures or acquisitions may be reported based solely on additions to property, plant, and equipment, or a broader range of assets).
- There is a need to consider accounting issues specific to the oil sector, such as different approaches to treating exploration expenditures (i.e., “full cost” versus “successful effort”).

7.5.3. *Third: National Mission Performance Variables*

The following are often cited as objectives in NOC mission statements: promoting technology transfer, creating jobs, increasing local ownership and control, promoting economic growth and diversification, contributing to energy self-sufficiency, and securing supply [2]. Similar objectives appear in countries’ local content policies, and thus affect both NOCs and private oil companies. However, NOCs are often given a primary role in promoting local content policies. Nevertheless, they have little control over policy choices in their countries. Local content policies are therefore assumed to be inherently effective and efficient. Consequently, NOCs that implement them create value for society. Measuring the performance of NOCs in achieving their national mission objectives is difficult due to the lack of detailed reporting and the absence of standardized disclosure policies in this area. With this in mind, the following alternative measures are proposed for key aspects of national mission performance:

- The share of local content, measured as a percentage of expenditure on local goods and services relative to total expenditure on goods and services, reflects the contribution of the NOC to the local economy and technology transfer through the establishment of reverse linkages.
- The use of domestic output measures the contribution of the NOC to energy self-sufficiency and security of supply, as well as the processing of domestic value-added crude oil (either in factories or in other industries in the refining section). Local supply often comes at a financial cost, as exports will maximize revenues, but at the same time, it indicates strengthening of links to the local economy. The use of domestic output is measured as the ratio of the supply of petroleum products to the local market to total domestic consumption.
- The contribution of the national oil company to local employment and the creation of a skilled local workforce is measured by three proxy indicators:
- The share of nationals in the NOC workforce, measured as the ratio of local employees to the total NOC staff, is an indication of local skill levels. However, for some NOCs, the share of domestic workers may simply represent the NOC’s ability (and pressure) to employ nationals [3]. The NOC’s share of employment in its country: The salaries of NOC employees are often very high compared to those paid by other publicly or privately owned companies operating in different sectors of the economy. If the NOC accounts for a large share of employment in its country, the disposable income of NOC employees may have significant multiplier effects on the national economy.
- The growth of employment in the NOC relative to the growth of the country’s labor force measures the contribution of the NOC to national employment [2].
- The contribution of an NOC to economic growth and diversification in its country is measured by two proxy indicators:

- The share of the NOC's non-commercial spending in total spending indicates the importance of the company's social responsibility efforts, which can include malaria awareness campaigns, building schools and clinics, public roads, and similar projects. In countries with low capacity to manage public investment, the NOC is often seen as the most efficient administrative organization. As such, the NOC may be asked to manage projects that have little or no connection to the oil or gas sector. In effect, the NOC becomes a contractor on behalf of the government.
- The share of a national oil company's non-core net trading income in total net income indicates its contribution to the diversification of its country's economy. For the purposes of this indicator, non-core trading activities may include: airlines, banking, commercial storage, oil logistics, seismic data processing, as well as handling and shipping services. This is particularly important in countries with strong demand and limited production linkages, especially when the national oil company is able to perform efficiently in sectors with high multiplier effects.
- The contribution of the NOC to poverty reduction is measured by the ratio of subsidies to total revenues. While subsidizing oil and gas prices may not be an effective means of protecting the poor, the political choice here is beyond the control of the NOC. For this purpose, the benefits of the NOC must be transferred to society [2].

7.6. The Second Requirement: Value Creation Index

7.6.1. The First Section: Determination of VCI

For any NOC, the average of three sub-indices of value creation is calculated in detail annually: operational performance, financial performance, and national mission performance. These are then summed into a composite index. The first weights are assigned to each indicator within a specific sub-index. The overall index is then calculated by assigning weights to each sub-index according to equations (A) and (B) [2].

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

Where I is the composite index, N_j is a normalized variable, and j denotes the number of subcomponents in each subgroup i . It is natural to aggregate the different individual indices, which are measured on different units and have different ranges. The distance from the best performer to the worst performer is used, where the position is determined with respect to the annual sample maximum and minimum, and the index takes values between 0 (lagging) and 1 (leading) [11].

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

Where N_j is the measured value, X_j is the original value, and $X_j^{\min}$ and $X_j^{\max}$ are the minimum and maximum values of the annual sample data [7].

7.6.2. The second section: Value Drivers

The value creation model assumes that the historical, political, social, and economic environment of a country – the country context – largely determines the objectives of petroleum sector policy. As the resource owner, the state's administrative capacity and effectiveness, the quality of public policy, accountability, and the level of qualitative knowledge of the sector influence the state's choices regarding sector regulation and governance arrangements. The state can decide how, at what pace, and by whom it should be developed, thereby determining the role of the market and the level of direct intervention by the NOC. The state's goals and objectives, sector policy, and regulation influence the strategy and corporate governance arrangements of the NOC. Finally, the state's resource endowment, distance from the market, and the quality of infrastructure – i.e., geology and geography – are expected

to influence the state's objectives and policy choices, as well as the level of competition and performance of market participants (both NOCs and private oil companies). Value drivers can be classified into five categories: (1) geology, (2) country context, (3) petroleum sector organization and management, (4) NOC strategy and behavior, and (5) NOC governance. Ideally, there is a single measure for each of the theoretically identified value drivers. Since such measures do not exist, they are estimated using proxy variables that capture aspects believed to be important for each category [2]. Table 1 lists the overall value drivers and the proxy variables used to measure them.

Table 1.

Total value drivers and proxy variables used to measure them.

(Driver)	(Components)
1- Geology	Resource endowment (millions of barrels of oil)
2- Country context	- World Bank indicators on: voting and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. - Hydrocarbon revenues as a percentage of government revenues. - Hydrocarbon revenues as a percentage of GDP. - Membership in the World Trade Organization. - Membership in the Organization of the Petroleum Exporting Countries (OPEC). - Net oil exports as a percentage of GDP. - Government budget surplus as a percentage of GDP. - Existence of stabilization mechanisms, such as oil funds.
3- Organization and management of the oil sector	- Publicly disclosed national policy addressing hydrocarbon sector issues. - Clear state objectives with administrative separation. - Share of oil and gas production by NOCs. - Share of refined products by NOCs. - Specific, clear, announced, prioritized targets, generally measured by the NOC.
4- National Oil Company Strategy and Behavior	- NOC capital expenditure as a percentage of total capital expenditure. - NOC capital re-spending as a percentage of total capital expenditure. - NOC exploration division shares as a percentage of total NOC production. - NOC international revenues as a percentage of total NOC revenues. - Joint ventures and other companies.
5- National Oil Company Governance	- Percentage of non-governmental ownership of the NOC. - Percentage of members of the board of directors of the independent NOC. - Appointing authority of the Chairman of the Board. - Independence of the capital operations and budget of the NOC. - Financial transparency of the NOC. - Transparency of the upstream reserves of the NOC.

Source: Tordo et al. [2]

To create a driver variable, each of its baseline agent variables is transformed into a normal variable, and the driver variable is the result of the average of the normalized agent variables [2].

7.6.3. The Third Section: Selection of Proxy Variables

A. Geology: The question behind this requirement is whether the operations and performance of NOCs vary with a country's resources. Some NOCs are based in countries that are net oil and gas exporters, while others primarily serve the energy security of their home countries by reducing import requirements. In many cases, domestic production does not meet consumption, even though the available resources may be large. In other cases, production levels are much higher than domestic consumption needs, either because of exceptional endowments or because of the level of local economic development. The abundance of petroleum resources may also affect a government's depletion policy, the commercial conditions for exploitation, and the NOC's resource extraction strategy. The size of a country's reserve base is used as a proxy for future prospects and the availability of relevant infrastructure for the sector [3].

B. Country Context: The country context engine consists of 13 proxy variables, which aim to capture the institutional and economic environment in the home country of the NOC. Stable, predictable, and effective public policies are expected to contribute positively to value creation by NOCs and POCs. It is also expected that the lower the socio-economic development indicators, the higher the importance of the national mission. The World Bank's Worldwide Governance Indicators are used to measure a country's political stability, institutional strength, regulatory quality, control of corruption, democracy and accountability, and the rule of law. While there are many possible measures of these variables, the use of composite indicators is widely recognized. National dependence on the oil sector is assumed to influence the government's macro-level focus, sectoral policies, and the goals and objectives that are given to the NOC. Four alternative measures of dependence are used: oil revenues as a percentage of total government revenues, oil revenues as a percentage of GDP, net oil exports as a percentage of GDP, and government budget surplus or deficit as a percentage of GDP [3]. Three dummy variables: WTO membership, OPEC membership, and the presence of revenue stabilization mechanisms, aim to capture a country's trade openness, the presence of constraints on production levels, and the quality of fiscal policy, respectively [2].

C- Regulation and Governance of the Oil Sector: The state, as a "resource owner," has a wide range of choices regarding the implicit or explicit rules and procedures governing the exploitation of the country's oil resources, including the sector policy objective, the role of market participants, the distribution of institutional responsibilities, and the terms of exploitation. The state's fiscal regime, regulatory compliance, regulatory uncertainty, and the quality of environmental regulations all influence private oil companies' investment decisions. A national oil company (NOC) has no choice but to invest in its home country. Thus, its ability to create value depends in part on how favorable its country's conditions are for investment. Transparency regarding the responsibilities, tasks, and institutional objectives of the NOC will ultimately improve the efficiency of the NOC. This is particularly true when the government seeks to achieve multiple policy objectives through the NOC. Knowing the relative importance of these objectives will allow the NOC to develop appropriate strategies, reduce administrative costs, and mitigate the potential for risk. Three variables are used to assess a country's willingness to allow an NOC to operate within a transparent public policy framework:

1. The existence of a publicly disclosed national policy to address hydrocarbon sector issues.
2. The existence of clear country-specific objectives and administrative separation.
3. The existence of clear, announced, and measurable objectives for the NOC.

The presence of private oil companies or national oil companies in other countries is assumed to affect the performance of the local NOC by enhancing efficiency and taking risks in exploration and development. Two proxy variables that represent the openness of the oil production and refining markets in the country of the NOC are:

- The percentage of oil and gas production owned by the NOC.
- The percentage of refined products owned by the NOC [2].

D. NOC Strategy and Behavior: Like other oil companies, NOCs must make capital investments to maintain future production capacity. A proxy for the type of strategic behavior that is expected to create value is the NOC's capital expenditures as a percentage of total capital expenditures (exploration is separate from capital repatriation). NOCs that are net importers of petroleum products may be more vulnerable to changes in economic cycles, especially when they bear the burden of subsidizing domestic consumption prices. One measure of NOC self-sufficiency is the production of the exploration division's shares as a percentage of total production, which measures NOC self-sufficiency and is also an indicator of the country's security of supply, often part of the NOC's national mission. The ratio of international revenues to total revenues reflects the NOC's ability to create value through access to international markets. Another proxy for international engagement is the existence of joint ventures and other partnerships, which embody the NOC's access to international best practices and technology [7].

E. Governance of National Oil Companies: The governance of the petroleum sector in general and the national company in particular is of high importance. Countries that have efficiently adopted the principles of good governance in their public institutions are better able to manage natural resource revenues and employ them in the economy effectively, enabling them to achieve high rates of economic growth. Additionally, such governance helps to undermine rentier tendencies and combat corruption [1]. The governance structure of the national oil company affects the strategic options available to the national oil company and thus influences its ability to create value. For example, technology, competition, and management techniques in the oil industry are constantly evolving. Successful companies are those that can anticipate changes and quickly adjust their strategies accordingly, which requires making flexible decisions that may not always align with the realities of a state-owned company. Partially privatized NOCs are generally considered more capable of creating value because they are subject to market scrutiny and are less susceptible to political influence. The percentage of non-state ownership, along with the ownership structure and organization, serves as a measure of this dimension. Independent boards are also believed to be more effective in shielding the NOC from political interference, regardless of whether the NOC is partially privatized. This allows the NOC to focus on achieving its objectives. Proxies for board independence include the percentage of independent board members with the authority to appoint the NOC's CEO. Various arrangements exist for managing state resources: some NOCs are granted full rights to oil rights, others partial rights, and some non-exclusive rights to develop and exploit resources directly or in partnership with third parties. These arrangements influence the NOC's capital structure, mandate, and organizational and financial independence. The ability of an NOC to finance its operations is crucial for value creation. If an NOC is granted too little financial autonomy from the state, it may hinder efficiency and increase operational costs. Conversely, excessive financial autonomy could disincentivize efficiency improvements. Financial transparency and periodic audits enable the state to protect its interests without overly restricting the NOC's autonomy. The NOC's capital and balance sheet autonomy, financial transparency, and transparency of initial reserve values are used as indicators of autonomy and transparency [2]

7.7. *The Third Requirement: Factors That Affect the Role of National Oil Companies in Creating Value*

There are internal and external factors that affect the role of the national oil company in creating value. External factors represent the operational context of the national oil company, while internal factors involve how the company responds to its operating environment. It is worth noting that, in many cases, the distinction between external and internal factors is blurred due to the fact that the national oil company is a product of its operating environment [3]. Although it is possible to mention the factors that would create value in the hydrocarbon sector, it is impossible to estimate their individual adequacy and importance on an objective basis [12]. The following are the factors that affect the role of national oil companies in creating value:

A- Internal factors: These are the following:

1- Objectives: The national oil company is the only player in the economic sector, especially the hydrocarbon sector. Other players include the state in all its various manifestations, including politicians, bureaucrats, regulatory bodies, and other stakeholders. Each player has their own goals, whether official or unofficial, explicit or implicit. Thus, the goals of the national oil company and its "national message" appear through the interaction of all players [12].

2- Decision-making: The issue of decision-making is related to corporate governance. It is important to understand how the decision-making process creates an incentive system within which managers operate. The actual decision-making process varies depending on the formal and informal structure of the NOC. The formal structure relates to the finer details of ownership, and it is essential that the NOC has an independent board of directors appointed based on competence and professional experience. The informal system relates to the political context in which the NOC operates and the extent to which powerful individuals within the system influence decisions. The effectiveness of the

decision-making process in creating value is strongly influenced by the nature of the budget system, through which the NOC's operations are determined, and the levels of discretionary authority and limits on signing off on procurement and project expenditures. Disclosure and transparency in the decision-making process are important factors in laying the foundation for accountability within the NOC on the one hand, and between that company and other stakeholders in this sector on the other hand [3].

3- Capabilities: Capabilities relate to the quality and nature of management work, the company culture and technical personnel, and the extent to which they are motivated by the incentive system created by the decision-making process. This, in turn, depends on the quality of potential managerial and technical income, as well as the NOC's ability and willingness to invest in training and professional development. Competence and performance are at the forefront of workforce recruitment and development [3].

B- External factors: These are the following:

1. Political: Political ideology has a decisive contribution to the nature and role of the national oil company. During the fifties, sixties, and seventies of the twentieth century, acceptance of state intervention in the economy was the prevailing ideology in the context of market failure, Keynesian macroeconomic policy, and an example of this is Soviet planning, which legitimized the establishment of many national oil companies. Then, in the eighties and nineties of the same century, the "Washington Consensus" and the accompanying rejection of government intervention in the allocation of resources made national oil companies unpopular and, in many cases, encouraged their privatization. The political system in which national oil companies operate also has an impact on the classification of these companies. The structure of the oil sector is also a very important factor in the role and performance of national oil companies. This structure is often a product of the prevailing ideology and political system. The structure also determines the governance of the public sector within the country, and international obligations can play an important role in constraining the behavior of the national oil company. Thus, OPEC membership may limit production levels, while WTO membership may influence domestic pricing policies.

2. Economic: The level of dependence on oil affects the economy, its financial sustainability, and immediate revenue needs in the role of the NOC. Depletion policy and national mission, which relate to state choices, are also important factors, even if NOCs play only an advisory role. The state's positions and energy policy on domestic energy issues and self-sufficiency also play a role in what the NOC can do [3].

3. Technology: General operating conditions affect the role and effectiveness of the NOC, starting from the legal environment that limits the actions of the NOC to the availability and quality of production factors that restrict its performance. The competitive environment also affects the role of the NOC. In the first stage, the "upstream stage," the legal environment can play a major role in the nature of the NOCs' access to reserves. It is worth noting here that the monopoly of the NOCs on reserves prevents their efficiency. In many countries, competition in the final consumption stage, in terms of marketing and distribution, has affected the role of the NOC [10].

7.8. Fourth Requirement: Practical Application of the Value Creation Index for National Oil Companies

In this section, an applied example of the theoretical topics addressed in this chapter was presented, especially regarding value creation for national oil companies, for the purpose of guidance and the possibility of benefiting from it in application. The World Bank [13] measured the Value Creation Index (VCI) of national oil companies through the experience of a selected group of these companies, with the aim of extracting lessons and applying them on a wider scale, using data from 20 national oil companies during the period 2004–2008. Three of these are from OPEC (Algeria's Sonatrach, Venezuela's PDVSA, and Qatar Petroleum) and two from Russia (Gazprom and Rosneft), in addition to well-known national oil companies such as Petrobras, Petronas, Statoil, Pemex, Italy's Eni, and India's ONGC. The index is based on identifying three objectives for national companies: Preserving oil and

gas wealth by maximizing the optimal rate of extraction and production under the state-defined depletion policy, supporting national development by maximizing financial, forward, and backward linkages, and supporting their countries' policies abroad. The index identifies three frameworks for the performance of national oil companies: operational, financial, and contribution to national development, and five drivers of value creation: Geology & Geography (location), country context (such as the share of the oil sector in output and exports, public finances, OPEC membership, etc.), oil sector governance (through licensing, concessions, oversight, and target setting), NOC strategy and behavior, and corporate governance and structure. The study assumed that the five categories of value creation drivers contribute randomly to explaining the Value Creation Index (VCI). The main independent variable is (Value Creation Drivers), and the dependent variable is (Value Creation Index). This model was written as follows:

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

Where y_i is the value creation index, x_i is the set of value creation drivers, and β_i is a coefficient for each value creation index. So the equation becomes as follows:

$$y_i = \alpha + \beta_1 \text{geology} + \beta_2 \text{state} + \beta_3 \text{petsec} + \beta_4 \text{nocsb} + \beta_5 \text{nocgov} + \varepsilon_i$$

The equation came as follows:

$$y_i = 0.953 - 2.511 (\text{geology}) + 0.221 (\text{state}) - 0.446 (\text{petsec}) - 0.070 (\text{nocsb}) + 0.277 (\text{nocgov})$$

Using proxy approaches for each component of value creation drivers, the study concluded that the average value creation index for the twenty national oil companies was 0.42 (out of one) over the period, with a range of 0.2 to 0.68 for the lowest and highest. Companies fully owned by their governments have greater commitments to the development of their countries and more demands from their governments, and therefore fewer drivers for increasing efficiency than companies with partial government ownership. Countries with high oil and gas reserves are also more stringent in terms of the level of state ownership or the degree of opening up the field to foreign investment at the upstream stage. From studying the influences on the value creation index (VCI) for twelve of the aforementioned companies, the study noted that the value of the index fluctuated over the period for each of the companies under study. Accordingly, the following relationships were concluded from the standard analysis of the companies' data.

- The amount of resources a company controls is important, but what is more important is how those resources are managed.
- The political and institutional status of the country is more important than the company's activity in creating value from the wealth in the ground.
- The company's internal governance, decision-making mechanisms, financial independence, commercial orientation, and organizational structure are more important for creating value than its ownership structure.
- The institutional arrangements for governance in national oil companies are generally not different from those in government-owned companies in general or from international companies, although the procedures, systems, and structures (including the board of directors) differ between them, especially in terms of levels of transparency and background.
- Restricting investment in the sector, especially in the production phase of the national company, if organized, can support its ability to create value, although it affects efficiency over time by restricting competition.
- The achievement of national goals by companies, whether in technology localization, increasing local content, industrial development, or employment, does not affect their ability to create value.
- Strengthening forward and backward links to and from the company contributes to its ability to create value, depending on the policies adopted in this regard and how they are implemented.

- Sector reforms contribute to the company's ability to create value if they are characterized by a predictable and evolving pattern that is consistent with long-term goals and not as reactions to short-term conditions such as declining revenues or investments.
- The technical and administrative capabilities of the national oil company, in addition to its culture, legacy, and regulations, as well as the degree of government intervention in the company's decision-making mechanisms, are important determinants of its ability to create value. This independence is more closely linked to the role of oil in the country's economy and not necessarily to the degree of independence of the board members, whose independence contributes to enhancing transparency.

The drawbacks of these conclusions are that they are based on short-term data (five years) and do not include major national oil companies in the Middle East (such as Saudi Aramco, Kuwait Oil Company, UAE ADNOC, and Iranian National Oil Company), and that the index includes approaches for each of the drivers with weights that appear to be equal for each of them. In fact, some of its conclusions may be biased. For example, Mexico's Pemex is the only company out of the twenty that enjoys a monopoly position in its country, which makes the general conclusion that the national company's investment in the sector negatively affects efficiency over time controversial. The opposite may be true, i.e., increasing efficiency over time through learning and interaction with the global industry, as well as the development goals of the national oil company, such as developing the local workforce in the industry, local content, and localizing technology, may reduce its costs over time and thus increase its efficiency.

8. Results

The research reached a number of points, the most important of which are the following:

- There are two categories of variables that affect value creation: (a) variables that describe the initial conditions and context (economic situation, political history, ideology, international commitments, and natural resource endowment) and (b) variables that describe human and organizational agency (the objectives of the national oil company, sector and corporate governance options, and the strategy of the national oil company). Together, the variables of context and agency constitute drivers of value creation: multidimensional variables that affect value creation by the national oil company. These variables can be grouped into five categories: country context, sectoral organization and governance, national oil company strategy, national oil company governance, and geology.
- The historical, political, social, and economic environment of the country, and the country context, largely determine the objectives of the oil sector policy. The organization of the oil sector and governance arrangements in the country are also affected by the administrative capacity, effectiveness, and governance in the country. The ability of a national oil company to implement its tasks and objectives is determined by its contribution to value creation.
- State resources, distance from the market, and quality of infrastructure influence the state's objectives and policy choices, as well as the level of competition and performance of market participants.
- The performance of a national oil company is measured by reference to its objective function, which in turn depends on the policy objectives of shareholders. Although the mission and objectives vary greatly among national oil companies, they often include one or more of the following: (a) protecting the national hydrocarbon wealth, (b) promoting economic development, and (c) promoting the country's political interests abroad.
- A composite indicator, the "Value Creation Index," is proposed to measure the performance of national oil companies. The index, which measures key aspects of operational, financial, and national performance in the short term, is not intended to capture all aspects of value creation of a

national oil company, but it provides a simple measure to monitor the performance of a national oil company over time and facilitates comparison between national oil companies.

9. Future Research Avenues

In order for national oil companies to create value, develop their performance, and achieve national goals, they must follow procedures and strategies, the most important of which are the following:

- A clear definition of the company's commercial and non-commercial objectives and the priority of the first objective when they conflict.
- Developing an appropriate model for the company to retain revenues.
- Obtaining external financing by offering some of the company's shares in the financial market or issuing external debt instruments if necessary.
- A precise definition of the structures and role of the company's owners from the government.
- The independence and professionalism of the board (or boards) of directors, and enabling them to perform their duties.
- Investing in the company's administrative capabilities and potential.
- Maximizing public disclosure of the company's basic data.
- Finding and publishing independent financial reviews.
- Choosing an efficient level of legislative oversight.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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