

Reserve Depletion, Depreciation of Capitalized Petroleum Assets, and Economic Value: An Illustrative Production-Sharing Contract Model Inspired by the Algerian Framework (20-Year Contractual Horizon)

Salima DERROUIS

LAREGE Laboratory, University of
Oran 2 Mohamed Ben Ahmed
Algeria
derrouissalima@gmail.com

Chérif LAHLOU

LAREGE Laboratory, University of
Oran 2 Mohamed Ben Ahmed
Algeria
cherif.lahlou@gmail.com

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Abstract:

This article develops a systemic analysis of petroleum reserve depletion, CAPEX capitalization, depreciation of petroleum assets, and economic value. Financial credibility depends on consistency among reserves, CAPEX, technical depletion, recoverable amount, taxation, cost recovery, and rent sharing. The qualitative, analytical, and illustrative approach combines a depletion-CAPEX-governance matrix, a 0-3 ordinal scale, and a constructed production-sharing contract inspired by the Algerian framework. SONATRACH is treated as the national non-operating contracting party, assumed to exercise a partial financing option, while the operator-investor conducts operations; the financing split is not quantified separately. The analysis connects past CAPEX, current *Cost Oil* and *Profit Oil*, and future economic value. Depletion information supports accounting credibility, contractual control, and informational sovereignty. Results derive from a simplified 20-year model; they do not represent an actual agreement or an exhaustive field study and do not support statistical generalization.

Key Words: depreciation; CAPEX; depletion; governance; petroleum rent.

JEL Classification: Q35, L71, Q32, M41

* Corresponding author: DERROUIS Salima (*derrouissalima@gmail.com*).

Introduction

Upstream petroleum projects often absorb capital for years before production begins and cost recovery becomes possible. During that interval, geological knowledge changes and reserve estimates are revised. The accounting treatment of CAPEX cannot be separated from this technical history. Exploration, evaluation, and development expenditure is capitalized according to its nature and the entity's accounting policy, then depreciated once the relevant asset is available for production. Under units-of-production depreciation, each revision of reserves changes the pace of expense recognition: a larger denominator defers part of the charge, while a lower estimate brings it forward.

IFRS 6 governs exploration and evaluation expenditure, while IAS 36 applies when the asset's recoverability must be assessed. These two standards do not,

however, establish a single petroleum accounting model. The depreciable amount remains linked to the nature of the expenditure, the project phase to which it relates, and its expected capacity to support future production (IASB, 2004a, 2004b; Jennings et al., 2000; Yaiche, 2004; Orellana Fuentes, 2014).

The study traces depletion information across three domains that serve different purposes. Standardized financial accounts record CAPEX, depreciation, net book value, provisions, and impairment losses. Analytical and contractual monitoring focuses on the scope and control of costs and on the *Cost Oil* and *Profit Oil* mechanisms. Forward-looking evaluation, in turn, uses **NPV**, **IRR**, **DPP**, and price assumptions. This comparison links past expenditure, its recovery during the agreement, and the cash flows still expected.

The research question is as follows: In the upstream petroleum industry, how can depletion information be used to connect reserves, CAPEX, depreciation, economic value, taxation, and rent sharing?

The hypothesis does not rank straight-line depreciation against units-of-production depreciation. It concerns the reliability of the links among reserve estimates, capitalization policy, depreciable amount, depreciation pattern, recoverable amount, and contractual cost recovery. The accounting representation of the asset is credible only if those elements can be reconciled. The same continuity is needed to govern petroleum rent.

The article brings two readings together. Contract analysis identifies the rights, cost-recovery rules, audit provisions, taxes, and sharing arrangements established by the petroleum agreement. Systems analysis then asks whether the information used in these mechanisms remains consistent as it moves from one register to another (Johnston, 1994; Bindemann, 1999; Daniel et al., 2010; von Bertalanffy, 1968; Le Moigne, 1990).

This is a qualitative and analytical study supported by an illustration. It neither proposes a new depreciation method nor estimates a statistical causal effect. No actual agreement is examined. The numerical case covers a constructed 20-year PSC whose institutional setting is drawn from the Algerian framework. Within this case, SONATRACH is the national contracting party but not the operator; it is assumed to have exercised an option to help finance upstream operations.

In the constructed case, it therefore acts as a contractual co-financier without conducting day-to-day operations. Operational responsibility remains with the operator-investor, which acts on behalf of all parties in accordance with the functions defined in the operating agreement. SONATRACH's financial participation is assumed to entail rights to negotiate, review, approve, and control contractual accounting procedures, cost eligibility and recovery, work programs, and the technical choices included in approved plans. It does not, however, confer unilateral selection authority: the operator proposes and implements technical methods in accordance with the agreement, joint decisions, and the requirements of the competent authorities, while general accounting methods remain subject to the applicable legislation and standards. The precise financing, governance, and

decision-making arrangements are not quantified separately and do not reproduce a published clause or a statutory rate. The results are therefore analytical and non-generalizable. The approach uses a depletion-CAPEX-governance matrix, a 0-3 qualitative ordinal scale, and a fully constructed case (National Agency for the Valorization of Hydrocarbon Resources [ALNAFT], n.d.-a; People's Democratic Republic of Algeria, 2019, Arts. 71, 84, and 85).

The contribution is threefold. Conceptually, the article separates the physical exhaustion of reserves, the accounting allocation of a capitalized cost, and the recognition of an impairment loss. Analytically, it connects the scope of capitalization to the depreciation pattern. Institutionally, it treats depletion as information capable of supporting the credibility of the accounts, control of the agreement, and national stewardship of rent-related data.

The article is organized into six sections. The first presents the theoretical and systemic framework of the depletion-CAPEX-governance articulation. The second explains the methodology and the constructed analytical case. The third examines reserves, CAPEX, depreciation, and economic value. The fourth connects the petroleum agreement, taxation, and rent governance. The fifth presents the aggregate results of the constructed PSC case. The sixth discusses the contributions, limitations, and implications.

I. Theoretical and Systemic Framework of the Depletion-CAPEX-Governance Articulation

1. Theoretical Grounding of the Analysis

These theoretical perspectives are not merely juxtaposed; each addresses a specific question raised by the model. Accounting theory concerning asset recognition clarifies the conditions under which CAPEX can represent future economic benefits (IASB, 2004a, 2004b; Jennings et al., 2000; Yaiche, 2004; Orellana Fuentes, 2014).

Agency theory helps examine the distribution of information among the state, the operator, partners, auditors, and the tax administration (Jensen & Meckling, 1976). Transaction cost economics explains the usefulness of clauses that define cost eligibility and control (Coase, 1937; Williamson, 1985). Signaling theory clarifies how verifiable reserve and flow data can support confidence (Spence, 1973).

Systems theory provides the final lens. It is used here to follow feedback between technical records, accounts, fiscal calculations, contractual execution, and governance decisions (von Bertalanffy, 1968; Le Moigne, 1990).

2. Theoretical Foundations of the Depletion-CAPEX-Governance Articulation

Table 1: “Theoretical Foundations of the Depletion-CAPEX-Governance Articulation”

Item	Function in the Article	Analytical Field	Main References
Recoverable reserves	Technical basis of depletion	Reserve modeling and estimation	Lepez (2002); Orellana Fuentes (2014); SEC Rule 4-10
Production profile	Pace of extraction and reserve consumption	Technical depletion and units-of-production method	Lepez (2002); Jennings et al. (2000); Anighoro (2020)
Capitalized CAPEX	Accounting basis for depreciation	Petroleum accounting and preproduction costs	IASB (2003a, 2004b); FASB (1977); Yaiche (2004); PwC (2017)
Capitalization methods	Formation of the depreciable base	<i>Full Cost, Area-of-interest, Successful Efforts, Full Expensing</i>	FASB (1977); SEC Rule 4-10; Orellana Fuentes (2014); Blum et al. (2013)
Depreciation (straight-line / units of production)	Allocation of the capitalized base	Link between accounting and depletion	IASB (2003a); Jennings et al. (2000); PwC (2017)
Recoverable amount and fair value	Economic sustainability test	Impairment and economic information	IASB (2004a, 2011b); Orellana Fuentes (2014)
<i>Reserve Recognition Accounting</i>	Economic valuation of proved reserves	U.S. experience and supplementary information	FASB (1982); Yaiche (2004); Orellana Fuentes (2014)
NPV, IRR, and DPP	Economic evaluation of the project	Discounting, profitability, and economic payback	Johnston (1994); Daniel et al. (2010)
Petroleum agreement	Cost recovery and rent sharing	Contract theory and agreement governance	Johnston (1994); Bindemann (1999); Daniel et al. (2010); ALNAFT (n.d.-a); People's Democratic Republic of Algeria (2019)
Informational sovereignty	Public oversight of rent and auditability	Extractive governance and informational control	Al-Kasim (2006); Tordo et al. (2011); Nakhle (2017)

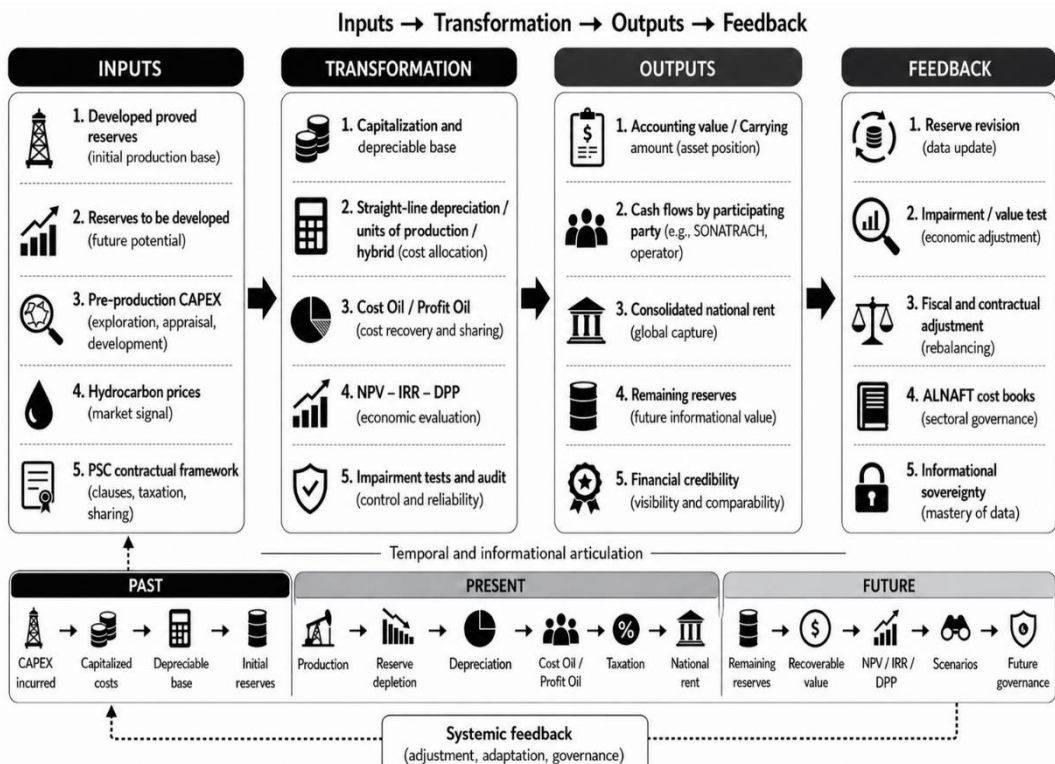
Source: Author's synthesis based on the cited literature.

3. Systemic Logic of the Depletion-CAPEX-Governance Articulation

The starting point is that none of the relevant data can be read on its own. A reserve estimate acquires financial meaning only when it is set beside capitalized CAPEX, planned production, fiscal and contractual rules, and the chosen sharing arrangement. The model follows this circulation of information. It receives reserve, cost, price, method, and clause data; depletion, depreciation, impairment tests, discounting, and taxation act on those data. The resulting carrying amounts, charges, recoverable costs, *Cost Oil*, *Profit Oil*, and rent flows feed later decisions. They may prompt a reserve revision, an impairment, additional audit work, or a change in contractual or fiscal provisions.

This perspective shifts the focus of the analysis. The issue is no longer to decide abstractly whether straight-line depreciation is preferable to the units-of-production method, but to determine whether the selected pattern remains consistent with reserves, capitalized costs, expected production, and the recoverable amount. The units-of-production method follows reservoir consumption more directly. Straight-line depreciation instead applies a time-based allocation convention to historical cost; its relevance therefore depends on the actual production profile rather than on any inherent superiority (Jennings et al., 2000; Yaiche, 2004).

Figure 1: “Systemic Architecture of the Depletion-CAPEX-Governance Articulation”



Source: Author's proposed representation.

II. Methodology and Constructed Analytical Case

1. Qualitative, Analytical, and Illustrative Nature of the Approach

The purpose is not to identify a statistical correlation. Rather, the analysis follows the changing status of the same item of information: technical when it describes reserves or production, accounting when it affects the asset, contractual when it supports cost recovery, and fiscal when it enters the calculation of rent. The depletion-CAPEX-governance matrix identifies informational linkages as well as possible discontinuities between these transitions. The case remains qualitative and illustrative.

Table 2: “Depletion-CAPEX-Governance Methodological Matrix”

Dimension	Observed Item	Effect Examined
Technical	Recoverable reserves, production profile	Pace of depletion
Accounting	Capitalized CAPEX, depreciable base, depreciation method	Depreciation expense and carrying amount
Economic	Prices, future cash flows, recoverable amount, NPV, IRR, DPP	Economic value, profitability, and impairment
Contractual	<i>Cost Oil, Profit Oil, cost recovery</i>	Production sharing and contractual cost recovery
Fiscal	Royalties, taxes, taxable income	Rent capture and distribution
Governance	Audit, reporting, reserve and clause revisions	Financial credibility and informational sovereignty

Source: Matrix constructed by the author.

The 0-3 scale serves only as a transparent coding device for the quality of informational linkages. Its four scores distinguish absent, weak, partial, and strong articulation. They are not assigned to the numerical case, and the study derives neither a performance index nor a statistical result from the scale.

Table 3: “Qualitative Scale for Assessing Informational Articulation”

Score	Level	Meaning
0	Broken articulation	Depletion, depreciation, economic value, and rent sharing are disconnected.
1	Weak articulation	The mechanisms exist, but traceability, audit, or consistency remains limited.
2	Partial articulation	The system operates, but some dimensions remain incomplete or insufficiently coordinated.
3	Structured articulation	Reserves, CAPEX, depreciation, taxation, and rent are consistent, traceable, and auditable.

Source: Developed by the author based on Likert (1932), Miles et al. (2014), and Yin (2018).

2. Description of the Constructed Analytical Case

The case is a constructed analytical PSC inspired by the Algerian framework. For calculation purposes only, it assumes a 60/40 economic allocation of *Profit Oil* between the operator-investor and SONATRACH, aggregate recoverable CAPEX of USD 420 million, a 10% royalty, an annual *Cost Oil* ceiling equal to 30% of net production value, and a simplified 30% tax on the operator-investor's gross *Profit Oil* share. The 60/40 split is a distributive assumption, not a statutory participation rate or a financing share. At the same time, SONATRACH is assumed to exercise a partial financing option provided for in the Algerian PSC architecture. In the absence of contractual data, however, the model does not allocate either initial CAPEX or *Cost Oil* between the parties (ALNAFT, n.d.-a).

Selecting a PSC with non-operating national participation brings together the technical, accounting, contractual, fiscal, and governance dimensions. Under the framework described by ALNAFT, the foreign contracting party generally finances upstream operations, while the national company has the option to participate in financing; the operating agreement specifies the functions of the operator acting on behalf of the parties (ALNAFT, n.d.-a). The term “passive participation” is therefore used here as an analytical category: SONATRACH retains contractual and information rights without conducting day-to-day operations. The case thus makes the following chain observable: reserves → depletion → CAPEX → depreciation → *Cost Oil* → *Profit Oil* → taxation → rent → governance.

Table 4: “Comparative Rationale for Selecting a PSC with Non-Operating Participation”

Alternative Arrangement	Limitation for the Article's Objective	Relevance of a PSC with Non-Operating Participation
Traditional concession	The link among recoverable costs, <i>Cost Oil</i> , and <i>Profit Oil</i> is less visible	Makes cost recovery and production sharing observable
Service contract	Remuneration is fee-based and less directly related to rent sharing	Connects investment, production, taxation, and rent
Jointly operated joint venture	Shared decision-making reduces the information asymmetry examined	Non-operating participation highlights the non-operator's need for control
PSC without exercise of the national financing option	The national company's direct financial contribution is less visible	Assuming partial exercise of the option makes the non-operator's information needs visible
Purely accounting case without an agreement	Shows depreciation but not cost recovery or sharing	Connects depreciation, <i>Cost Oil</i> , <i>Profit Oil</i> , taxation, and governance

Source: Comparison proposed by the author.

3. Analytical Dimensions

Reading the matrix begins with estimated reserves and production volumes. It then traces how these figures enter CAPEX or expense records and how they relate to the recoverable amount, NPV, IRR, and DPP. The contractual and fiscal reading addresses cost eligibility, *Cost Oil*, *Profit Oil*, and levies. The final step concerns governance: who is responsible, what can be audited, whether the trail is traceable, and who may access the information.

Time is not treated as a separate backdrop. Capitalized CAPEX records earlier decisions; production, recovery, and sharing belong to the period in which the PSC is performed; remaining reserves and discounted cash flows concern the economic possibilities that are still open. Depletion links these moments, although its meaning differs across the accounting and contractual registers.

Table 5: “Three Accounting Registers and Three Time Horizons of the Analysis”

Accounting Register	Time Horizon	Items Concerned	Function	Contribution to Governance
Financial / standardized	Past and present accounting	Capitalized CAPEX, depreciation, NBV, provisions, impairment, recoverable amount	Recognize, measure, and present assets, expenses, and obligations	Credibility of financial statements, comparability, and auditability
Analytical, management, and contractual	Current operational and contractual	Costs, <i>Full Cost / Successful Efforts</i> , recoverable costs, <i>Cost Oil</i> , <i>Profit Oil</i>	Classify, monitor, and control costs and their recovery	Cost control, oversight of <i>Cost Oil</i> , and reduced information asymmetry
Prospective / economic	Future economic outlook	Future cash flows, remaining reserves, NPV, IRR, DPP , price scenarios	Anticipate value, profitability, and sustainability	Decision-making, renegotiation, robustness, and forward-looking informational sovereignty

Source: Constructed by the author.

One technical datum can thus serve three different purposes: asset measurement, verification of a contractual cost, and revision of an expected value. The method does not merge these uses. It checks whether they can be reconciled from the first reserve estimate to the final allocation of rent.

4. Key Formulas and Their Analytical Roles

For the constructed case, the contractual calculations are written out so that the passage from technical data to governance information can be checked. Table 6 records each formula and explains why it is used.

Table 6: “Dimensions, Formulas, and Analytical Purposes of the Constructed Case”

Dimension	Key Formula	Analytical Purpose
Gross production value	Annual production $\times$ Annual price	Measure annual production value
Royalty	Gross production value $\times$ 10%	Measure the state's priority take
Net production value	Gross production value – Royalty	Determine the basis of <i>Cost Oil</i> and <i>Profit Oil</i>
Cost Oil ceiling	Net production value $\times$ 30%	Measure the maximum annual recovery capacity
CAPEX-only Cost Oil	min(annual ceiling, unrecovered CAPEX balance)	Track effective recovery of initial CAPEX
Profit Oil	Net production value – <i>Cost Oil</i>	Determine the contractual rent available for sharing
Illustrative gross Profit Oil share of the operator-investor	<i>Profit Oil</i> $\times$ 60% (assumption)	Measure the operator-investor's gross contractual share
Illustrative tax on the operator-investor's gross Profit Oil share	Gross <i>Profit Oil</i> share of the operator-investor $\times$ 30%	Measure additional tax revenue
After-tax Profit Oil share of the operator-investor—simplified illustration	Illustrative gross <i>Profit Oil</i> share of the operator-investor – Illustrative tax	Measure the simplified contractual share after tax, without deducting unallocated CAPEX/OPEX
Illustrative national economic share	<i>Profit Oil</i> $\times$ 40% (assumption)	Measure the assumed national economic share
Illustrative consolidated national rent	Royalty + Taxation + National economic share	Measure total national take

Source: Formalization by the author.

Volumes, prices, reserves, and CAPEX enter the formulas as technical or monetary inputs. The resulting figures belong to different registers—accounting, fiscal, contractual, or governance—and should not be treated as a single performance measure. Their purpose here is narrower: to show where depletion enters depreciation, cost recovery, and, eventually, rent governance.

Table 7: “Accounting and Economic Formulas Used”

Accounting Item	Formula	Function
Straight-line depreciation	Depreciable amount / Depreciation period	Allocate the depreciable amount on a time basis
Units-of-production depreciation	Depreciable amount $\times$ Annual production / Recoverable reserves	Connect depreciation to the pace of depletion
NBV	Depreciable amount – Accumulated depreciation	Measure the remaining net book value
NPV	Σ discounted cash flows – Initial investment	Assess the project's economic value
IRR	Discount rate at which NPV equals zero	Measure the project's internal rate of return
DPP	Year in which cumulative discounted cash flows recover the investment	Measure the discounted payback period

Source: Author's calculations and formalization.

Two sets of calculations are retained. One allocates contractual rent; the other supplies accounting and economic indicators for judging whether the asset remains sustainable.

5. Limitations of the Constructed Case

The numerical case must not be interpreted as a field study. It draws on the Algerian PSC architecture without reproducing a published agreement, a statutory sharing key, or the conditions actually negotiated for SONATRACH's financing. The 60/40 ratio is a calculation convention; financing and *Cost Oil* are not allocated between the parties. The results therefore allow neither legal generalization nor statistical inference. Their value lies in the transparency of the assumptions, formulas, and analytical sequence.

III. Reserves, CAPEX, Depreciation, and Economic Value

1. Reserves, Wells, and Technical Depletion

Depletion is based on estimates of recoverable reserves derived from geological, technical, economic, and probabilistic assumptions (Lepez, 2002). Estimation methods, reservoir models, and production profiles are neither specific to Algeria nor freely imposed by one party. The operator selects them on the basis of the data and reservoir characteristics, in accordance with the agreement, technical standards, and the approved development plan. Their reliability affects units-of-production depreciation and impairment testing. This relationship is already documented in professional materials jointly prepared by Ernst & Young and Sonatrach (1998). Reserves therefore inform depreciation, the recoverable amount, cost recovery, taxation, *Cost Oil*, *Profit Oil*, and contractual control (ALNAFT, n.d.-b; People's Democratic Republic of Algeria, 2019).

2. CAPEX Formation, Depreciable Amount, and Accounting Standardization

The statement of financial position does not record the total value of the reservoir. It reports expenditure that meets the selected recognition criteria, including acquisition, exploration, evaluation, development, and preparation for production. Capitalization depends in particular on the nature and outcome of the work and on when commercial viability can be demonstrated (Jennings et al., 2000; Yaiche, 2004; Orellana Fuentes, 2014).

This feature requires extractive accounting to accommodate revisable reserves, substantial expenditure before any production, and a persistent gap between the cost reported in the statement of financial position and the project's economic potential. The diversity of capitalization policies therefore requires supplementary information on reserves, calculation assumptions, and future cash flows (Noël-Lemaître et al., 2010; Blum et al., 2013; Blum et al., 2016; Orellana Fuentes, 2014). CAPEX is accounted for within a reporting framework that combines IFRS 6, IAS 16, IAS 36, IFRS 13, IAS 37, IAS 8, and IFRS 11, supplemented by SFAS 19, SFAS 69, and SEC Rule 4-10 for U.S. practice (IASB, 2001, 2003a, 2003b, 2004a, 2004b, 2011a, 2011b; FASB, 1977, 1982; U.S. Securities and Exchange Commission, n.d.). Reserves thus become a basis for calculation, control, audit, and governance.

3. Preproduction Cost Capitalization Methods: A Continuum of Prudence

The range of preproduction practices can be framed by a simple question: at what point does uncertainty justify capitalization rather than immediate expense recognition? In historical-cost systems, the answer ranges from extensive capitalization to maximum prudence (Orellana Fuentes, 2014).

Full Cost adopts the broadest scope: prospecting, exploration, evaluation, and development expenditure may remain capitalized even when some activities are unsuccessful. Earnings become less volatile, but the risk of retaining costs without future economic benefits increases; impairment testing therefore becomes particularly important.

Under the **Area-of-Interest** method, the unit of account is the geological area. Costs remain capitalized within that area as long as the work provides a reasonable basis for anticipating a commercially viable discovery.

Successful Efforts makes the outcome of exploration a decisive criterion: a commercial discovery contributes to the asset, whereas an unsuccessful well is normally expensed. **Full Expensing** goes further by recognizing preproduction expenditure immediately in profit or loss. This conservative treatment reduces the risk of recognizing uncertain assets but excludes a substantial portion of incurred expenditure from the statement of financial position.

This comparison should not be interpreted as a measure of depletion. The four methods define the content of the asset; they do not measure reservoir exhaustion. The capitalization policy first determines the depreciable base. The depreciation method then determines how that base is allocated, either by period or by production volume.

4. Depletion, Depreciation, and Impairment

Depletion, depreciation, and impairment are related, but they do not describe the same event. Depletion records the reduction in recoverable reserves. Depreciation spreads the recognized cost of an asset over its pattern of use. Impairment addresses a different problem: the carrying amount may no longer be recoverable. This distinction matters in practice. A regular depreciation schedule may differ from the extraction profile, and a correctly calculated charge cannot rule out an impairment when reserves, prices, or costs worsen. Since the constructed case contains no quantified impairment indicator, no full IAS 36 test is performed. Impairment is used only as a conceptual checkpoint.

5. Straight-Line and Units-of-Production Depreciation

Straight-line and units-of-production depreciation are recognized internationally; neither is peculiar to Algeria. IAS 16 requires the method to reflect the expected consumption of the asset's economic benefits (IASB, 2003a). The illustration uses five years of straight-line depreciation beginning with commercial production. That assumption allocates the capitalized amount; it does not imply physical exhaustion of the reservoir after five years. Units-of-production depreciation follows extraction more closely, but its denominator relies on reserve estimates and production profiles. Those inputs require regular documentation, audit, and revision (Ernst & Young & Sonatrach, 1998). Contractual rules determine which costs are eligible for recovery and audit. They do not displace the applicable financial reporting framework.

6. Economic Value, Fair Value Information, and the U.S. Experience

Reserve valuation starts with recoverable volumes and the confidence attached to them, but it also requires a production profile, price assumptions, future costs, taxes, and sharing terms. The resulting economic estimate is not the fair value reported in financial statements. IFRS 13 defines fair value as an exit price in an orderly transaction between market participants; the standard does not, on its own, require petroleum reserves to be recognized on that basis (IASB, 2011b).

The U.S. accounting debate highlights this gap between recorded cost and economic information. The coexistence of different capitalization policies created a comparability problem. SFAS 19 (1977) required the *Successful Efforts* method, while the SEC explored *Reserve Recognition Accounting* as a means of reporting proved reserves. Volume uncertainty, price sensitivity, and audit difficulties nevertheless prevented *Reserve Recognition Accounting* from becoming the primary accounting method (Yaiche, 2004; Orellana Fuentes, 2014).

This experience does not validate the general use of fair value to measure reserves. Instead, it supports supplementing historical cost with documented economic information useful for transparency and recoverability testing, without dispensing with depreciation or the contractual verification of eligible costs.

7. NPV, IRR, and DPP: Discounted Cash Flows and Economic Sustainability

Three financial indicators complement the analysis without forming part of financial reporting standards. **NPV** measures, at a given date, the excess of discounted cash flows over the initial investment. **IRR** is the discount rate at which **NPV** equals zero. **DPP** indicates the time required to recover the investment on a discounted basis. **DPP** must not be confused with *Cost Oil*: the former measures an economic period, whereas the latter applies a contractual cost-recovery clause.

IV. Petroleum Agreement, Taxation, and Rent Governance

1. Petroleum Agreement and Information Governance

The petroleum agreement does not generate the underlying data; it gives them enforceable effect by defining rights, obligations, cost eligibility, audit, taxation, and production sharing (Johnston, 1994; Bindemann, 1999; Daniel et al., 2010).

In the Algerian PSC architecture, the foreign contracting party finances upstream operations and the national company may exercise a financing option; the operating agreement then allocates the operator's functions and the rights of the other parties.

Three roles must be distinguished. The host state and competent authorities exercise sovereign regulatory, approval, and oversight powers without replacing the operator in day-to-day management. SONATRACH acts as the national company and a contracting party; when it remains non-operating and exercises a financing option, it may negotiate and exercise the information, approval, control, and audit rights provided by the PSC and the operating agreement. The operator-investor retains day-to-day technical responsibility and proposes operating methods, subject to applicable law, the approved plan, and decisions contractually reserved for joint approval. Neither SONATRACH nor the operator unilaterally selects the accounting or technical methods (ALNAFT, n.d.-a, n.d.-b).

2. *Cost Oil*, *Profit Oil*, and Cost Recovery

The relationship between depletion and cost recovery is mediated by production volumes and the duration of production; it does not justify conflating these flows. Depreciation is an accounting expense. *Cost Oil* results from the contractual application of cost-recovery rules. *Profit Oil* is the remaining production available for sharing, not accounting profit. In the model, the operator-investor's after-tax share of *Profit Oil* is a simplified economic aggregate. It is not a comprehensive net cash flow because CAPEX, OPEX, decommissioning and abandonment costs, and financing arrangements are not separately allocated.

The quality of control depends precisely on reconciling these registers without merging them. In the constructed PSC, the sequence from net production value through *Cost Oil* and *Profit Oil* to sharing organizes rent and information rights. Conversely, a mismatch among volumes, costs, and sharing rules would increase information asymmetry among the operator, the non-operator, the state, and partners (Jensen & Meckling, 1976; Spence, 1973).

3. Petroleum Taxation and Informational Sovereignty

An error in reserves or volumes may be transmitted to recovered costs, levies, and rent. Informational sovereignty refers here to the ability of the state, SONATRACH, and duly authorized public bodies to access traceable and auditable data on reserves, production, costs, taxation, and flows generated by the PSC (Al-Kasim, 2006; Beau & Pigé, 2007; Charreaux, 1999). NPV, IRR, and DPP add an assessment of economic sustainability without replacing accounting or contractual control.

V. Aggregate Results of the Constructed PSC Case

1. Summary of the Structuring Assumptions

The case uses a constructed 20-year PSC comprising seven years of preproduction and thirteen years of commercial production. *Profit Oil* is allocated, for illustrative purposes, 60% to the operator-investor and 40% to SONATRACH; this allocation represents neither a statutory rate nor the financing split. SONATRACH's partial financing option provides qualitative institutional grounding, without a quantified allocation of CAPEX or *Cost Oil* by party. Recoverable CAPEX and the capitalized accounting base are both set at an aggregate USD 420 million, with no residual value. Straight-line depreciation over five years is the reference scenario, while units-of-production depreciation is the depletion-based alternative; these methods are international and not specifically Algerian.

Table 8: “Structuring Assumptions of the Constructed Case”

Item	Assumption	Analytical Role
Agreement term	20 years	Long contractual horizon
Preproduction / production	7 years / 13 years	CAPEX accumulation followed by recovery
Initial CAPEX	USD 420 million	Aggregate base; financing by party not allocated
Ultimate proved reserves	75 MMbbl	Overall technical basis of the case
Cumulative production (13 years)	62.5 MMbbl	Cumulative depletion over the contract term
Remaining reserves	12.5 MMbbl	Remaining technical potential and information for ALNAFT
Hydrocarbon price	Variable profile around USD 70/bbl	Effect on rent, taxation, and NPV
Royalty	10% of gross production value	State's priority take
<i>Cost Oil</i> ceiling	30% of net production value	Annual recovery capacity
Reference depreciation	Straight-line over 5 years	Accounting allocation of the depreciable base
Illustrative <i>Profit Oil</i> allocation	Operator-investor 60% / SONATRACH 40%	Economic assumption distinct from the financing option
Illustrative economic indicators	Simplified operator NPV , IRR , and DPP	Economic assessment based on simplified cash flows

Source: Assumptions of the case developed by the author.

2. Aggregate Results

The formulas translate the assumptions into economic measures. By reconciling volumes, prices, recoverable CAPEX, royalty, *Cost Oil*, *Profit Oil*, and taxation, they trace the formation of rent in the constructed case. This consolidation allocates neither initial financing nor *Cost Oil* recovery between SONATRACH and the operator-investor. The analysis therefore concerns the contractual aggregate; detailed annual calculations remain in the internal calculation file.

Table 9: “Aggregate Results of the Constructed PSC Case”

Indicator	Case Result
Initial recoverable CAPEX	USD 420 million
Cumulative production	62.5 MMbbl
Cumulative gross production value	USD 4,471 million
Cumulative royalty	USD 447.10 million
Cumulative net production value	USD 4,023.90 million
<i>CAPEX-only Cost Oil</i>	USD 420 million
<i>Cumulative Profit Oil</i>	USD 3,603.90 million
After-tax <i>Profit Oil</i> share of the operator-investor—simplified illustration	USD 1,513.64 million
Illustrative SONATRACH economic share	USD 1,441.56 million
Illustrative consolidated national rent	USD 2,537.36 million
Illustrative operator indicators	Simplified NPV at 10%: USD 700.36 million; illustrative IRR : 37.9%; illustrative DPP : 3.25 years

Source: Developed by the author from the internal calculation file.

Under the selected scenario, depletion determines the depreciable base, the pace of CAPEX recovery, and, indirectly, the formation of *Profit Oil*, taxation, and national rent. *Cost Oil* enables the recovery of aggregate CAPEX of USD 420 million, while cumulative *Profit Oil* reaches USD 3,603.90 million. Royalty, taxes on the operator-investor, and the economic share attributed to SONATRACH raise illustrative consolidated national rent to USD 2,537.36 million. These amounts do not allocate financing or reimbursements between the parties. The operator's simplified **NPV** is calculated from the start of commercial production and does not separately discount CAPEX incurred during the seven preproduction years or detailed OPEX. **IRR** and **DPP** therefore remain illustrative.

3. Price Sensitivity and Stress Scenarios

Price is treated as a stress assumption rather than as a simple annual input. The demand shock observed in 2020 and the subsequent energy tensions associated with the war in Ukraine illustrate the scale of possible variation.

In the model, these scenarios are used to test how the recoverable amount, discounted cash flows, *Cost Oil*, *Profit Oil*, and fiscal rent respond.

A price decline reduces gross production value, royalty, net production value, *Profit Oil*, and tax bases; the opposite movement improves project economics and NPV. Reserves still available at the end of the agreement also retain informational value. They may inform ALNAFT databases, the preparation of future tender specifications, licensing rounds, or an extension of the contract area.

VI. Discussion

The results give depletion an integrative function. A reliable estimate provides information not only about the subsurface; it also supports control of the asset, recoverable costs, taxation, and sharing. The analysis therefore concerns consistency across these uses rather than each use considered separately.

The capitalization policy is the first point requiring attention. *Full Cost*, *Area-of-Interest*, *Successful Efforts*, and *Full Expensing* account for uncertainty differently: broader approaches carry a larger share of uncertainty in the statement of financial position, whereas more prudent approaches recognize the effect of unsuccessful activities in profit or loss earlier (Jennings et al., 2000; Orellana Fuentes, 2014; Blum et al., 2016).

The depreciation pattern raises another difficulty. Straight-line depreciation stabilizes expense recognition; units-of-production depreciation aligns it more closely with estimated extraction, at the cost of greater dependence on the quality of technical data. The choice must be assessed against the asset's actual consumption pattern, not merely the regularity of reported earnings.

The carrying amount must ultimately remain consistent with the expected economic benefits. IAS 36 requires a recoverability assessment when there is an indicator of impairment. IFRS 13 governs fair value measurement without requiring petroleum reserves to be recognized on that basis (IASB, 2004a, 2011b).

The experience with *Reserve Recognition Accounting* illustrates this limitation. An estimate of proved reserves enriches the information set, but its decision usefulness in accounting remains constrained by volume revisions, price volatility, and verification difficulties (FASB, 1982; Orellana Fuentes, 2014).

The agreement connects volumes to eligible costs and sharing. A continuous audit trail reduces the operator's informational advantage. Conversely, weak technical data can propagate to *Cost Oil*, *Profit Oil*, and fiscal levies (Jensen & Meckling, 1976; Bindemann, 1999; Daniel et al., 2010).

In the illustration, SONATRACH does not direct day-to-day operations. Its status as the non-operating national contracting party nevertheless gives it access to the information and controls provided by the agreement, without conflating its role with the prerogatives of the state or public authorities. Depletion data can then be used to verify consistency among reserves, produced volumes, recovered costs, and the sharing key.

This information requirement is consistent with Madene's (2026) analysis of SONATRACH: business continuity requires both effective control of operational risks and data reliable enough to support asset audit and governance.

Conclusion

The constructed case leads to a precise conclusion: neither reserve volume nor the depreciation method is sufficient, in isolation, to establish the credibility of a petroleum asset. Credibility depends on the ability to trace information from technical reserve estimates to rent flows through capitalization, recoverability, the agreement, and taxation. The purpose is not to propose a new rule, but to verify the compatibility of the rules already applied.

Terminological distinctions remain essential. Depletion describes the exhaustion of the resource; depreciation allocates the cost recognized as an asset; impairment reduces a carrying amount that is no longer recoverable. These phenomena interact but cannot be used interchangeably.

The analysis separates two accounting decisions. First, the policy for preproduction expenditure determines whether an outlay becomes an asset or an expense. Only after the depreciable base exists does straight-line or units-of-production depreciation allocate it among reporting periods. Treating these decisions as one would wrongly assign a capitalization choice to the depreciation method.

Depletion information also enters institutional practice. It can support a PSC audit, substantiate claimed costs, and help interpret the resulting economic flows. When that information is documented and accessible, public authorities are better placed to monitor the allocation of rent.

The matrix traces this pathway without presenting it as mechanical causality. It examines the transitions among reserves, CAPEX, depreciation, economic value, cost recovery, taxation, and sharing, and identifies where an informational break may arise.

The case shows that the same produced volume may be used in the units-of-production calculation, the *Cost Oil* ceiling, and the determination of *Profit Oil*. Its role nevertheless changes from one register to another. Transparency requires preserving these differences while making the calculations reconcilable.

This analysis does not justify the direct recognition of reserves at their economic value. The *Reserve Recognition Accounting* debate shows that an estimate may be decision-useful but still too dependent on assumptions to become the primary accounting measure.

The results remain limited by the construction of the PSC: no actual agreement is reproduced, SONATRACH's financing option is not quantified, and the 60/40 split remains a calculation assumption.

Future research based on accessible agreements could allocate financing and *Cost Oil* between the parties, compare the methods permitted by IAS 16, and measure the effect of price or reserve revisions.

Rent governance ultimately requires a verifiable information trail: documented reserves, traceable CAPEX, justified recoverable costs, reconciled flows, and revised assumptions. Such continuity is a prerequisite for the faithful representation of the accounts, control of the PSC, and transparency in sharing among the state, the operator, SONATRACH, and partners.

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