

CURRENT DEVELOPMENTS
IN PRODUCTION SHARING CONTRACTS AND
INTERNATIONAL PETROLEUM CONCERNS *

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I appreciate this opportunity to start a regular column for the *Petroleum Accounting and Financial Management Journal*. The focus of my work is on the contractual relationships between governments and oil companies. Economic evaluations, analysis, and contract negotiations will be a feature of my column. I log many miles each year and should have my finger on-the-pulse of these issues in some fashion or another. It remains to be seen, of course, if my finger is on an artery or a vein.

***Editor's Note:** With this issue we are happy to introduce our newest columnist, Daniel Johnston. Mr. Johnston, who is no stranger to *Journal* readers, is an international petroleum consultant with 23 years experience in the petroleum industry. He has worked in 38 countries conducting oil and gas reserve certifications, performing field development feasibility studies, evaluating exploration potential of licenses and concessions, and providing expert testimony. He formed his independent consulting practice in 1985.

He has worked directly for numerous governments and/or government owned national oil companies in Latin America, Europe, the FSU, Asia, and the Middle East. He has also worked for many major and independent oil companies.

He has a Bachelor of Science degree in geology from Northern Arizona University and an M.B.A. (Finance) from the University of Texas at Austin. He has published numerous articles and lectures worldwide on the topics of economics and risk analysis, petroleum fiscal systems, and financial analysis.

Mr. Johnston is the author of *Production Sharing Agreements* published by the University of Dundee-Scotland and three best-selling PennWell books, *Oil Company Financial Analysis in Nontechnical Language*, *International Petroleum Fiscal Systems and Production Sharing Contracts*, and *International Oil Company Financial Management in Nontechnical Language* (with James Bush).

In this column I introduce the current setting of international exploration as I see it. Today's climate is characterized by companies and governments which are awakening to a new era. Countries have become more proactive in their efforts to compete with each other for capital and technology. As an example, in November 1996 for the first time ever, Pertamina (the National Oil Company of Indonesia) went "on-the road" and gave promotional presentations to industry in Houston and London which focused on their country's geological prospectivity and their contract terms. Future columns will expand on this and other topics.

Contract Terms and Prospectivity

Contract analysis from a financial point of view must be closely linked to the geological prospectivity associated with a given license area or region. This is not a new concept. Adam Smith in *The Wealth of Nations* (1776) characterized both agricultural acreage, as well as mineral deposits (coal, copper, gold, precious gems, etc.), in terms of fertility and situation. Agricultural fertility equated with, for example, the richness of the soil. For extractive deposits such as coal, fertility was a function of the thickness of the overburden, the quality of the coal, and so forth. Situation dealt with the distance from market and the relative costs of transportation.

Smith pointed out that with coal mines both fertility and situation were important, but the same was not true for a gold mine. Fertility is important for gold mines (richness of the ore, etc.), but situation is not so important. The transportation costs per unit are relatively low compared to the value of this commodity. The opposite is true with coal.

	<u>Fertility</u>	<u>Situation</u>
Coal or gas	Important	Important
Gold or oil	Important	Not so important

These same concepts apply to the petroleum industry. Fertility (prospectivity) for both oil and gas is important, but their situations are not identical. Gas is much more sensitive to distance from market than oil. This is why half of the world's nearly 5,000 TCF gas is stranded—too far from markets. Of course, half or more of the world's conventional oil reserves are non-producing, but not for the same reason.

A catalogue of contract terms and geological prospectivity is depicted in Table 1. Tough terms usually correlate with good rocks. The various elements that capture the essence of “tough terms” and “good rocks” are summarized in this table. There must be a balance, of course, between the fertility and situation and the associated terms. There is much involved in this relationship.

Table 1
The Balance Sheet

<u>Prospectivity</u>	<u>Contract Terms</u>
<ul style="list-style-type: none"> • Expected field size distributions • Petrophysical characteristics: porosity, permeability, saturations, etc. • Well deliverability • Estimated success probability: source, seal, reservoir, migration, etc. • Oil vs. gas: fluid properties, API gravity, wax, HS2, etc. • Data: quality and quantity • Exploration drilling costs • Post discovery costs: development drilling, production facilities, transportation costs, operating costs • Water depth and climate • Political risk 	<ul style="list-style-type: none"> • Type of system: PSC, service agreement, royalty/tax system • Signature bonus • Working program: seismic and drilling expenses, timing, relinquishment, bank guarantees • Royalty • Cost recovery limit • Effective royalty rate • Government take • Government participation • Entitlement • Cost savings index • Ringfencing • “Crypto” taxes • Contract stability

Risk and Reward

There must also be a balance between risk and reward. The industry standard evaluation tool is the expected value (EV) approach—also known as expected monetary value (EMV)—which yields a “risk weighted” value as shown in the equation below.

Expected Monetary Value (EMV)

$$\text{EMV} = (\text{Reward} * \text{SP}) - [\text{Risk capital} * (1 - \text{SP})]$$

Where:

EMV	=	Expected monetary value
Risk capital	=	Bonuses, dry hole costs, G&G, etc.
SP	=	Success probability
Reward	=	Present value of a discovery based on discounted cash flow analysis discounted at corporate cost of capital.

This formula is the foundation of risk analysis and decision making. The decision rule is that EMV must be positive to consider making an investment, i.e., the risk-weighted potential reward outweighs the risk.

Typically signature bonuses and work commitment capture the essence of the risk side of the equation. Nearly all of the other elements on both sides of the balance sheet affect the reward side of the equation if a discovery is made. The linkage between risk and reward, then, is the probability that one outcome or another might occur.

Two key elements in the exploration business are estimates of success probability (sometimes called chance factor) and the anticipated or target field size. Post mortem analysis of exploration efforts of the past couple of decades indicates that explorers have been optimistic in their estimates of both probability of success as well as field size distribution. The rates of success have not been as robust as expected, and when discoveries have been made they typically have not been as large as expected.

Reserve Replacement

Companies have managed to replace reserves—but only partially through exploration. The demands are great. Wall Street pays close attention to reserve replacement ratios and finding costs. This creates intense pressure on companies to “book” barrels—regardless of the *value* of those barrels. Mobil Corporation provides a good example of how difficult it would be to replace reserves through exploration alone. Mobil (prior to the Exxon acquisition) produces around 1.75 million barrels of oil equivalent per day (BOE). Thus, Mobil would have to find at least 640 MMBOE a year in order to replace production through exploration alone. Just a couple of 300+ MMBOE discoveries per year or so. This is just not happening, and Mobil is a typical example among many. With the new Exxon/Mobil merger the new organism

will be producing more like 4.45 MMBOE per day or 1.6+ Billion BOE per year.

These are obviously dramatic times in the far upstream end of the industry, but exploration is simply not what it was even a generation ago. Over 80% of the world's oil production comes from fields discovered prior to 1973.¹ Giant discoveries are not a thing of the past, yet they are extremely rare these days as shown in Table 2. And, just as the industry appears to be facing the reality of a maturing planet, the mega mergers are changing our landscape. In the past few years, as the industry has been coming to terms with the realities of exploration business, another dynamic has evolved.

Table 2
Large Field Discoveries Worldwide*

Greater than 50 MMBOE (excludes U.S. and Canada)

Discovery Size MMBOE	Number of Reported Discoveries			
	1960s	1970s	1980s	1990s
50 - 100	235	261	300	314
100 - 200	105	162	113	90
200 - 500	179	208	170	154
500 - 1,000	90	95	66	52
>1,000	129	116	90	20

*From: Peter Rose, "Analysis is a Risky Proposition," *AAPG Explorer*, March 1999. Based on Petroconsultants data 5/96 [1990s data extrapolated].

Exploration acreage is taking on more and more of the characteristics of a commodity. This is because of the dramatic increase in competition among companies for exploration and development opportunities, as well as the competition among countries for exploration capital and technology. There are more companies than ever before seeking opportunities worldwide, and there are more countries than ever before open for business.

The market for projects and acreage is much more competitive and efficient. Governments are acutely aware of what the market can bear, and the

¹ Laherre, J. "Production decline and peak reveal true reserve figures," *World Oil*, December 1997, p. 77.

terms companies are getting are not nearly as good as they were 20 years ago—not relative to dwindling prospectivity. Furthermore, governments are demanding more aggressive and faster relinquishment of acreage so that they can turn the acreage over more quickly than in the past.

Each year there are 40 to 50 countries offering official license rounds or “blocks offers”. Those countries with official license rounds at year-end 1998 are listed in Table 3. Out of this group of countries nearly a third were not “open” even 10 years ago. In addition to the official license rounds there are many countries that entertain offers and negotiations “out-of-round”. Each year approximately 20 countries make major changes to their petroleum fiscal systems and more countries than that introduce new petroleum laws, model contracts, or regulations.

Table 3
Countries with Official Block Offerings at Year-end 1998*

Latin America	Argentina, Bolivia, Brazil, Colombia, Cuba, Falkland Islands, Guatemala, Nicaragua, Trinidad & Tobago
Europe	Bulgaria, Denmark, Faroe Islands, Hungary, Ireland, Netherlands, Norway, UK
FSU	Kazakstan, Russia, Tartarstan, Yakut-Sakha, Uzbekistan
Africa	Algeria, Angola, Benin, Cameroon, Egypt, Equatorial Guinea, Gabon, Madagascar, Namibia, Nigeria, Senegal, South Africa, Togo
Middle East	Pakistan, Iran, Iraq, Qatar
Far East	Australia, Brunei, Cambodia, China, India, Indonesia, Mongolia, Nepal, New Zealand

* From: *AAPG Explorer*, August 1998 pp. 12-17.

Exploration results in recent years have not been as successful in terms of the number and size of discoveries. As a result, industry is moving into higher-cost environments. Furthermore, terms are tough; countries now extract resource rent much more efficiently and effectively. Unfortunately

some companies interpret this trend as a measure of government greed. In most cases greed is not the issue; we are seeing an increasingly efficient and competitive market place at work.

The future of exploration is not dead, but companies must go into deeper water and more remote, inhospitable, frontier regions, both geographically and politically. Advances in technology have been spectacular, but this is because of necessity due to lower prices, tougher terms, deeper water, and smaller, more subtle traps. The business of petroleum exploration has always been a high risk business, but in most respects it is tougher these days.