



# MCDM Approach Limits Risk, Enhances Performance

By Michael R. Walls

GOLDEN, CO.—The emphasis placed on strategic planning in firms over the last two decades reflects the proposition that there are significant benefits to gain through an explicit process of formulating strategy toward some common set of corporate goals or objectives.

Oil and gas firms, as are firms in all other business sectors, are periodically faced with the very basic business strategy questions of how they should compete in their businesses, and what their important objectives are. Allocating scarce investment capital, in the face of business risks and uncertainties, is perhaps the E&P manager's most fundamental concern in terms of effecting the firm's business strategy. In other words, the link between strategy and capital allocation has become more and more important to petroleum managers.

Often, however, oil companies have a very distinct separation between the strategic planning process and decisions regarding capital allocation. A new decision-making approach attempts to provide a means to link the strategic management process, which is concerned with how a business is going to compete and what its objectives should be, with a systematic capital allocation process designed to achieve those objectives.

The multi-criteria decision-making (MCDM) approach brings strategic planning closer to the operating philosophy

of the company. In effect, it formally integrates the firm's stated business strategy with decisions about capital allocation. This decision science-based technique:

- Provides a means to identify and evaluate a larger set of potential opportunities;
- Links those opportunities and decisions with the company's objectives and goals;
- Formalizes the risk analysis process, such that the E&P firm can select opportunities consistent with its risk propensity;
- Provides a means for the firm to evaluate its position relative to its strategic plan; and
- Improves the overall quality of investment decisions, which ultimately creates value for the firm.

### Important Questions

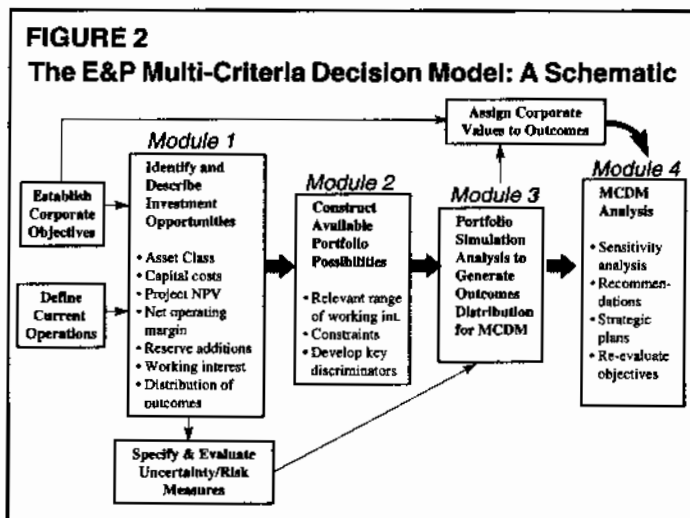
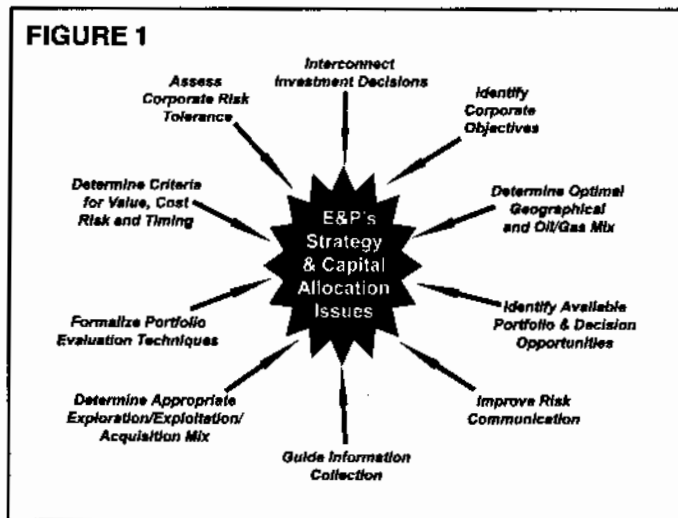
E&P managers face a number of important questions when establishing a strategy and capital allocation process for the firm, such as determining what the important components are of the E&P firm's strategic planning environment and decision problem, defining the firm's corporate objectives and their relative importance in terms of the long-term corporate mission, and identifying the firm's tolerance for financial risk and other uncertain outcomes. Other critical questions include what does the firm know and what does it not know, and how can managers take those factors into account? What ele-

ments can the E&P manager influence? What are the key constraints? What investment opportunities are really available to the firm?

Figure 1 provides a representation of the general decision problem faced by typical E&P firms—both large and small. At issue is how the manager can systematically integrate all of these concerns into his/her decision-making process—a process that effectively links what the firm does with the ultimate picture of what the firm is and what it wants to achieve. These are the issues that the decision-science approach confronts and systematically answers.

The fundamental question that E&P firms face is what mix of new decision opportunities is most appropriate for the firm to achieve its set of stated goals and objectives? That answer lies in an approach that explicitly relates the capital allocation process to the E&P firm's stated strategy with regard to issues such as geographical concentration, acquisition (development) of new core areas, exploration, and exploitation of mature assets (including divestiture), etc. In other words, a well-formulated decision process enables the firm to act on its business strategy, improve performance, and create value for its owners.

The basic engine of this decision-making framework utilizes a portfolio approach. First, we are interested in identifying the set of portfolio opportunities available to the firm over a designated



planning horizon. Second, we seek to evaluate those opportunities in the context of corporate objectives, the relative importance of those objectives, and management's propensity to take risk. This integrated portfolio model enables the E&P firm to evaluate the impact of interconnecting decisions, determine the optimal mix of acquisition, development and exploration, identify the optimal geographical and hydrocarbon mix, evaluate their current asset inventory in light of new opportunities, act on a risk policy, and improve risk communication throughout the organization.

The major components of the MCDM approach to E&P planning enable the firm to integrate its corporate objectives into the capital allocation process. The schematic shown in Figure 2 provides a visual representation of the linkage among input and output modules, and how each component in the strategy/capital allocation framework contributes to understanding and solving the decision problem faced by the E&P manager. As shown, after defining the firm's corporate objectives and its current operations, the decision model consists of four major modules: identifying investment opportunities (Module 1), constructing feasible portfolios (Module 2), portfolio simulation (Module 3), and MCDM analysis (Module 4).

### Identifying E&P Opportunities

For strategic planning purposes, the firm defines project opportunities to include all existing and potential investments. The description of all current and potential investment alternatives is essential to the design, because this is how managers can ensure consistent comparisons among investment opportunities. The firm's stated objectives and strategies to achieve those objectives will guide the design and required inputs. A sample of some of the elements that are evaluated over the designated planning horizon might include:

- Major asset class (exploration, development and acquisition);
- Geographical location (domestic or international);
- Predominant hydrocarbon (oil, gas, condensate);
- Asset status (existing or potential asset);
- Divestiture status (potential or non-potential sale of asset and estimated market price);
- Capital or acquisition costs;
- Project life (short-, medium-, or long-term);
- Cash flow analysis;
- Project's net present value;
- Net operating margin;
- Hydrocarbon production levels;
- Gross reserve additions or reserve

deductions in the case of sale;

- Working interest or participation options and net revenue interests;
- Minimum and maximum budget allocations for planning period; and
- Distribution of uncertain outcomes on key variables.

It is important to emphasize that this data collection is not simply an exercise to provide fodder for the strategic planners, or some "black box" that spews forth decisions. On the contrary, consistent information collection and discussion of tradeoffs among these various measures is the best way for the firm to assure long-term buy-in and consistency across all levels of the company's decision-making process.

### Constructing Portfolios

In order to meet the stated goals or objectives of the corporation, it is critical to utilize a full asset-allocation approach to modeling the firm's opportunities. This approach includes the firm's current inventory of projects, from an exploration, development, acquisition and divestiture viewpoint, as well as potential new opportunities in these asset classes. The ultimate mix of activities is what drives the key discriminators in choosing among potential portfolios. For this reason, the modeling effort includes all of the firm's current and potential activities.

Module 2 is defined as the portfolio scenario generation module, which is designed to identify the set of decision opportunities available to the firm over the planning horizon. Portfolio construction is subject to operational, capital and contractual constraints as well as any other "hard" constraints specified by the firm. Among the items considered in the scenario generation module are project-specific issues such as minimum and maximum participation levels, minimum and maximum capital budget constraints, divestiture status, and any other key constraints relevant to generating portfolio opportunities.

After specifying the constraints and range of potential activity level for each project, Module 2 generates a feasible set of portfolio opportunities by varying the mix of projects and level of participation in each project for different portfolios. These potential portfolios are compared to the firm's current portfolio and evaluated in the context of the company's corporate objectives and goals.

### Portfolio Simulation

Individual acquisition, development, and exploration projects have their own unique components of risk and uncertainty. Similarly, each portfolio generated in Module 2 (including the firm's current portfolio) has its own characteristics of

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risk and uncertainty concerning potential outcomes. It is the interaction among the mix of assets in the portfolios that we are interested in capturing through the simulation process.

The portfolio analysis enables manag-

ers to analyze the risk and uncertainty associated with each key objective (net present value, reserve replacement, finding costs, etc.) at the portfolio level rather than the project level. This module facilitates a systematic analysis of the risk/re-

ward tradeoffs within and among key objectives. Managers are able to systematically compare alternative business strategies or tactics and their impact on risks faced by their respective companies.

**MCDM Analysis**

Decision makers often consider the financial risks associated with petroleum exploration. There are, however, risks and uncertainty associated with any number of objectives that are of interest to the firm. Moreover, the firm has different propensities for risk with regard to each of these objectives.

As shown in the stylized example in Figure 3, the MCDM analysis enables key decision makers to articulate their strategies through a set of key objectives, and specify their willingness to take financial and other risks associated with each of these objectives. The preference, or utility, functions shown in this example summarize the firm's risk attitude and enable its managers to formally and consistently incorporate their willingness to take risk into the evaluation and decision process.

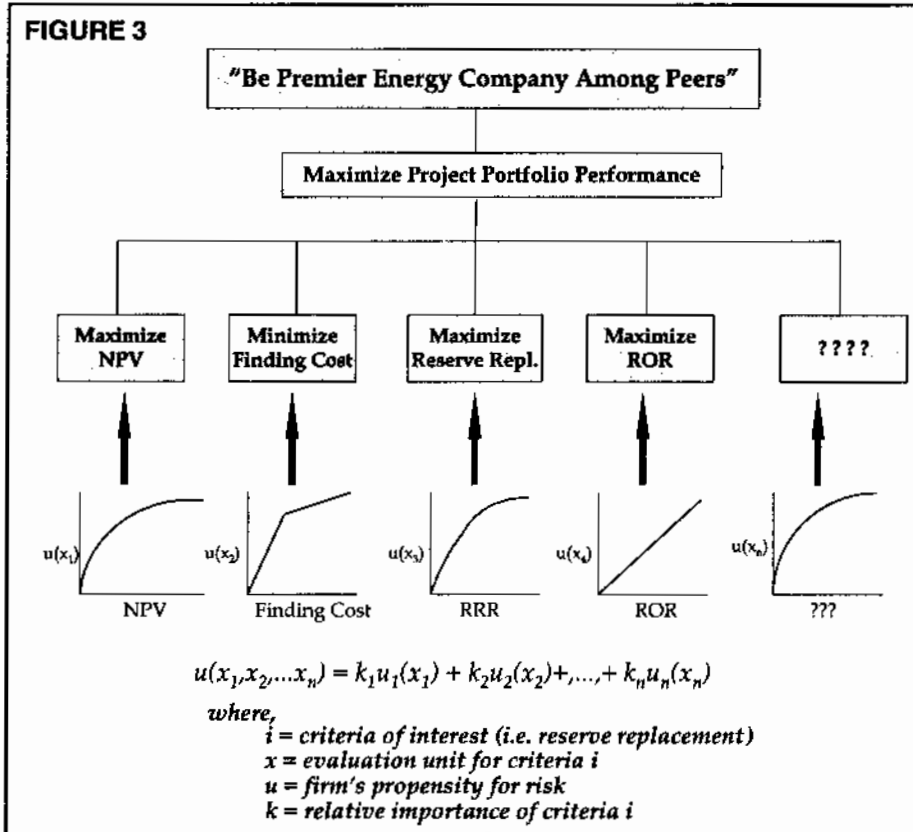
The MCDM approach also enables the firm to make systematic tradeoffs among the stated business objectives in a risky environment. For example, what trade off in terms of finding costs is the E&P manager prepared to make in order to attain a specified reserve replacement goal, or what level of risk is he willing to accept to achieve an annual 20 percent growth in reserves? It allows the firm to simultaneously incorporate the relative importance (*k* variable) of each of the firm's objectives into the evaluation.

This approach explicitly links capital allocation and business strategy and provides a mechanism to rank all portfolios generated in Module 3 based on the MCDM value model. It provides the means for decision makers to act on the firm's stated strategy by linking the capital allocation process with a clearly stated set of goals and objectives.

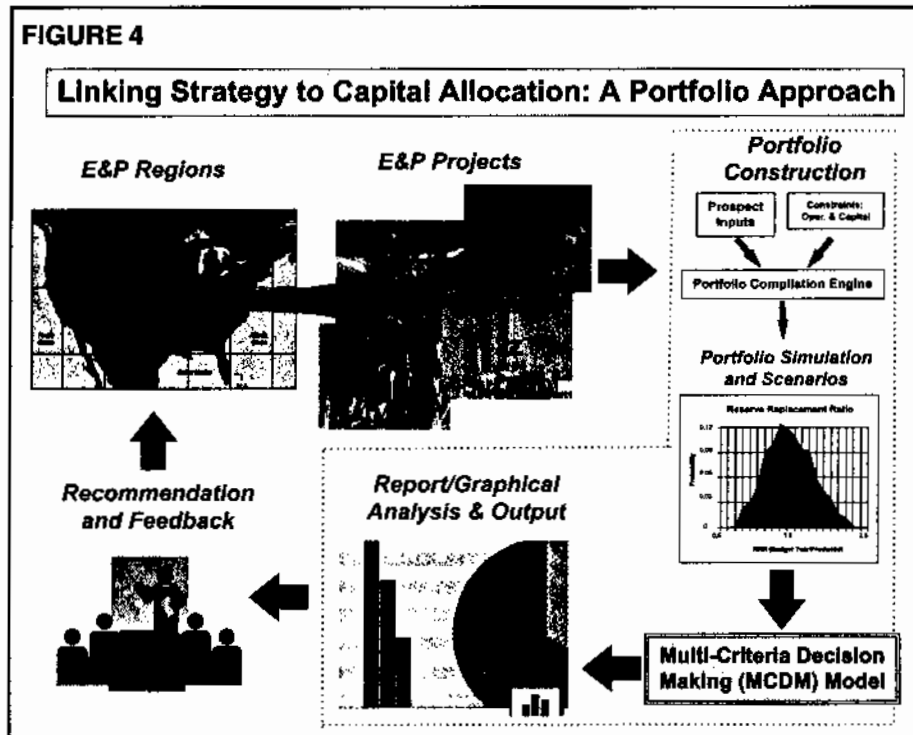
**Closing the Loop**

The MCDM approach helps managers understand what differentiates the "best" portfolios from one another. Portfolio composition is an essential element in terms of understanding the link between the firm's E&P strategy and decisions about capital allocation. Decision makers can observe portfolio composition on as many discriminating characteristics as defined in the input module. For example, recommended portfolios could be evaluated in terms of domestic versus international composition. They could also

**FIGURE 3**



**FIGURE 4**



be examined in terms of exploration, development and acquisition strategies, and in terms of hydrocarbon type, project scale, short-term versus long-term, and a host of other factors.

As shown in Figure 4, linking strategy to capital allocation "closes the loop" in terms of developing strategies and action plans for the firm's entire capital budget and asset portfolio. For example, the MCDM approach indicates to the firm how to maintain its target reserve replacement ratio, where to target exploration and development capital, where to improve productive capabilities, what mature assets should be monetized, where to target and implement new exploration efforts, how to maintain financial flexibility and achieve a desired rate of return.

Understanding the composition of portfolios, as well as the risk and uncertainty associated with recommended portfolios and developing a formal process for feedback to the firm's corporate objectives represent fundamental elements of the MCDM approach. In other words, it provides a means to evaluate the firm's position relative to its strategic plan.

What are the unique strengths of this E&P planning approach? While many other approaches assess individual investment performance and risk (often using the expected value paradigm), this approach deals with two of the most important business challenges that ultimately prove to be the undoing of otherwise "good" business strategy.

First, it explicitly and systematically quantifies a firm's implicit tradeoffs among its multiple objectives and its attitude toward risk and uncertainty. Since

corporate strategy ultimately must be implemented by a plethora of decisions made throughout the organization, it is essential that all levels of management appreciate the tradeoffs that the E&P firm is (or is not) willing to make among its key objectives. Companies whose managers set objectives for each key result area, and then aggressively pursue actions calculated to achieve their performance targets, are strong candidates to outperform companies whose managers operate with hopes, prayers and good intentions.

Second, the portfolio approach captures the dependence among all investment opportunities. Far too often, "good" investment decisions are undone by external factors. For instance, "focusing our efforts" is usually an excellent strategy

unless it creates a portfolio without enough diversity to withstand an unfriendly change in one of those external factors (such as complete reliance on oil exploration accompanied by a precipitous decline in world oil prices).

In summary, this approach formalizes the firm's preferences concerning its goals and the risks it is willing to undertake to achieve those goals, while at the same time quantifying how dependence among project outcomes can affect overall (portfolio) performance. This approach leads to a decision process that is clear and understandable, decisions that are open and justifiable rather than ad hoc in nature, and actions and outcomes that lead to better firm performance. □

## Successful Companies Learn To Understand, Allocate Risk

By Sam Soliman

HOUSTON—Usually when one is exposed to risk management concepts, he is informed about isolated ideas without being provided with an understanding of the core principles required to extract the maximum benefits from revolutionizing the way he does business. This lack of basic internalization manifests itself in the inappropriate shortcuts taken by many producers that result in negative experiences. The producer then reverts to past practices, and falls farther behind in the competitive race.

What follows is an attempt to create the foundation for revolutionizing how companies view their price risk. Persons who have already done this, need not read any farther. For everyone else, let's get started.

### Getting Comfortable

Everything involves risk. In layman's terms, risk generally refers to the variability of outcomes resulting from an action. When we get into our cars to go to work, there are a number of possible outcomes, ranging from getting to work on time to getting into an accident. When we drill for natural gas, there is variability in whether we find gas at all to how much gas we find, and what it will be worth. What distinguishes successful people and companies is their ability to identify, isolate and appropriately manage various risks.

Some risks are best "out-sourced," while for others we feel we are the best managers. In today's terms we call this our core competency or our comparative advantage. It is unconventional to view our core competency in terms of what risks we are bet-

ter at managing than others.

In the financial markets, one often hears that over time, stocks yield more than bonds. This does not mean that one is a better investment than the other, but merely reflects the fact that on average and over time, the market tends to compensate participants for absorbing more variability or risk. In the short term, the market can punish variability if there is a perception that the variability is poorly managed or not understood.

This variability can have negative long-term implications if it causes a "stop and start" approach to capital budgets and investments in personnel or technology. These are the common woes heard from people who claim to be victimized by the commodity cycle. The commodity cycle is the market's way of punishing those who have poorly managed some of the risks that they are exposed to, particularly commodity prices.

Remember that everything we do involves risk or variability, so why do people feel victimized by the commodity cycle? The answer may be in our approach to managing price risk.

### Thriving In The Cycle

To understand how a producer can thrive in an industry exposed to the commodity cycle, we need to examine why



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