Beyond Prospect Evaluation:
Techniques For Exploration Portfolio Optimization

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Summary

The challenge for business managers in any industry is to select the mix of investment opportunities that will maximize returns at reasonable cost. This presentation offers techniques to quantify the opportunity costs of exploration prospect portfolios and to ensure that corporate hurdle rates are met or exceeded.

An exploration portfolio is the mix of individual exploration prospects that are expected to be drilled in a defined operational cycle. It may or may not include the entire prospect inventory. Like individual prospects, portfolios have characteristics that can be compared for different options. But where a Prospect has a high risk of failure, a properly designed Portfolio has a high, and measurable, certainty of success. Portfolio analysis looks beyond the success or failure of a single prospect, and focuses on the fiscal results of the program.

Portfolio characteristics can be examined to quantify the opportunity costs of various portfolio options, and to design a portfolio that meets specific requirements. A portfolio can be constructed to meet corporate hurdle rates for Finding Cost, Return on Investment, or Reserve Additions. Portfolio analysis can be used to optimize working interest participation in different play types and farm-out opportunities. It can help determine financial allocations to high –vs- low risk opportunities and to gas -vs- oil programs.

Examples will illustrate an intuitive workflow that can be adapted to any type of investment portfolio. A model-based technique is offered to compare different portfolio designs, and “look-back” techniques are shown to compare actual and predicted results.

Method

A familiar portfolio optimization technique is the Risk -vs- Reward plot shown in Figure 1. This is a cross plot of the geologic risk (probability of success) for each prospect against the reward (newly discovered resource) expected if successful. The line on the plot distinguishes opportunities that offer sufficient reward for the risk involved from those which may not.

The exact placement of this line is unique to each company. It may represent a corporate hurdle that is independent of the actual opportunities. It might also be a suite of lines to represent several different geographic areas. The prospects below the line are not necessarily “bad” - there may be strategic reasons or commitment obligations involved - but they do not compare favorably to other opportunities in the portfolio.

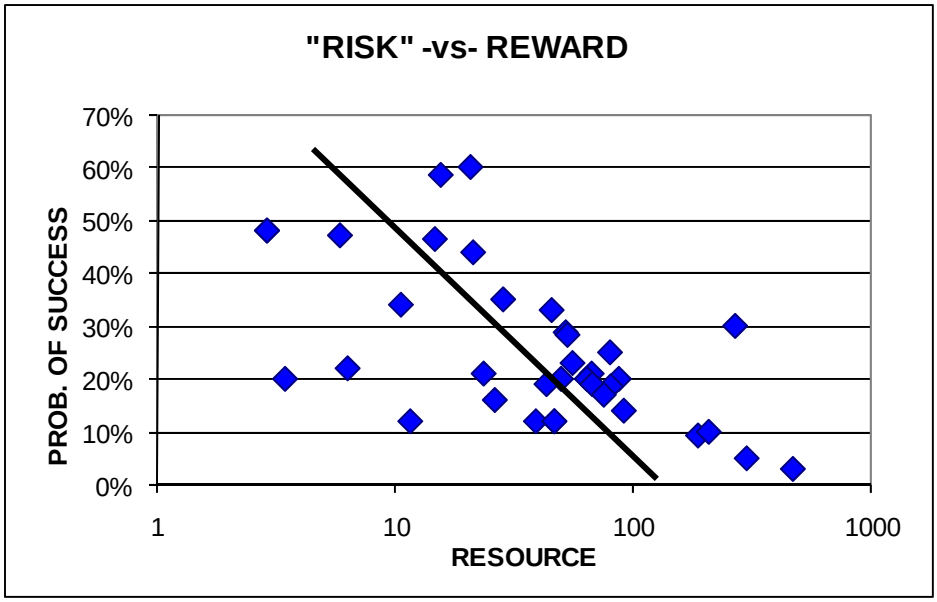

Figure 1: Geologic Risk –vs- Newly Discovered Resource. Prospects to the left of the line may not offer sufficient reward for the risk required.

Figure 2 is also a Risk -vs- Reward plot, but offers a financial instead of technical comparison. It considers the investment required to execute each prospect against the expected value (Risked NPV). Again, the line discriminates "better" opportunities, and again, the placement of the line is relative to corporate strategy and to unique characteristics of the portfolio.

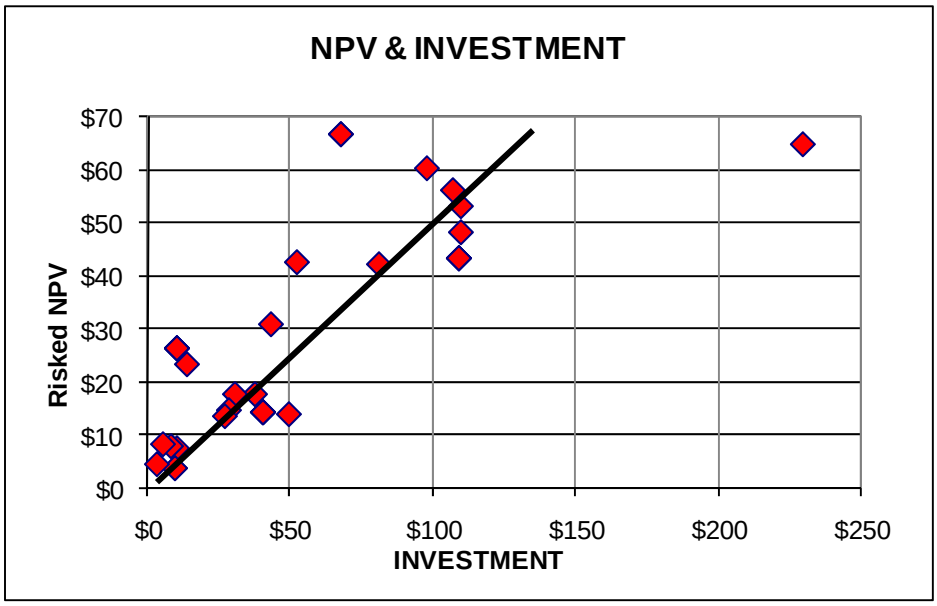

Figure 2: Expected Net Present Value –vs- Exploration Investment. Prospects to the left of the line offer more than 1.5 times return on investment.

Both plots are useful to optimize an existing portfolio, but is it the "best" portfolio to meet corporate goals and hurdles? In order to determine this it is necessary to compare the various investment

options – or various portfolios – that are available from this prospect inventory. Two examples are used to illustrate situations to which portfolio optimization techniques can be applied: determination of an appropriate exploration budget, and addition of a new opportunity to the existing portfolio.

In the first example, an expenditure of more than $200 (add the zeros reflective of your company) is required to drill the entire drill-ready prospect portfolio. To determine if this is the best investment, several model portfolios were generated from the current inventory. The prospects were simply "ranked" on various common metrics and then "cut" below an arbitrary expenditure level of $150 (the "rank & cut" process – not necessarily recommended for real life.) Table 1 summarizes the results.

Portfolio	Expenditure	No. of Prospects	Mean NMER	NPV
1 Current	$210	21	227	$648
2 Ranked on Pc	$143	17	140	$454
3 Ranked on NPV	$153	14	199	$576
4 Ranked on Success Case Mean Resource	$144	9	151	$349
5 Ranked on NFC	$151	16	186	$558
6 Ranked on NMER	$144	13	195	$559

Table 1

Figure 3 illustrates an opportunity cost cross plot generated from the data. It now compares portfolios instead of individual prospects, so each data point represents a different blend of prospects. The three circled portfolios – which are simply subsets of the original portfolio – can achieve nearly as much value with less cost exposure. Prospects common to these three portfolios are the impactive opportunities in the inventory.

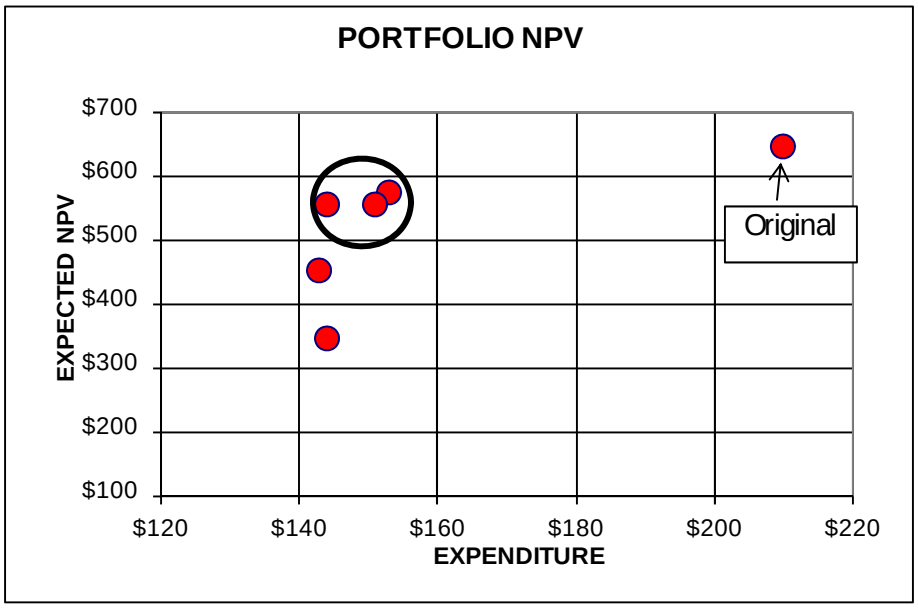

Figure 3: Expected Portfolio NPV –vs- Investment. The circled portfolios offer nearly the same NPV as the original portfolio, but at significantly less expenditure.

Consider now a situation in which there is the opportunity to add new prospects to the inventory through land acquisition, farm-in, or a new play concept. The new opportunities should improve the

overall portfolio results if they are to receive additional funds or replace funding for existing prospects. The decision is whether additional funds are required, or if financial goals can be achieved or exceeded within the current budget.

In this example, model portfolios were constructed to reflect various operational options. Some models assume all prospects, old and new, will be drilled, others contemplate local farm-outs in different areas, and others consider deferral of certain projects. Ten model portfolios were generated, and the opportunity cost plot is shown in Figure 4.

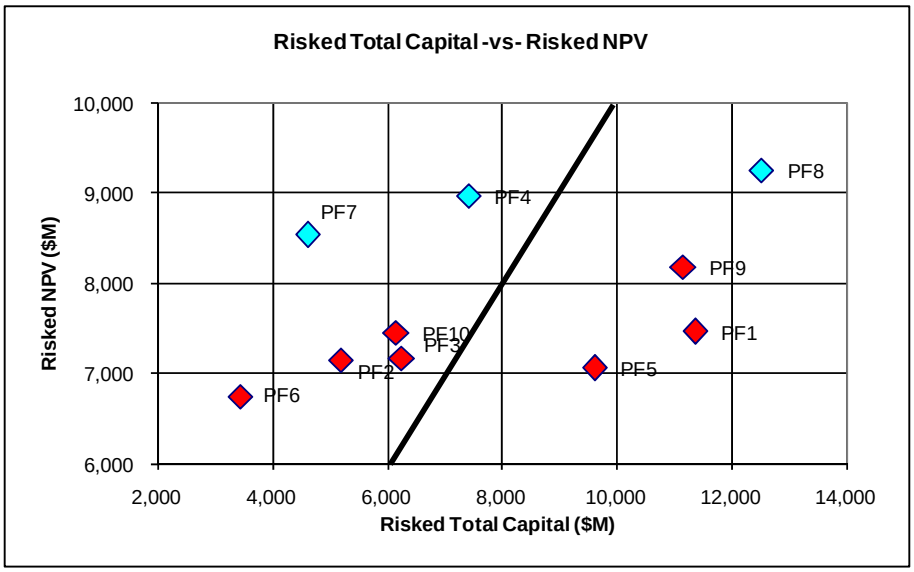

Figure 4: Expected Portfolio NPV –vs- Investment. Portfolios to the left of the line offer more than 2x return on investment.

The line on the figure illustrates a “double”; that is, portfolios to the left of the line have the potential to more than double the exploration investment. Since those are models in which current prospect areas are farmed-out and funds are reallocated to the new opportunities, additional expenditure to drill all of the prospects may not be the best investment decision.

Of course, specific operational requirements will strongly influence, or even force, exploration investment decisions. Commitment wells or other required expenditures may be included in all models, or can be excluded to look only at the discretionary investment.

Conclusions

In addition to improved insight into tactical decisions, the results of portfolio analysis are an excellent tool for designing and communicating strategy. Explorers can focus their efforts on new opportunities that strengthen the total portfolio. Exploration and financial managers can quickly quantify opportunity costs and rewards from different play trends or exploration areas and can plan accordingly.

Portfolio comparisons do not replace experience, but enhance it with a consistent process to allow empirical comparison of investment options.