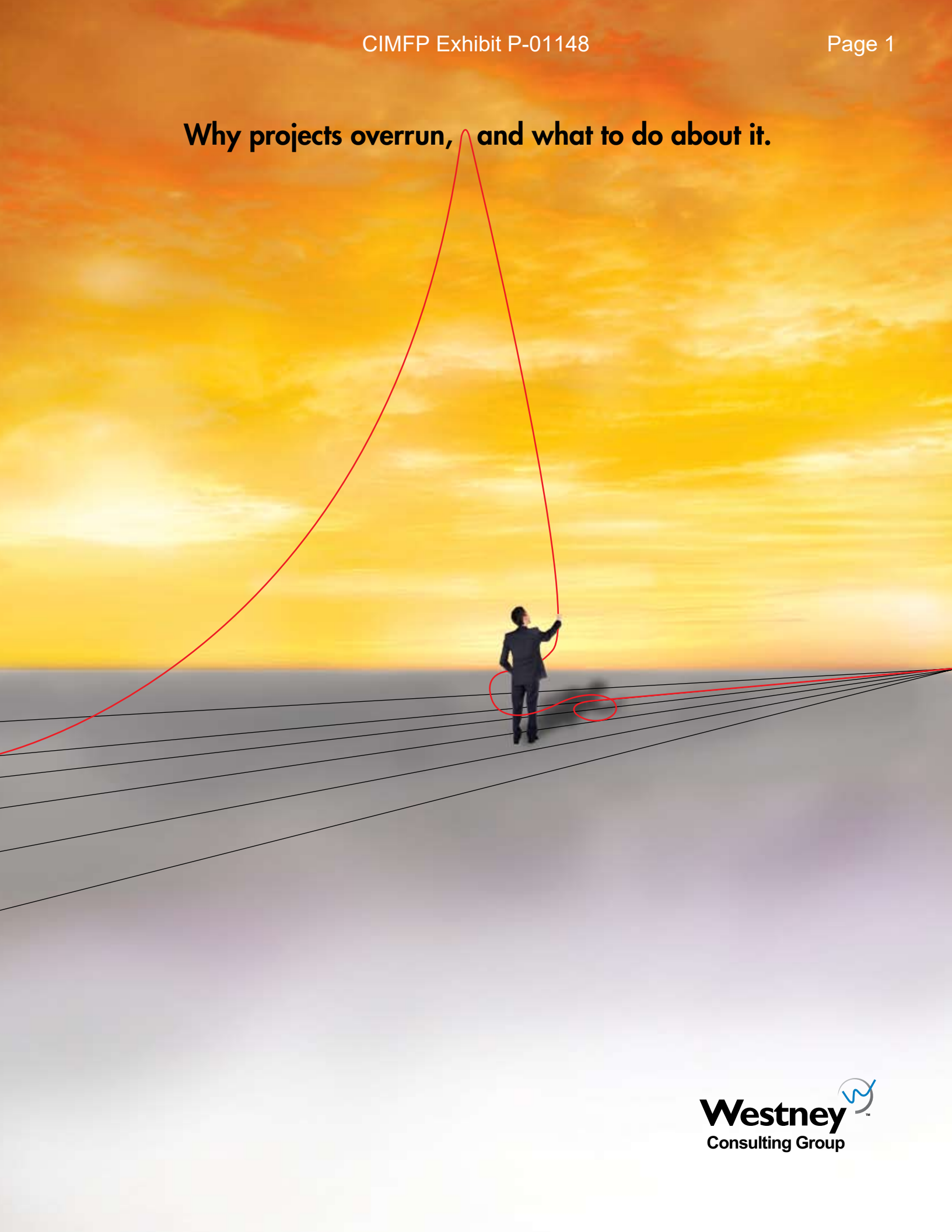
Why projects overrun, and what to do about it.



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A Challenging Time for Capital Projects

In spite of the excitement of $100/bbl oil, the energy industry today faces unprecedented investment risks. According to the International Energy Agency (IEA), worldwide investment in energy infrastructure is projected at $22 trillion (un-escalated) between now and 2030—roughly $1 trillion/year. With capital investments growing at a compound annual growth rate of 36% (see Figure 1), it is evident that the high levels of activity, pricing, and cost uncertainty now being experienced will be with us for the foreseeable future. And much of this investment will be on very large projects involving complex technology and difficult locations.

Relative CAPEX Investment

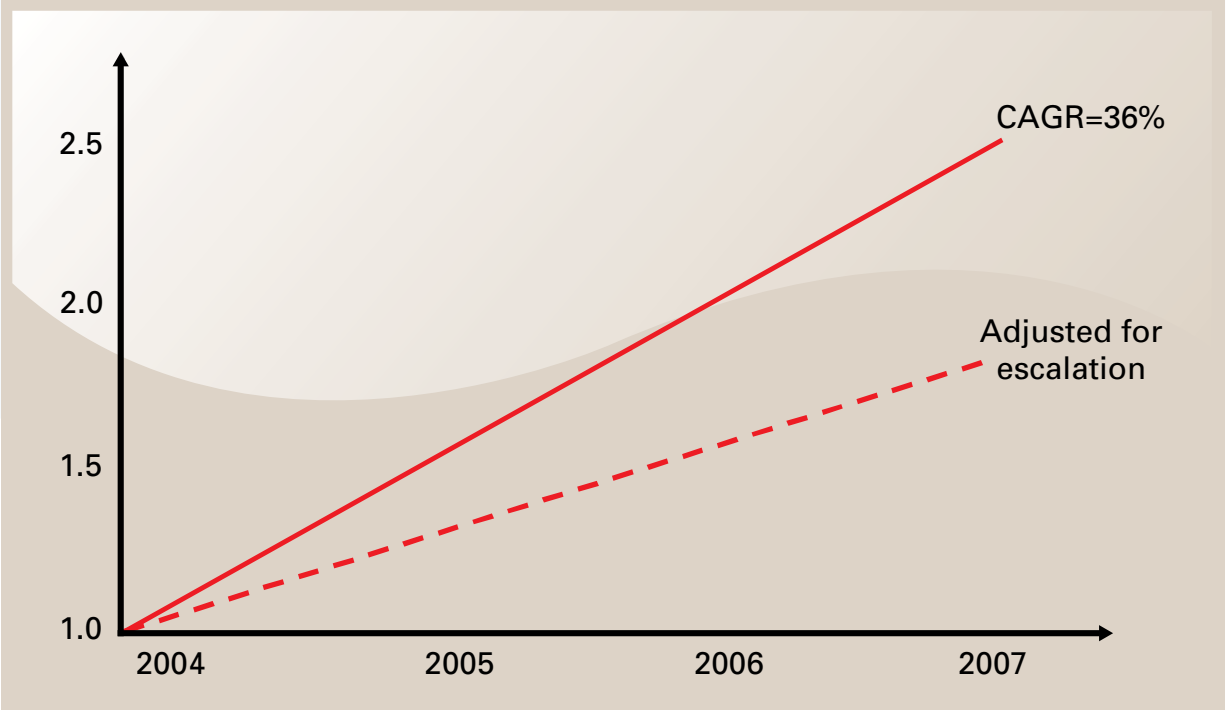

Figure 1:
High levels of investment in energy infrastructure will continue.

Industry executives are, naturally, more concerned about CAPEX predictability than ever. Consider a recent report from Booz Allen Hamilton(1) indicating the majority of energy industry executives:

- Are dissatisfied with project performance (40% of capital projects overrun); this level of dissatisfaction is the highest ever.
- Agree that poor project performance is not acceptable when the market expects predictability and strong returns.
- Accept that they cannot afford to miscalculate project risks, yet they do not have a good grasp as to how to manage them.

There is good reason for these concerns. While there is no shortage of examples, Shell's Sakhalin II project is instructive. A huge and complex oil and gas production project at Sakhalin Island (off the east coast of Siberia), the project was sanctioned in 2003 at $10 billion (a value that exceeded Shell's net income for the prior year). Two years later, with the project well into construction, Shell issued a 6K report announcing the cost had doubled to $20 billion (today it is over $22 billion). One does not have to look far for other examples. Many projects in the Canadian oil sands have experienced 50% to 100% cost overruns, as have numerous offshore developments, refineries, and pipelines.

Effective project risk management in this environment requires early indicators of the major risk factors. What if Shell or the oil-sands operators had had a risk management system that alerted management of these potential cost trends well before sanction? What decisions might have been made differently?

Clearly, competitive advantage accrues to those organizations that can optimize ROCE and risk in the CAPEX portfolio. Consider the following quote:

> *"A company with good risk management can actually take greater project risk and (yet) have lower overall enterprise risk."*
> *Jim Hackett, CEO, Anadarko Petroleum Company*

How is this possible? The answer lies in an approach that meets head-on the root causes of cost overruns and provides practical risk management solutions at both the project level as well as for the overall CAPEX portfolio.

Why Projects Overrun

Everyone in the industry is aware of the major cost overruns and schedule delays associated with major projects today. An often overlooked fact is that these overruns are often announced when projects are well into construction—long past sanction and at a time when traditional project risks have (or should have) been mitigated. How is this possible when conventional wisdom suggests that all project risks should have been understood and under control by this time?

Conventional project risk management is based on two assumptions:

- Good "front-end loading" ensures a high level of confidence in the estimate of time and cost at sanction.
- Project risks decrease with time and progress.

Since it is not uncommon for projects with good front-end loading to experience major overruns well after sanction, we must ask, "What is missing from the conventional approach?" We suggest that improved predictability requires an increased emphasis on two critical factors:

- Strategic Risks

  Standard practice for project teams has long been to assess the risks they can control by setting ranges around their deterministic estimate of cost or duration. This practice discourages the use of early risk assessments and tends to anchor project teams to optimistic early estimates. And project teams, quite properly, focus on the project-level, tactical risks they can control. Assumptions, exclusions, and qualifications are made to establish a basis for their project-level, tactical risk analysis.

  Failure to recognize strategic risks means that executive management never gets a true picture of the extent and potential impact of *all* project risks, particularly the strategic risks whose impact can be devastating.

- Volatility

  Conventional project risk management assumes that risks are diminished with time and progress.

  Strategic risks (unlike project-level, tactical risks) are not generally correlated with definition and their volatility may well increase over time. Failure to recognize volatility means that the uncertainty surrounding project risks, particularly at sanction, is likely to be greatly understated.

Figure 2 indicates the difference between the conventional approach and the proposed approach that accounts for all project risks. The converging black lines represent the traditional assumption that the magnitude and uncertainty of project risks are significantly reduced with time and progress. This assumed "tunneling" suggests that any risks not considered in the deterministic estimate and covered by contingency need not be included in project economics or funding. Strategic risks (the dark-blue dots) are considered outliers, and generally ignored until they occur. (The recent best-seller *The Black Swan* by Nassim Nicholas Taleb addresses this phenomenon quite well.)

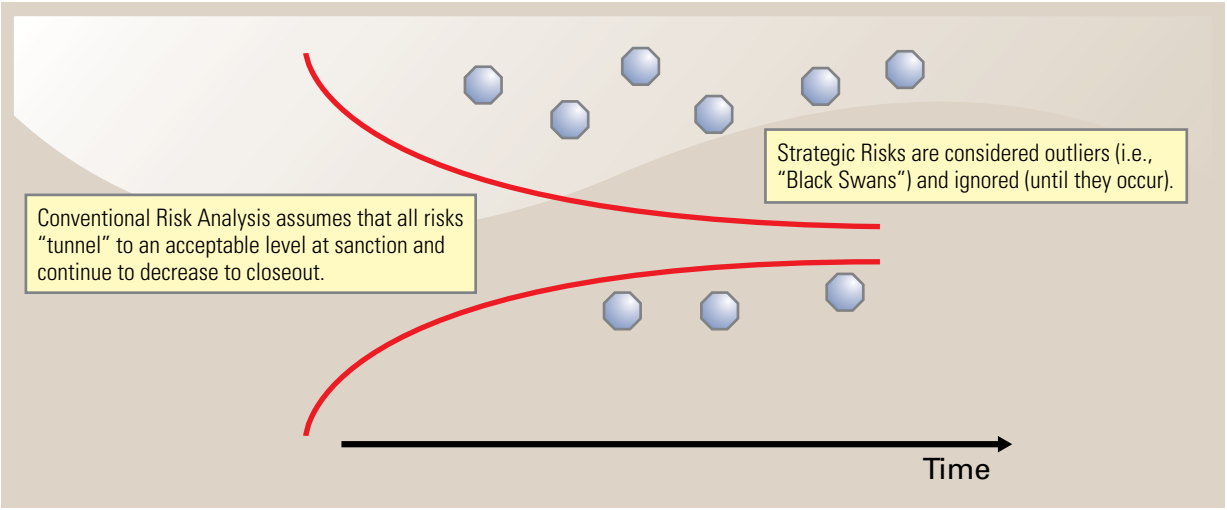

Figure 2:
Conventional project risk analysis assumes risks decrease with time and treats strategic risks as outliers.

Clearly, **conventional project risk management is no longer sufficient for today's CAPEX portfolio.** Although conventional practices are well-suited for project-level, tactical risks and for calculating project contingency, what is needed is a new methodology for addressing strategic risk management for capital projects.

Figure 3 illustrates how conventional (tactical) risk management, focused at the project manager level, was appropriate for the typical CAPEX portfolio up to year 2000 or so. There is a rich body of knowledge around the management of projects and project-level tactical risks. But, as projects become larger and more complex, Strategic Risk Management, focused at the executive level, becomes critical. Here the body of knowledge is quite limited, and new ideas are needed.

Figure 3: Strategic Risk Management is needed to address the size and complexity of today's projects.

Projects overrun because most owner and contractor organizations lack a practical and disciplined approach to Strategic Risk Management – as a result, strategic risks and volatility are seldom understood or mitigated effectively.

A Risk Management Taxonomy

It is useful to separate project risks into two categories—tactical and strategic, as described below.

- Tactical risks – These risks are covered by cost and schedule contingency and managed by the project team. There are two types of tactical risk:
  - **Definition risks** – Associated with the degree of design development and planning definition for the given project scope.
  - **Performance risks** – Associated with normal/reasonably expected variations in owner and contractor performance.

  Conventional project risk management techniques, if applied effectively, provide a good solution for identifying, analyzing, and mitigating tactical risks.
- Strategic risks – These risks require executive management attention and are typically ignored or only partially addressed by the project team (who have neither the capability nor authority to manage them). Strategic risks are often considered outliers and excluded from the analysis and mitigation plan. There are two types of strategic risk:
  - **Background (external) risks** – These are typically associated with:
    - Scope changes – Includes changes that will be required to make the facility work but are not included in the basis of design. These are often driven by external risks, such as changes in legislation, infrastructure capacity, or local conditions.
    - Market conditions – Includes both general worldwide economic conditions as well as specific trends, such as worldwide contractor backlog for critical capabilities associated with the project's requirements and location.
    - Location factors – Includes geo-political risks, taxes and regulations, extraordinary environmental conditions, etc.
    - Commercial or partner requirements and behaviors – Includes misalignment of business goals, host country laws and regulations, financing issues, etc.
  - **Organization (internal) risks** – Includes risks typically associated with an asymmetry between size, complexity, location, and risks of a project and the organization's ability to deliver. These risks can be assessed by looking at such variables as:
    - Resource requirements and availability, skills, and ability to be effective.
    - Work processes, methods, systems, and effectiveness for the project's size and complexity.
    - Effectiveness of the governance model.

This simple taxonomy for project risks provides a framework for effective risk management at both the project and portfolio levels.

Risk Management Variables

A risk management methodology must recognize the difference between "risk" and "uncertainty:"

- A *Risk* is a potential event that has a probability and an impact (the higher the probability and/or impact, the greater the risk).

The level of risk will be expressed by *Risk Exposure*, i.e., the potential cost impact of strategic risks beyond what is covered by the deterministic estimate and cost/schedule contingency.

- An *Uncertainty* is a measure of the range of likely values (the more uncertain we are, the larger the range).

The level of uncertainty will be expressed by *Volatility*, i.e., the standard deviation of the project's potential cost or schedule outcomes.

It is evident that for large, complex, international projects, the greatest exposure and volatility is likely to be found in strategic risks.

The Risk Map

The intersection of exposure and volatility provides a new way of looking at project risk which is called the risk map (see Figure 4).

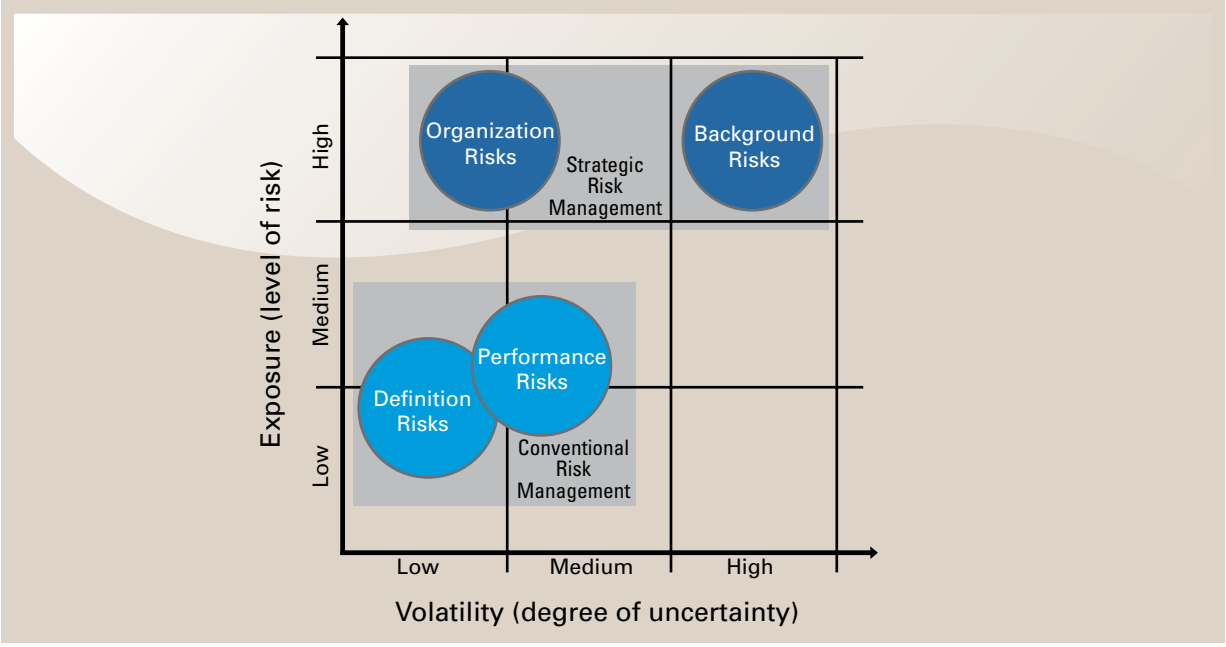

Figure 4: Strategic Risk Management is needed to address the size and complexity of today's projects.

The risk map illustrates why conventional risk management, which focuses on project-level definition and performance risks, often fails to account for the strategic risks that have the greatest volatility and impact.

CAPEX Portfolio Risk Management

If strategic risks and volatility have been assessed for each project in the CAPEX portfolio, some useful variables and risk maps can be developed to enable improved portfolio-level planning and decision-making.

CAPEX Portfolio Risk Management is based on two variables:

- CAPEX VaR™ – (VaR = "Value at Risk") is an aggregation of the risk exposure of each project in the portfolio.
- CAPEX Volatility – Is an aggregation of each project's volatility; a measure of the uncertainty of the expected capital cost of a given project or the overall portfolio.

If the results of the calculation of each project's risk exposure and volatility are aggregated (using appropriate statistical analysis techniques), the result is a mapping of CAPEX VaR™ and CAPEX Volatility for a group of projects. For example, projects in a given country can be aggregated for a view of the country portfolio, and these country portfolios can be further aggregated to create the risk map for the region. The aggregation process can continue until the overall CAPEX Portfolio Risk Map is obtained.

The use of CAPEX Portfolio Risk Maps is illustrated by Figures 5, 6, and 7 that assume a portfolio of projects in Africa. Here we see the risk map as it appears for month #1. The company has projects in three countries and, in each country, there are two or more projects.

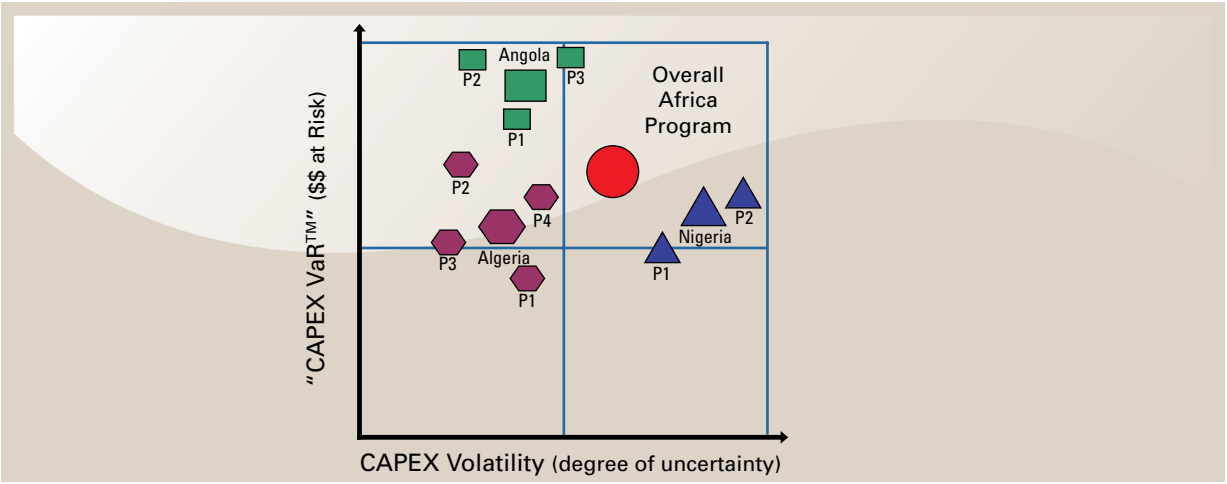

Figure 5:
Risk Map for month #1 for the portfolio of projects in Africa.

In month #2, the risk assessment for each project has been updated and aggregated into the country and region portfolio, resulting in the updated risk map shown in Figure 6.

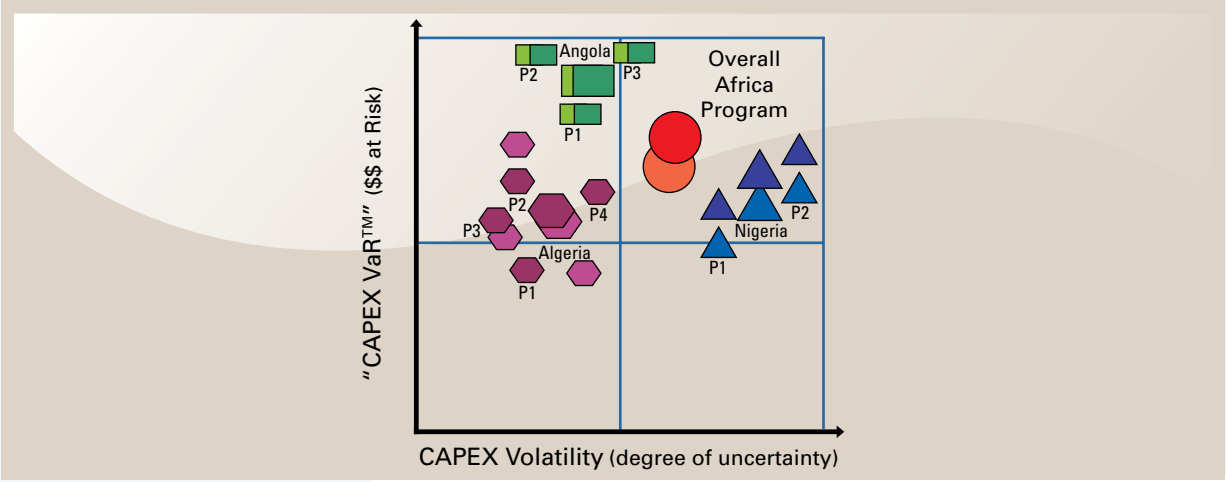

Figure 6:
Risk map for month #2 for the portfolio of projects in Africa.

Consider now the use of the CAPEX Portfolio Risk Map to assess the potential impact of new opportunities on the overall Africa region portfolio. In this example, two new projects are being considered—one in Libya and one in Equatorial Guinea (EG). The risk exposure and volatility for each project can be assessed and then aggregated to the country and regional portfolio levels. The potential impact of these projects is illustrated by the risk map shown in Figure 7.

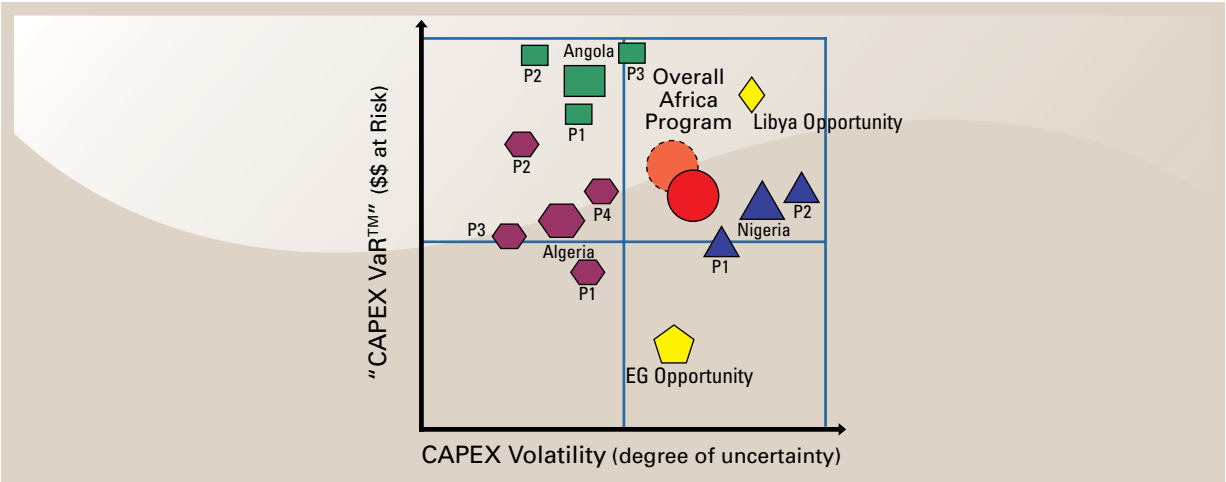

Figure 7:
Risk map showing the potential impact of two new projects on the Africa portfolio.

This type of display provides useful information for strategic decision-making. If the company decides to continue to pursue one or both opportunities, the results of the risk framing provide clear direction as to how the new investments will impact CAPEX VaR™ and Volatility.

Benefits to Project and Portfolio Managers

Implementation of Strategic Risk Management benefits individual projects as well as the overall portfolio.

- At the project level – Strategic Risk Management increases the probability of meeting cost, schedule, safety, and operability objectives by:
  - Providing a process for identifying and analyzing those strategic risks that are likely to have significant impact yet are outside the project manager's ability or authority to control.
  - Identifying the project's volatility so as to understand which risks are unlikely to be reduced with time and the inherent variability of these risks.
  - Improving the alignment and communication with partners and the host country by using risk as the common currency of communication.
  - Reducing project financing costs by reducing risks through an effective, state-of-the-art risk monitoring and surveillance capability.
- At the corporate/portfolio level – Strategic Risk Management improves CAPEX predictability and performance (ROCE or equivalent metrics) by:
  - Providing a risk-based portfolio view of capital projects for enhanced strategic decision-making (such as new country entry, level of investment in a given project, pace of development, field development plan selection, etc.).
  - Highlighting the strategic risks at the portfolio, region, and project levels that must be addressed at appropriate management levels of the organization.
  - Providing an early indication of an individual project's risk exposure and potential requirements for additional funding or alternative project funding mechanisms.
  - Improving the identification of "windows of opportunity" to capture favorable trends in market conditions and improve time to first production.

About the author

Richard E. Westney is Chairman of Westney Consulting Group which he founded in 1978. Author of five books on project management, he has served as visiting faculty at Texas A&M and Stanford Universities, as well as the Norwegian Institute of Science and Technology. Currently a member of the Executive Board of the Engineering & Construction Contracting Association, he is also a Fellow and Past President of AACE International (The Association for the Advancement of Cost Engineering) and received AACE's highest honor, the Award of Merit. He is a graduate of the City College of New York, Rensselaer Polytechnic Institute, and Harvard Business School.

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