CSC

Project Management Services

Quality Decisions Using Risk Management

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What We Do

CSC Project Management Services is a partnership of experienced engineers, scientists, economists and computer analysts. We assist corporations and institutions in making quality decisions on major undertakings of all types. Our primary tool is the application of probabilistic risk analysis.

Our "hands on" approach uses both traditional and modern group facilitation processes to frame problems, identify plausible strategies, assign decision logic to temporal scales, prepare probability and sensitivity models, quantify uncertainties, conduct assessment measurements and deliver defensible risk adjusted outputs to allow users to move confidently forward.

Our workshops and assessment sessions are conducted in a managed and structured environment. We use rigorous and defensible interview techniques to get balanced and objective input from corporate participants ("experts"). Our objective is to utilize individual and collective synergy to define the issues, to comprehend and quantify uncertainties and bring forward knowledge, experience and understanding for appropriate consideration and inclusion in the risk analysis.

At the conclusion of our process, there is a better understanding of the "big picture", unmade decisions are more clearly identified and real opportunities are identified and communicated to improve on team or corporate performance. In a sense, former intangibles have now become tangible--in terms and of time and money. The path forward remains challenging, but much clearer and well defined.

Who We Are

Stan Wilson, ***P.Eng., PMP***
Stan is the founder of *CSC* Project Management Services. He has over thirty years experience in the management of consulting engineering, heavy civil engineering, and pipeline construction at both implementation and corporate levels. He is one of Canada's leaders in the application of Risk and Decision Analysis techniques for strategic planning.

Dave Evans, ***Ph.D., P.Geol.***
Dave is a Senior Consultant for CSC. He has over 30 years experience in mining, petroleum, pipelines environmental and alternative dispute resolution practice. His expertise is in strategic management, risk analysis, regulatory and environmental management, and group facilitation.

Chris Coulthard, ***B.A.***
Chris is a Senior Consultant with extensive experience in the development of Risk Analysis models for planning, as well as the implementation of project management, cost control, and cost estimating systems in a corporate environment.

Ian Henderson, ***M.Sc., P.Eng., SPE***
Ian is a Senior Consultant for CSC. He has 30 years experience over a broad range of development, operations and strategic management in the oil and gas industry, with expertise in petroleum engineering management.

Roger Brundrit, ***M.Sc., P.Geo.***
Roger is a Senior Consultant for CSC. He has over 30 years experience in the oil and gas sector with a background in successful exploration strategies. He has

international experience developing world-wide corporate strategies.

Bev Ostermann, ***M.Sc, P.Eng.***
Bev is a Senior Consultant for *CSC*. He has over 30 years of experience in the areas of cost estimating, cost and schedule control, engineering, systems development in engineering disciplines, and senior corporate management functions.

Phillip Jones, ***B.A.***
Phillip is an Analyst with *CSC*. Phillip has a background in economics and has extensive experience developing Monte Carlo risk models for a variety of projects.

Introduction to the Process

Planned undertakings (projects) are always fraught with risk; uncertainties in markets, competition for resources, technological change, and economic forecasts. Managers (Decision Makers) must confront particularly difficult hurdles in exploiting new technologies and ensuring quality and productivity in research, design, implementation, operation and closure.

The present day complexities and inter-relationships of uncertainties require that management maintain its credibility not only with owners and regulators but also with stakeholder interests and the financial community-- all of whom are challenging the corporation's ability to anticipate and deal with risk.

Risk and decision analysis has been applied to many different types of business strategies. Simulations quantifying the impacts of potential economic and physical environments have been constructed for a variety of activities, including process plants, pipelines, portfolio analyses, safety, transit systems, environmental, mining projects, and oil and gas.

Problems with Traditional Approaches

Traditional design and planning sets out a logical step-by-step process which leads through scoping, detailed design, planning, resource lists and capital and operating cost estimates. Inherent in this process are assumptions about each of the variables and a single point estimate for outcomes, costs, revenues, etc.

Range estimating (cost) is sometimes used to develop a deterministic or probabilistic distribution of an activity outcome, but it does not provide full comprehension of the risks (and opportunities). Further, it does not identify rationale for the range in values, nor does it develop correlations or integration between contributing risk issues and predicted values. CSC addresses correlation analysis through the use of *conditioning variables* to capture and quantify such issues to measure a fuller and richer range of potential outcomes.

The traditional decision analysis process will ultimately lead to surprises--for scope, cost, time and unscheduled events. The single point answer is never right, but will fall within a range of values.

The Benefits

CSC's approach to risk analysis often raises questions that challenge embedded assumptions and biases. Increasingly, corporations or institutions must defend and communicate the basis for decisions and their potential impacts.

The assessment and analysis of future or planned activities in their uncertain environments using probability analysis techniques provides insights and opportunities which are not clear or easily explained using the more traditional "single point" design and estimating methodologies. Potential risk mitigation actions are usually identified early in the CSC process, so the value of actions can be determined, ranked and scheduled.

Preparing and conducting risk analysis to improve decision-making at the formative stages of projects provides significant benefits to owner organizations.

Risk Analysis expands and enhances conventional analysis by moving,

- from a technical focus to a comprehensive view of all sources of uncertainty;
- from a single set of base case results to a probability distribution of results;
- from limited identification of risk variables to extensive sensitivity analyses of all the underlying risk issues and;
- from a single project alternative to the analysis of several alternative strategies.

The greatest benefit can be achieved by Risk Analysis,

- if properly and comprehensively conducted, using a broad group of experts;
- if an impartial or disinterested perspective can be gained using outside independent expertise;
- if influence diagrams and computer models properly reflect the logic and interrelationships between risks and results; and
- if rigour and structure are applied to the risk assessment process.

The most significant benefit from a complete risk analysis is improved communication about both ***risks and opportunities***. The structured interview process used by CSC avoids in-house biases and provides a defensible basis for mitigation and improvement, while allowing management to focus on the most important issues in the planning effort.

A properly structured analysis will help avoid hidden pitfalls attached to downside risk, and will highlight real and quantifiable improvements by revealing the "upside opportunities". This is the essence of the Risk Analysis Process. It is a different way to plan and to bring confidence and quality to decision making.

The use of a probabilistic risk analysis process allows the decision-maker to view a planned or future activity in its uncertain environment and to evaluate the likelihood of various outcomes in that environment, thereby allowing a proactive approach to the planning activity.

Risk Analysis is the centerpiece of a Risk Management Process

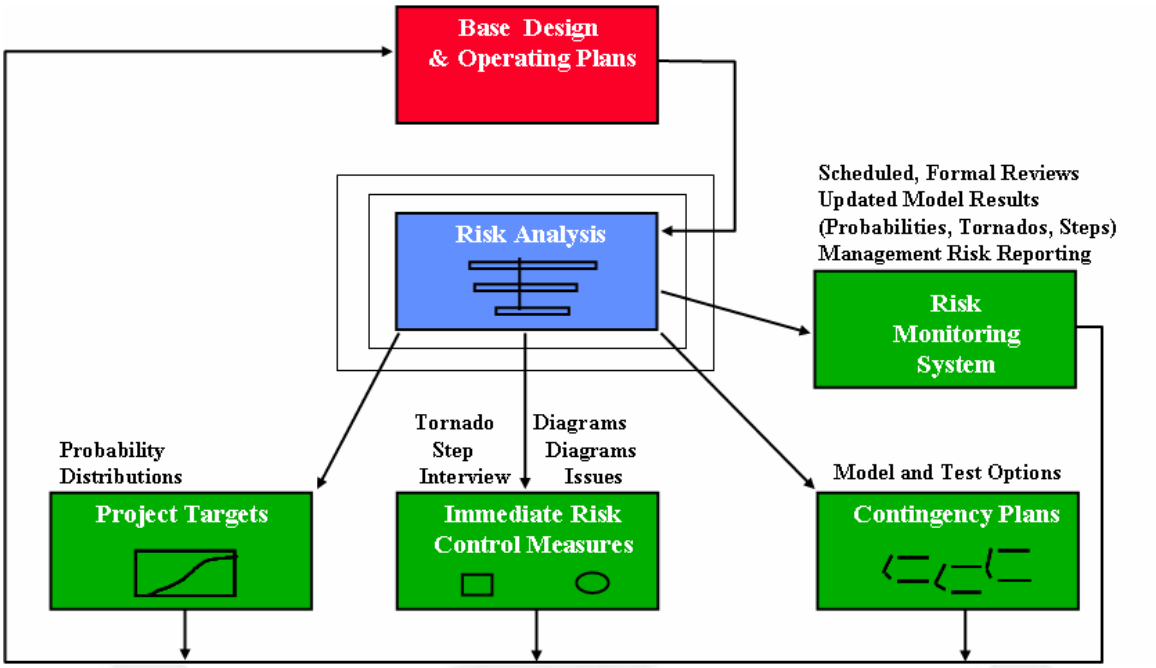


Figure 1

Figure 1 illustrates the Risk Management process and the central role of Risk and Decision Analysis.

Much more than the range of expected outcomes is produced by a properly structured risk analysis.

First, there is a significant benefit in the insights and understandings gained about the risks. *This usually leads to immediate changes in future direction,* either in the form of design or configuration changes or other fundamental plan revisions.

The second benefit from a structured analysis *is the development and review of contingency plans*. By defining potential future changes in a given working environment, the ability is created to test "what-if" scenarios for an appropriate response by team experts or group members prior to implementation.

A third benefit is the basis for risk monitoring of an activities life cycle.

Finally, analysis of the risks as the project proceeds is provision of an ideal mechanism to forecast the end cost and time results, allowing confident establishment of contingency estimates.

How is Good Risk Analysis Done?

Risk and Decision Analysis follows a fully structured and rigorous process.
Figure 2 illustrates the five step process, from framing the problem to the implementation action.

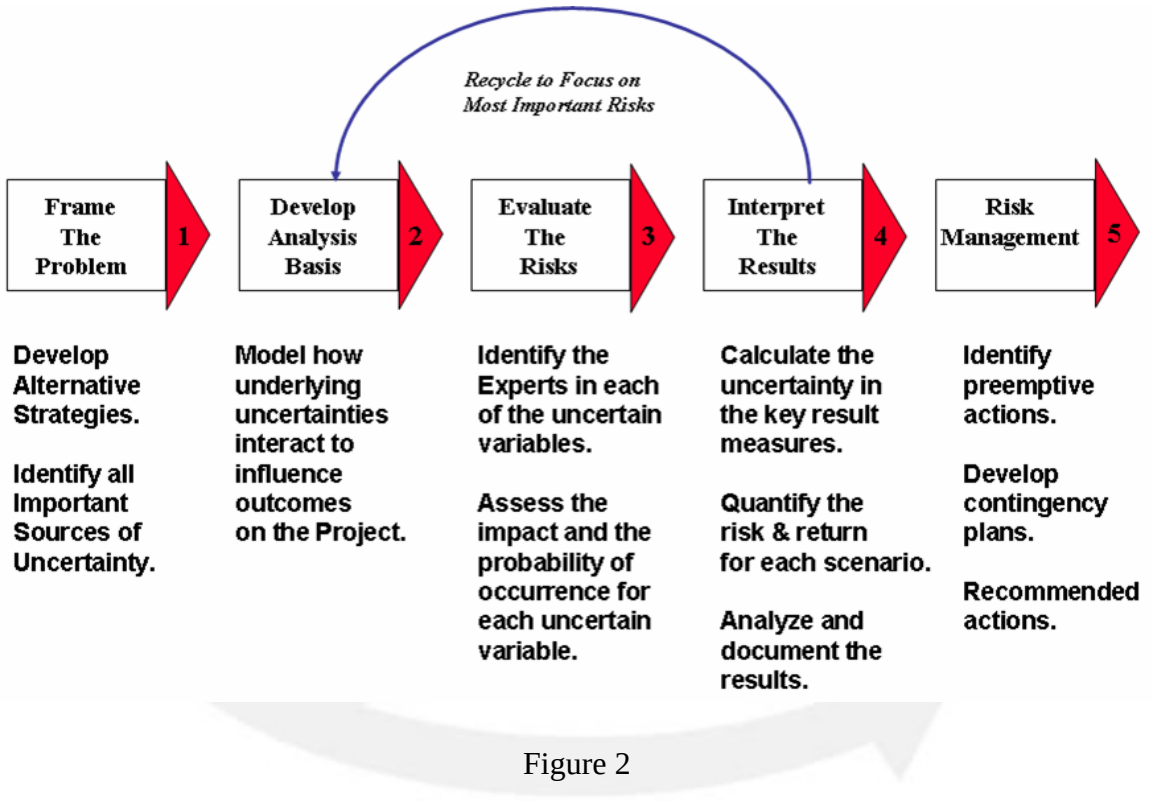


Figure 2

Frame the Problem

Framing the problem is the first step in the process. Three techniques are used during this step.

- The strategy table (see Figure 3) clearly lays out the decision options and the alternatives to be analyzed.
- The decision map (see Figure 4) provides understanding on temporal relationships and outstanding decisions in the life cycle.
- The influence diagram (see Figure 5) graphically illustrates the relationship between uncertain variables and the anticipated or expected key results.

Reaching agreement on these three deliverables by the experts and Decision Makers is needed before proceeding with the analysis.

A Strategy Table clarifies the alternatives to be studied on a single document.

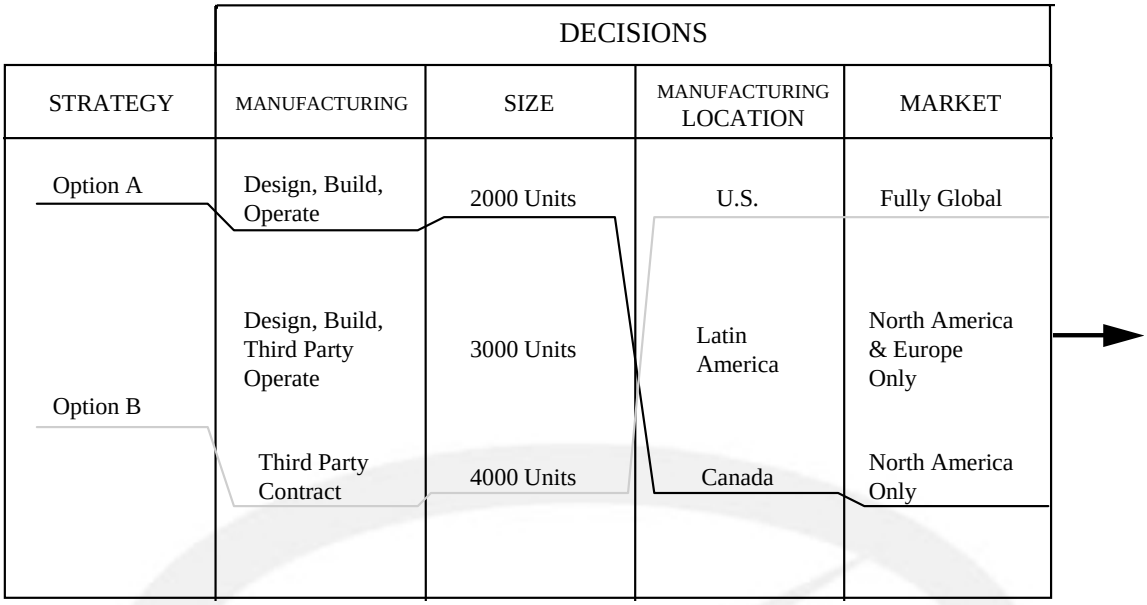


Figure 3

The Decision Map shows the decisions that must be made to achieve the milestone dates of the project..

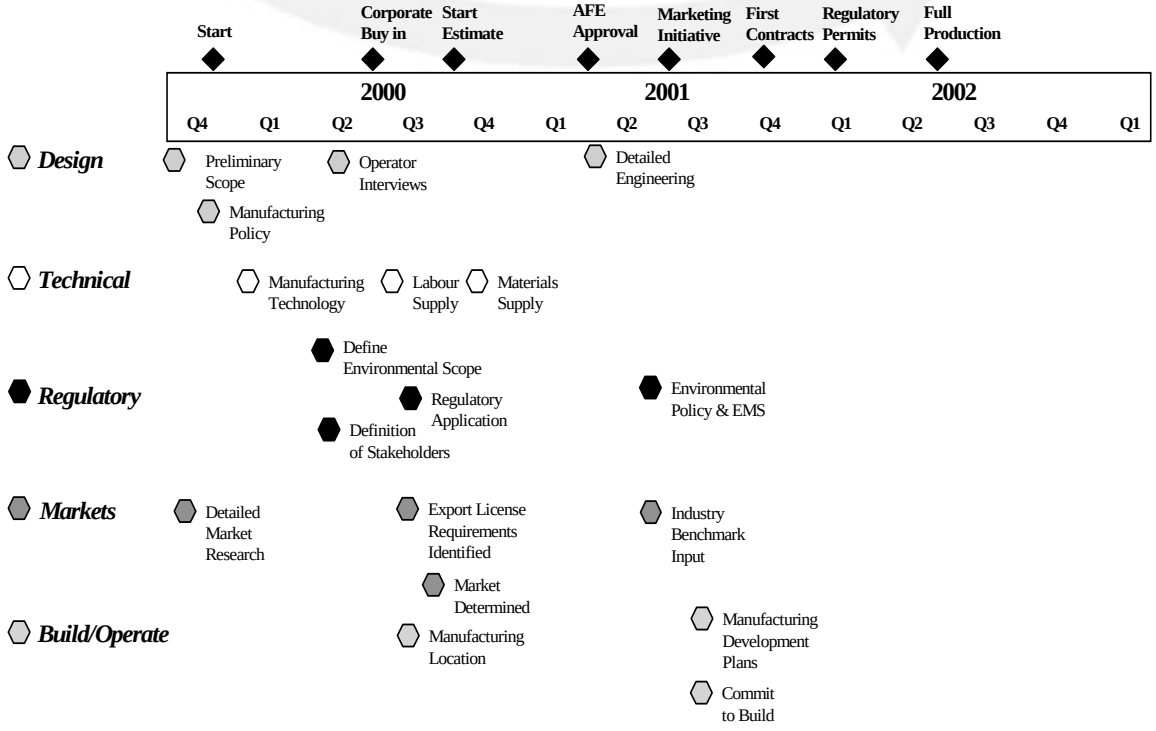
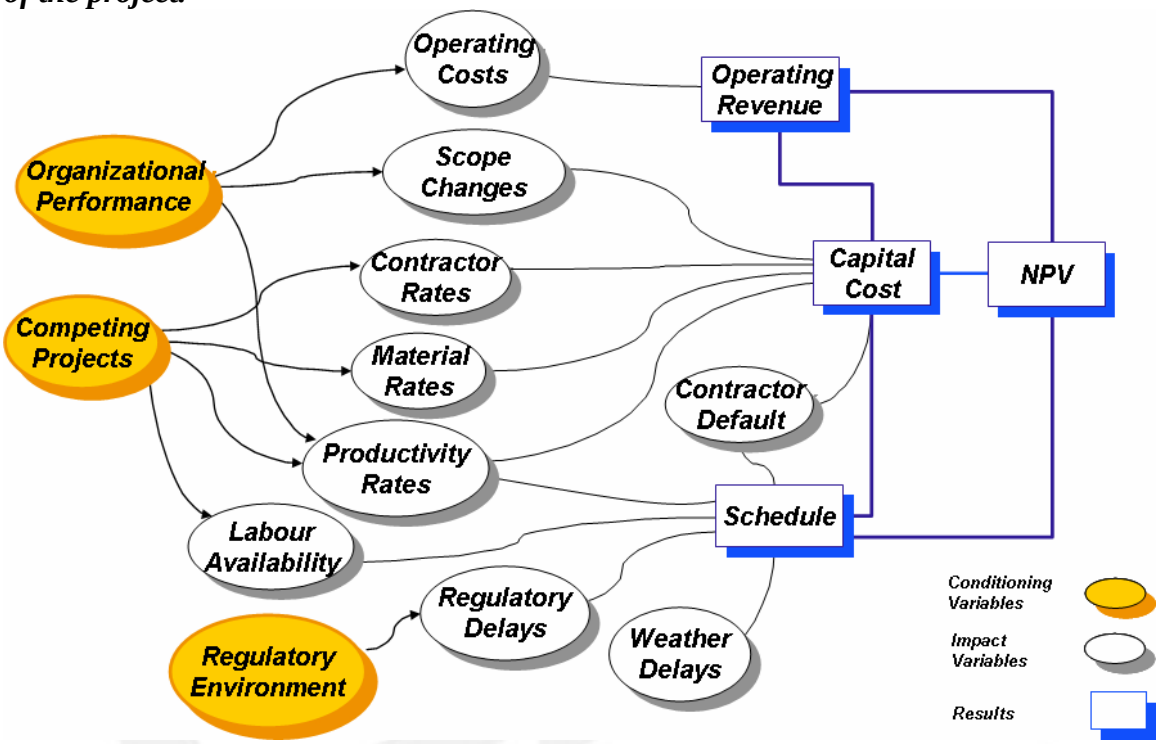


Figure 4

The Influence Diagram shows how risks influence each other and the ultimate value of the project.



Develop the Risk Analysis Basis

Modeling the working environment or operational setting is an important second step. The "Risk Model" is designed to measure the impacts of changes in value of the uncertain variables upon the expected value of each alternative, or upon the intermediate results which make up that value, such as cost, productivity, schedule, completeness, etc.

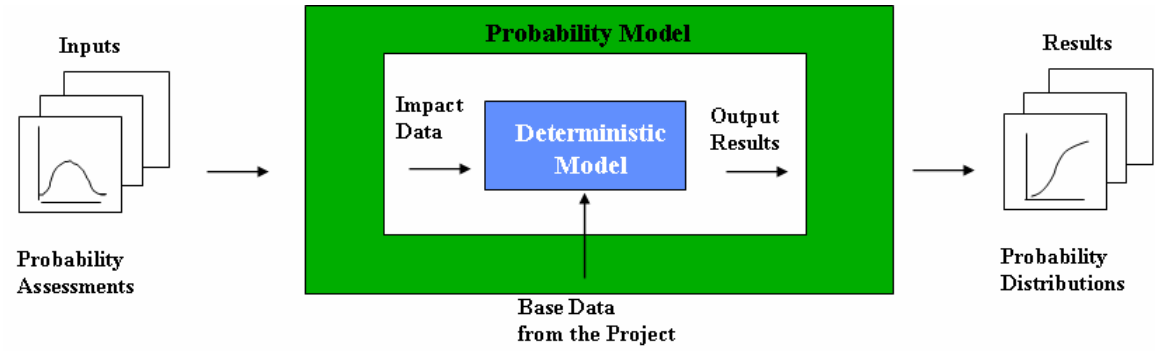


Figure 6

Evaluate (Assess) the Risks

The risk evaluation step is the key to success of the risk analysis process. The quality of the analysis is dependent on the experts' judgments. It is important that experts are selected or included based on both their level of knowledge and their credibility with the decision maker or owner.

The *interview process* (risk assessment sessions) also serves as an inter-disciplinary forum for the experts or group members. The individual areas of skill or excellence come into play to provide understanding, coherence and validation.

Interview techniques and facilitation are designed to avoid biases in the experts' judgment. Outside expert opinion is often used to bring an independent view on the important and critical variables. The experts are asked to provide both probabilities of occurrence and the quantification of the impact of each variable on the project results.

Concise definitions of each variable are necessary to ensure all experts have the same understanding and assumptions before the probabilities are assessed. It is also important that the "soft" variables (i.e. *conditioning* variables) which provide the underlying conditions for assessments are defined using some quantifiable scale.

Once definitions are agreed upon by the experts, probability ranges and a description of the environment which would lead to the extremes (*best, expected, worst*) are provided. Sharing these "stories" provides an important communication function between experts. Documentation of the assessment and the insights behind the extreme values are both important factors when considering ways and means to mitigate the risks.

Interpret the Results

The interpretation step involves running the analysis model to determine the key risk contributors and to compare decision and strategy alternatives on a "risked value" basis.

Cumulative probability curves are used to compare alternatives. Probabilities of achieving required results can be read directly from the chart.

Figure 7 shows an example of a comparison of two options. The significant upside opportunity for Option B would not be apparent in a single point analysis which would assign the same value to both options.

Figure 8 illustrates the different understandings of a strategic option by individual experts. These differences demonstrate the range in values placed on the option from the expert disciplines.

Early interpretations are provided to the experts. This is the "reality check" or further validation and often leads to review and reexamination of the most critical variables.

Comparing options on a Probability Curve clearly illustrates Risk/Opportunity tradeoffs. Option B has slightly more downside risk than Option A, but a much greater upside opportunity.

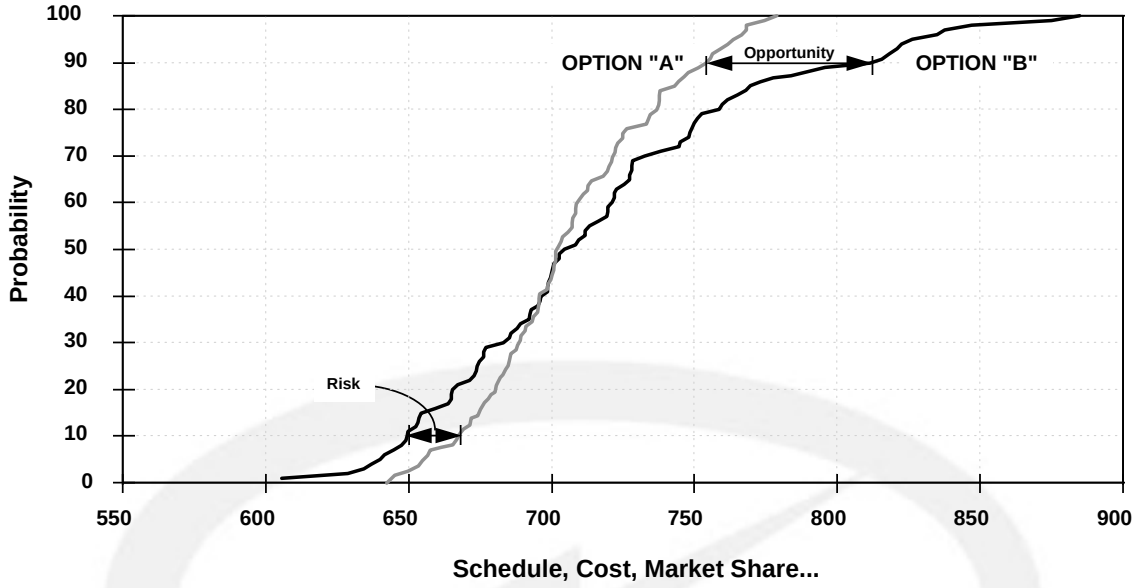


Figure 7

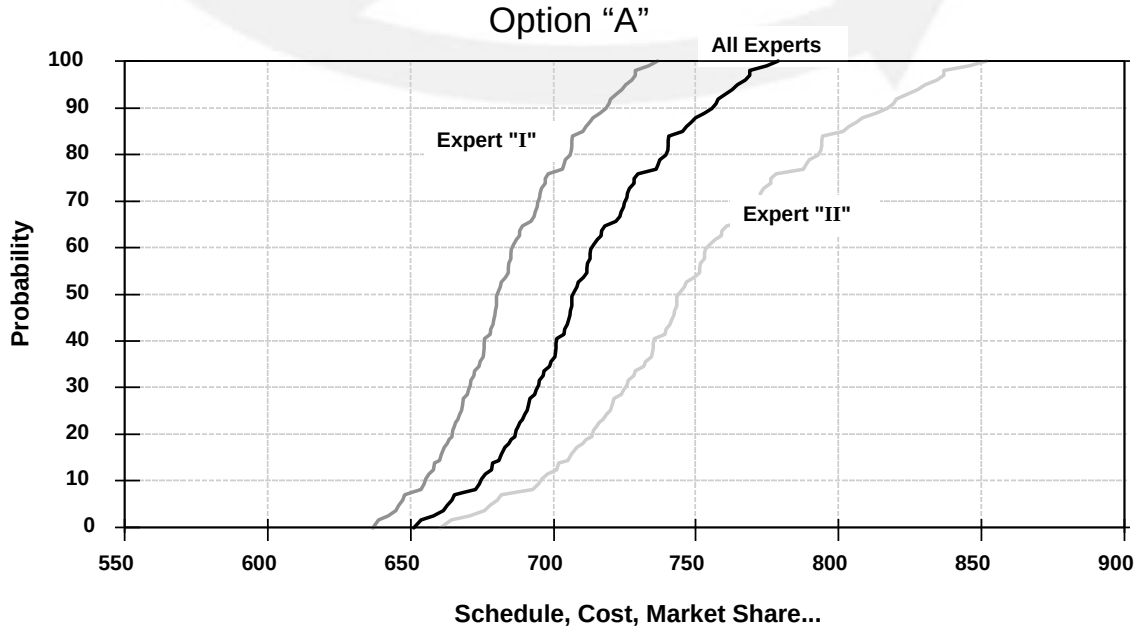


Figure 8

Comparing sensitivity analysis charts indicates the key risk drivers which are contributing to the uncertain results.

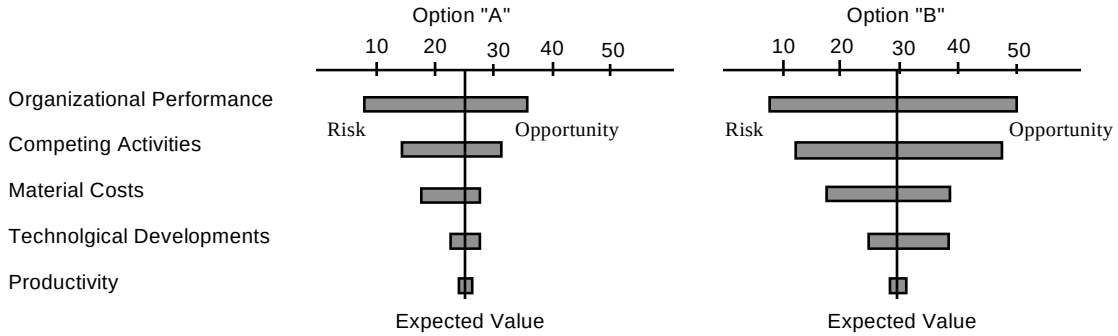


Figure 9

Figure 9 compares the results from the sensitivity analysis for two options to highlight the key risk drivers contributing to the uncertainty in each. Variables are individually set at their assessed extreme values - i.e., 10/90 percentiles, while all other variables are randomly set from their probability distributions. The model then calculates the range in project expected values for each extreme. The delta from the expected value is shown as the end of the bar for each variable.

Figure 10 is a step diagram which identifies areas that contribute to an expected value that is significantly different than the single point base estimate. This can be used as a tool to allocate contingency reserves if desired.

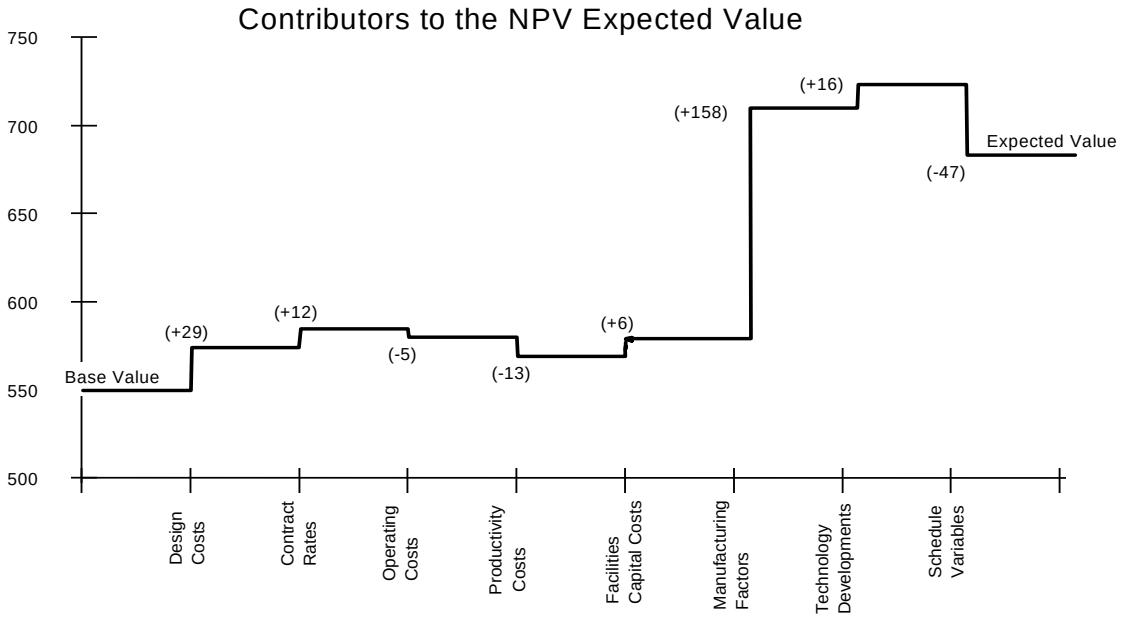


Figure 10

In summary.....

A good risk and decision analysis process takes a comprehensive view of the total life cycle of a future or planned activity within a likely or most probable operational, financial, social or political environment. The "soft" variables such as, "how the organization will perform", or the "quality of operations", or the "political environment" are defined and quantified by expert opinions and judgments and included in the risk analysis.

The application of *"best"* and "*worst"* case scenarios can assist in developing alternative plans and mitigation measures to realize upside opportunities, and reduce or deflect downside risk.

By far the most important benefit is the improved communication about uncertainty, and an understanding of how to measure and plan for mitigation of the high impact issues.

Some Examples:

At CSC we have used risk analysis on a variety of large and small future or planned activities. Some examples include:

Shell Athabasca Oil Sands Project – combined the risk analyses of the major projects into an overall risk analysis of this $5.0 billion project, to assist owners in decision making.

Calgary Northwest Light Rail Transit Extension - analysis of project cost and schedule, development of detailed schedules to overcome identified problems leading to acceleration of the project to meet '88 Olympic opening date.

Alberta Energy Company - strategic planning for operating and safety issues for a natural gas storage cavern project. Potential failures in mechanical operations were identified and tested to determine the probability of an extreme failure event.

Foothills Pipelines - the focus and attention on permafrost design was enhanced when the analysis indicated significantly more permafrost than the initial design basis. Construction plans were altered to reduce capital costs by extending the schedule in a resource competitive contracting environment.

B.C. Transit – analysis predicting ridership on the future Richmond to Vancouver extension provided an improved and shared understanding of the important risk variables on this project.

Suncor Millennium Oil Sands Project - comprehensive risk analysis used in the decision making process to develop the incentive formulas for sharing risk rewards with the contractor alliance team..

Billiton Maatschapij Surinam, Lelydorp III Expansion - risk analysis of proposed new bauxite mine, assessing alternatives and identifying risks/opportunities and areas for mitigation planning.

Imperial Oil Limited – Oil Sand Extraction Process research decision analysis, assessing alternative extraction processes to determine areas of research required to define capabilities of technologies and potential prizes for pilot programs.

YPFB Bolivia - Study of alternative strategies for the corporate reorganization and privatization of Bolivia's national oil company.

Sable Gas Development Project (Ongoing) - Risk and Decision Analysis used to enhance the early strategic planning on this offshore gas development joint venture. Sizing and scheduling uncertainty options were analyzed and interpreted.

Imperial Oil Resources Ltd. - Strategic framing, planning and costing were analyzed for reclamation, restoration and decommissioning of a petroleum producing facility in the NWT. Key cleanup cost uncertainties were identified for further review and project mitigation planning.