REAL OPTIONS IN TELECOMMUNICATIONS

FIRMS PRACTICING REAL OPTIONS CAN STEER BIG, COMPLEX, MULTI-STAGE INVESTMENTS IN DYNAMIC MARKETS. THEY DO THIS USING A RANGE OF PLAUSIBLE SCENARIOS AND MULTIPLE STRATEGIES. THEY PURSUE ACTIONS THAT ARE ROBUST TO THE RISKS AND UNCERTAINTIES. REAL OPTION VALUATION DRIVES THEIR CAPITAL BUDGETING. THEY KNOW THAT AN IMPORTANT DRIVER OF VALUE IN ASSETS IS INBUILT FLEXIBILITY. A NEW POWER PLANT, A MINING / ENERGY PROJECT, AN R&D JOINT VENTURE, A TECHNOLOGY PLATFORM, A POLLUTION REDUCTION PROGRAM, A NEW PRODUCT DEVELOPMENT, A MULTI-SOURCING STRATEGY ARE SOME OF THE WAYS FIRMS USE REAL OPTION THINKING. **THE STATE OF THE ART.**

STRATEGIS PARTNERS
www.strategispartners.com

PREFACE

At a recent corporate retreat, a senior-level executive of a large company was asked to name his most difficult problem. Instead of citing the new global competition or falling prices, the executive stated simply, “trying to convince top management to approve an investment to pursue an innovative idea.”

Many managers will agree that getting a project through the investment approval committee can be one of the most frustrating and unrewarding experiences of corporate life. Battles wage. Typically, two sides develop. Business developers and strategists, who look at a project for what it might accomplish, are pitted against the corporate financiers and analysts, who look at the project for what and when it will pay back. Often the only result is a stalemate.

This paper [1] explains how some companies are bridging the gap between the two sides. Using “real options” they apply a harder analytic edge to the intangible side of the innovation investment.

Let me describe my experience with real options. Since the 1990s I have introduced the practice of real options to companies in Asia and Australia: airlines, beverage companies, energy producers and electricity generators, infrastructure operators, miners and telecommunications companies. Projects realised a wide range of strategic benefits: better decisions on production capacity expansions, more accurate pricing of assets in competitive auctions, all-inclusive cost-benefit analysis of vertical de-integration, and full value recognition on market entry decisions.

Drawing on this experience and the work of other real option practitioners, this paper explains the practice of real options as:

- **A different way of thinking**: recognising that multiple scenarios and pathways to the future are a better way to manage risks and opportunities than a single view of the future;
- **New analytics for valuation**: taking into account both flexibility and forward market prices – and integrating the processes of formulating strategy and valuing assets;
- **A dynamic decision making process** that involves a strategic conversation between the decision makers, technical and market experts, and the financial analysts – and integrates judgment in strategic evaluation, not just hard data and the facts.

Jay Horton
Managing Director.

[1] The author would like to acknowledge the comments of Dr Adam Borison and Dr Alan Kallir in the preparation of this White Paper.

TABLE OF CONTENTS

QUANTITATIVE STRATEGY UNDER UNCERTAINTY

Some thirty years have passed since Myers (1977) coined the term "real options." Myers' key insight was that since the future is uncertain, it pays to invest in a range of options that allow management to capitalise on favorable opportunities – and mitigate the downside by responding to events over time in a flexible fashion.

Since the 1990s corporate finance and business strategy people started viewing strategy in a quantitative way through a real options lens.

Real Options Analysis is now the new standard for evaluating and managing strategic investment decisions under uncertainty. It recognises that the future is uncertain and changing, and that actions can be taken in the future – under the right conditions – to maximise shareholder value.

WHAT IS REAL OPTIONS ANALYSIS?

Real Options Analysis provides a hard analytic and quantitative edge to strategic decision analysis:

- Establishing a framework within which to value strategies that deal with future uncertainties. When markets, technologies and regulation are changing, real options are more valuable.
- Identifying those decisions which do most to generate higher returns for the company.
- Facilitating innovative and potentially valuable solutions delivering a competitive advantage for the company.

Real Options as a way of thinking strategically

Value is created through identifying, creating, owning, managing, and exercising options such as:

Value is created through identifying, creating, owning, managing, and exercising options.

Planting seeds: Experiment strategically by making a series of small investments, before making the big ones;

Learning actively: Decisions on a program do not always have to be made up front; conduct tests and capitalise on learnings;

Building ramps: Embed options to defer or accelerate, to switch direction at a future stage;

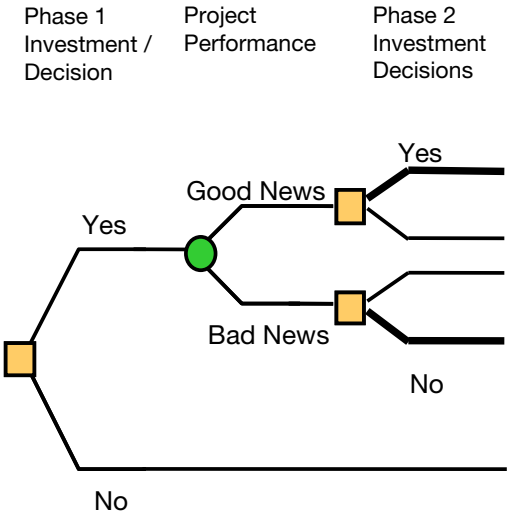
Real options logic has an intuitive sense. Real option thinking recognises that multiple scenarios and pathways to the future are a better way to manage risks and opportunities than a single view of the future.

It advises to move forward in stages when steering investments through uncharted waters: Consider a variety of future scenarios and potential strategies; favour actions that are robust to uncertainties; favour actions that yield useful information; probe, experiment and learn through doing; monitor results and adapt to changing conditions.

HOW DOES REAL OPTION ANALYSIS WORK?

Exhibit 1 illustrates a decision tree for a two-stage investment decision, the simplest form of real option: an initial investment commitment, followed by an uncertain outcome, then followed by the next stage investment decision.

Exhibit 1 – Decision tree for a two-stage investment decision

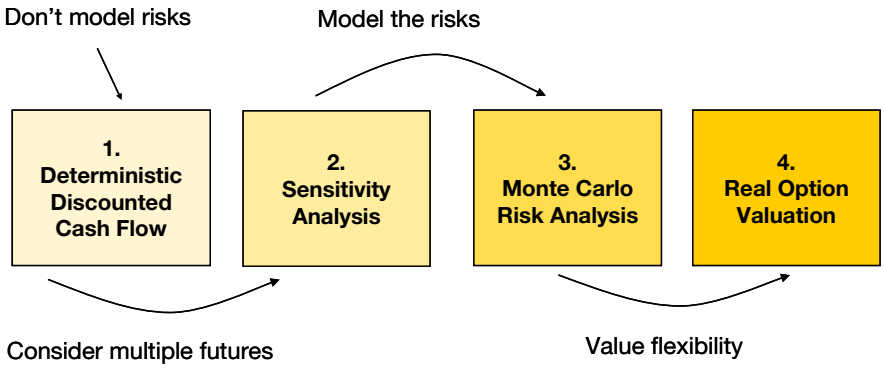


Valuation as an evolving technique

Valuation lies at the heart of investment decision making. "What is it worth?" "How can the full value potential be realised?" Exhibit 2 shows how project investment valuation techniques have evolved over the last two decades.

Valuation lies at the heart of investment decision making

Exhibit 2 – Evolution of valuation techniques

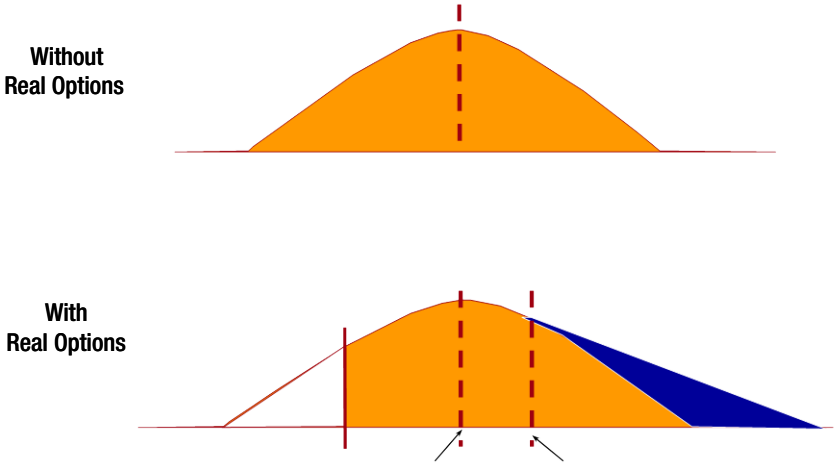


Appendix 1 explains the evolution of valuation via these methods.

Real Options Analysis as the new valuation method

The latest approach to valuation, Real Options Analysis was pioneered in the 1990s in the oil and gas and pharmaceutical industries. Active management of real options creates more value by limiting the downside and capturing more on the upside, as shown in Exhibit 3.

Exhibit 3 – Real Options limit the downside and capture the upside



Mathematical techniques of option pricing

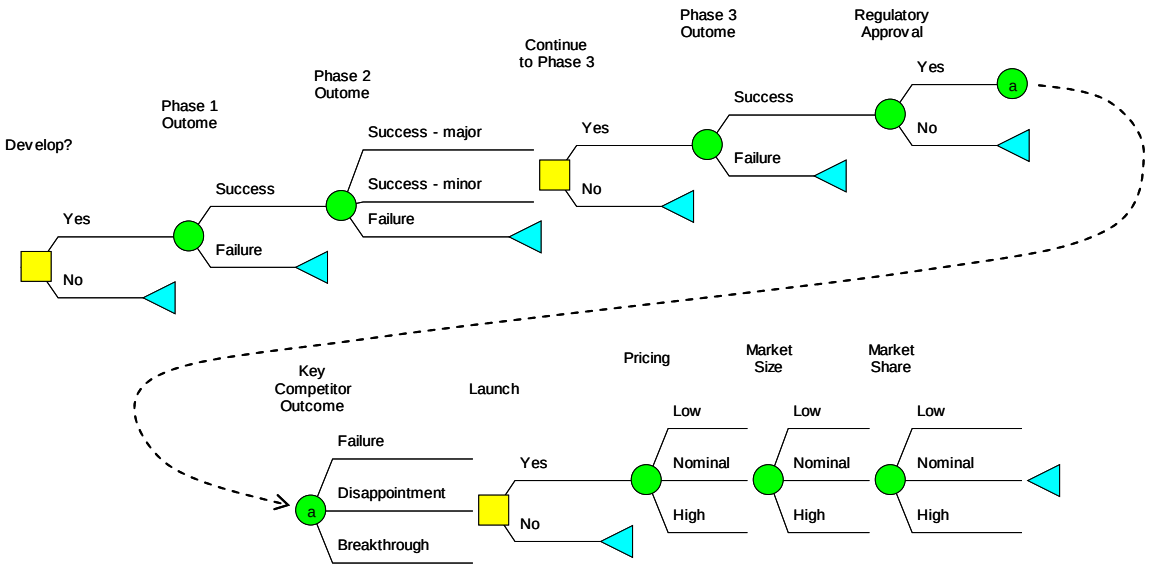
Financial option valuation theory such as Black-Scholes assumes that markets are complete in that all risks can be perfectly hedged by trading securities. Such techniques provide a sophisticated treatment of market risks such as future commodity prices, but cannot deal with firm-specific risks, and real investments such as developing growth businesses.

Modelling real options using decision trees

Decision tree software tools are used to build multi-stage real option valuation models with wide scope and complexity. Exhibit 4 shows an example of a new product strategy involving three real option decisions (the yellow squares) and eight uncertainties (the green circles).

Decision tree software tools are used to build multi-stage real option valuation models

Exhibit 4 – Example of a real options tree for a product development



WHERE ARE TELECOMMUNICATIONS COMPANIES USING REAL OPTIONS?

Spectrum acquisitions, joint ventures, marketing trials, new technology platforms, new product development, and multi-sourcing are some of the ways Telecommunications and Technology companies use real options. See Exhibit 5.

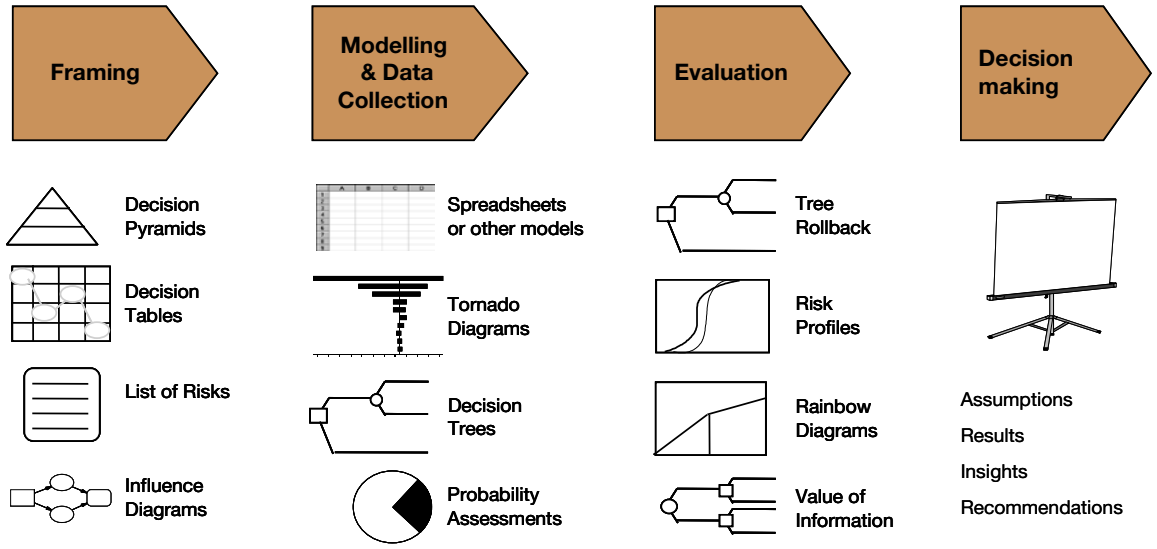
Exhibit 5 – Real options in Telecommunications and Technology firms

Type of Decision	**Examples of Real Options**
Joint ventures and the growth option	A fundamental decision problem is that of investing and expanding into new product markets characterised by uncertain demand. Joint ventures can be valued as real options that are exercised through divestment / acquisition decisions.
Asset development	Options such as staging capacity decisions provide flexibility to respond to changing conditions, such as capacity in long distance data service, a wireless network of base stations, and radio frequency spectrum acquisition.
Product development	Building options into the development process to modify new designs well into the product development cycle can add significant value to the development program.
Call centre network configuration	Real options analysis provides a framework for analysing market and business risks in a distributed network of call centre facilities.
Platform investments	Platforms are technological and organisational investments that permit a firm to address a wider menu of potential markets. They provide flexibility in the delivering the end result, i.e., what the system might provide for different markets and future uses. A negative NPV investment in the first stage can be justified for its growth option value in follow-on stage.
Marketing strategy	Market trials for new products can provide valuable learning prior to full-scale launch.
Equipment acquisition	Options in procurement contracts (e.g., adding or reducing the order quantity) are a common feature of contracts for major equipment purchases.
Sourcing strategy	Multi-sourcing in I.T. services may be more expensive but it reduces the risk exposure of being locked into one vendor only.
R&D and innovation capabilities	Acquiring new capabilities is one way companies can build resilience in the face of market and technological change. A "capability" real option creates a match between current competencies and the emerging business situation.
Network architecture	Real options help quantify the economic value of network, protocol, and service architectures; for example centralised versus decentralised, and modular versus integrated systems.

HOW DOES THE PROCESS OF REAL OPTIONS WORK?

The process for identifying, structuring and valuing real options is shown in Exhibit 6 below.

Exhibit 6 – The real options analysis toolset



Framing: Framing means determining the objectives, identifying alternatives, agreeing on what must be decided, and establishing the logic for choice. Developing a well structured decision frame leads to better and more defensible choices. For example the system of assets, rather than the individual investment decision, may often be the critical unit of analysis and decision.

The system of assets, rather than the individual investment decision, may often be the critical unit of analysis and decision

Framing tools such as a decision pyramid, decision table, risk identification list, and an influence diagram are used to structure the real options problem. [2]

Structuring the real option valuation of the project includes the following:

- **Defining value**: How should we measure value and success?
- **Risks and opportunities; decisions and options**: What alternatives do we have now and how can we adjust to maximise opportunities in the future?
- **Timing**: When do we have to make these decisions?

Modelling and data: Modelling involves the development of a spreadsheet financial model, gathering baseline information for the inputs (including estimation of the probabilities), and conducting a baseline analysis. Tools such as spreadsheet valuation models, tornado diagrams, decision trees, and probability assessments are used for the real options modelling and data analysis.

[2] A decision pyramid ranks the decisions in a hierarchy of importance. A decision table is a way to aggregate decisions into strategies. An influence diagram is a way of describing the dependencies among the probabilistic variables and decisions.

With real options, data estimation is not so much about predicting future outcomes, but about calibrating our level of uncertainty about future outcomes through the use of probabilities.

Evaluation: Evaluation uses the financial model together with the decision tree to value the project including flexibility options. Evaluation tools such as rainbow diagrams, risk profiles, and value of information are used for the real options modelling and data analysis.

Decision Making: Decision making includes communicating and documenting the analysis, assumptions, and the results and key insights for management.

Modelling uncertainty

Uncertainties in telecommunications impacting investment in growth options might include the following:

- Consumer and corporate demand for new mobile and data services. Uncertainties in future revenue from telecommunications infrastructure investments tend to be larger than in other markets, since the return on investment depends more on the roll-out of new complementary services and applications which make use of the improved performance of the new network (such as higher bandwidth);
- The risk of coordination problems in joint ventures and multi-partner network alliances may delay or reduce the benefits of collaboration;
- Changes in the direction and speed of rollout of the NBN;
- Competitive moves by global players such as such Google, IBM and Microsoft, and the rise of new business models like Cloud Computing;
- Competitor moves, such as the speed with which competitors transition to all Internet-Protocol platforms;
- The risk of price wars in telco capacity services;
- Media convergence creating new ways to communicate with customers.

To address these uncertainties Real Options Analysis relies on a combination of objective evidence and subjective judgment, and as options become more strategic, defining the real options and the criteria for success becomes more complex and subjective. Methods such as the Delphi technique [3] provide ways to be more precise about uncertain variables.

Care is needed. Otherwise real options may serve to justify, rather than guide, investment choices

With subjective assessments to quantify risks and future outcomes care is needed. Otherwise real options may serve to justify, rather than guide, investment choices. Given enough volatility and time it is possible to make the real option valuation a very big number. Without a sound process to generate solid, accurate estimates of volatility, real options can lead companies astray. [4]

3 The Delphi method is a systematic interactive forecasting method for obtaining forecasts from a panel of independent experts. See Rowe and Wright (2001).

4 The Nobel prize winning economist Daniel Kahneman and his colleague Amos Tversky identified ways in which people make incorrect judgements in the face of uncertainty. For example: overconfidence and believing an outcome is more certain than the evidence would suggest; escalation of commitment to a failing strategy; anchoring to the status quo in the midst of conflicting evidence; and risk aversion induced by organisational pressures.

Value estimation using probabilities and confidence bands

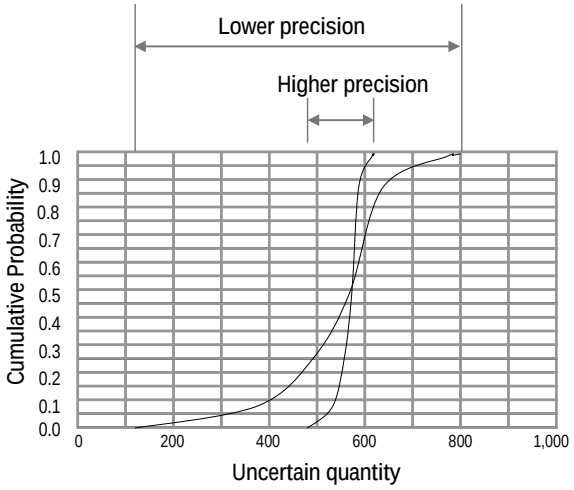
In estimating uncertain values, it is better to be approximately right than precisely wrong

Probability encoding – the process of quantifying judgment about uncertain quantities – plays an important role in the value analysis. It is important not to overestimate how much really is known about future benefits and their underlying drivers. In estimating uncertain values, it is better to be approximately right than precisely wrong.

To do this a probability distribution is used to represent the 'band of confidence' on estimating uncertain quantities. See Exhibit 7 following showing a probability distribution with different bands of confidence. A wider shape of probability distribution implies greater uncertainty in the quantity estimate. Conversely, the greater the precision of a quantity estimate, the tighter the band of confidence.

Exhibit 7 – Probability distribution showing bands of confidence

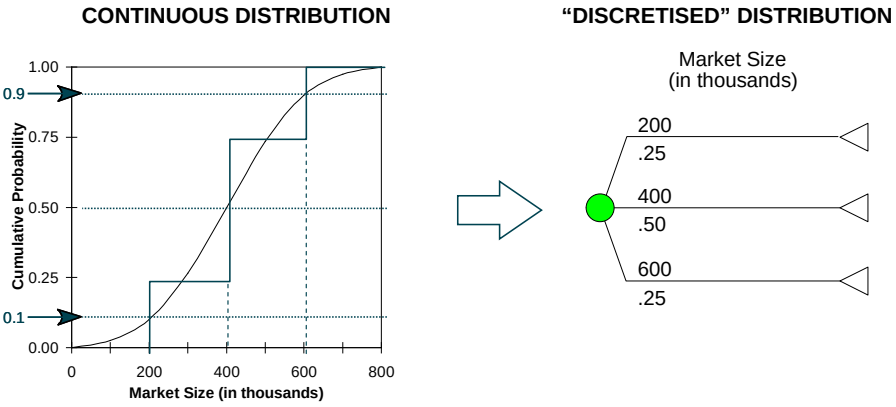
MODELLING UNCERTAIN QUANTITIES



Discrete approximations of continuous probability distributions are determined by dividing the range of possible values or the range of cumulative probabilities into a set of 'well-spaced' intervals. For three discrete states – low, nominal and high - the values corresponding to the .1, .5, and .9 cumulative probabilities are a good approximation. See Exhibit 8 following which illustrates how a continuous probability distribution is converted into a 'discretised' distribution.

Kahneman, D, Slovic, P, and Tversky, A. 1982. *Judgment under uncertainty: Heuristics and biases*.

Exhibit 8 – Example of a discretised probability distribution



Results of a real options analysis

ROV provides much more than just a "go/no go" recommendation and a dollar value for the project. In contrast to standard DCF, it provides a strategic management roadmap with milestones, decision points, on-ramps and off-ramps. This helps ensure that the project's "optimal" strategy identified through the analysis is actually realised through management action.

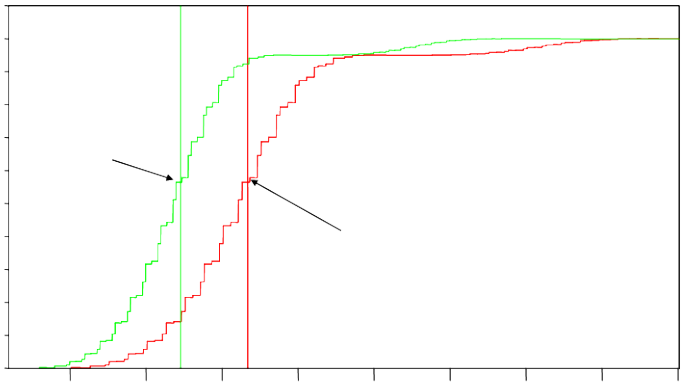
ROV provides much more than just a "go/no go" recommendation and a dollar value for the project

Risk profile

The aggregate probability distribution for Net Present Value for the optimal strategy is produced. The decision then is made based on comparing probability distributions of NPV, rather than point estimates that essentially ignore the uncertain quantities and factors involved in the decision.

Exhibit 9 following shows an example of a project valued with and without its real options taken into account.

Exhibit 9 – Cumulative probability distribution of net present value

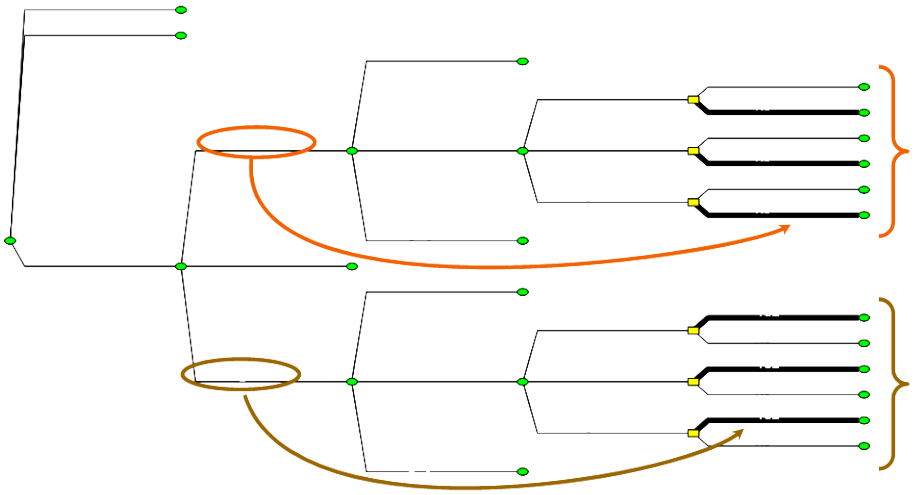


The graph shows the expected NPV of a project with real options (the vertical red line) is higher than the expected NPV of the same project with real options ignored (the vertical green line).

Optimal decisions – the value creation strategy through time

The real options analysis reveals the optimal strategy: the set of decisions both now and in the future to maximise the expected pay-off. The decision tree in Exhibit 10 shows that a different decision on "geographic expansion" is taken, depending on the "sales potential in the new market."

Exhibit 10 – Results of the real options analysis show the optimal strategy through time



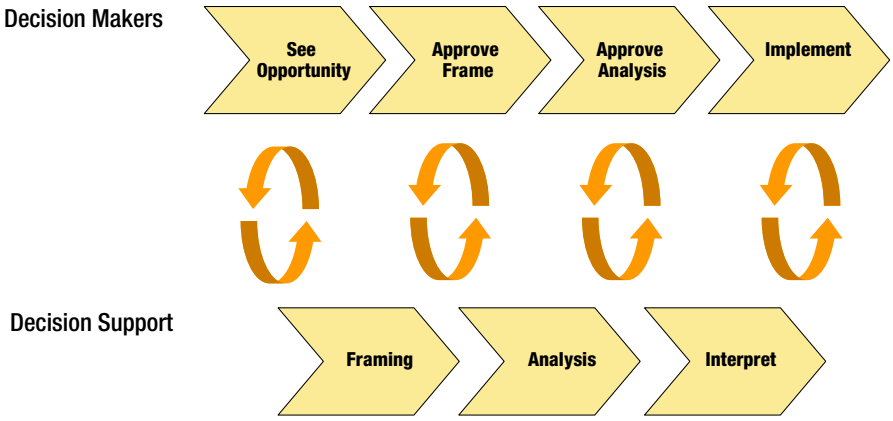
Using the real options analytic model, sensitivity analysis can examine under what circumstances a different decision set would have been recommended; in other words, by how much would the input assumptions have to change before a different decision strategy becomes optimal.

BUILDING AN ORGANISATIONAL CAPABILITY IN REAL OPTIONS

With real options the decision making process involves a strategic conversation between the decision makers, project experts and the financial analysts. Its aim is to integrate subjective judgment in project evaluation, not just hard data and the facts.

Exhibit 11 following shows the real options decision making process. The intent is that there is interaction throughout the decision making process: to ensure that the results are high quality, and have the "buy in" to be adopted. It's not a process of simply running the numbers. It must incorporate the expertise, judgment, and the intuition of seasoned professionals.

Exhibit 11 – The real options decision making process



An effective process for decision making has four requirements:

Make the process clear and understandable: Ensure that the process is not seen as some kind of management "mumbo jumbo." Enable alternatives to be considered, uncertainties to be quantified, a synthesis to be developed and clear decisions to be reached.

Ensure it is an apolitical process: Debate and disagreement do not preclude a working together while testing alternative views. Executives taking part in problem formulation should question their own and others' premises but still work together and recognise a sense of collective responsibility for the choice made.

Canvass a wide range of views: The range of perspectives considered should match the complexity of the investment problem. Compared to conventional project valuation processes, the real option approach places more emphasis on the front-end framing of the investment opportunity.

Define roles for the participants: Establish a clear process by which individuals are able to contribute and learn from one another – subject matter experts, analysts, project stakeholders, and decision makers. Include external people to expand the pool of ideas and perspectives.

Like any new "technology" real options involves some essential organisational changes for successful implementation. Individual and organisational barriers can impede the introduction of a real options approach.

Capabilities in real option processes and analytics will need to be developed. The implementation plan should therefore include the selection of a demonstration project, the establishment of a working group to coordinate the real options work, and training of real option specialists in key business areas – corporate strategy, corporate finance, strategic business development, and R&D.

CONCLUSION: BENEFITS OF THE REAL OPTIONS FRAMEWORK

The basic value proposition of the real option framework is that long-term, superior performance of the company depends on management's ability to respond flexibly to future events, discontinuities, innovations and trends better than the competition. This flexibility is inherently valuable. It increases the upsides and limits the downsides of strategies, enhancing their values.

The primary benefits of the real option process result through greater insight into the risks associated with a project, and how to manage and exploit them. Other benefits are explicit consideration of strategy for a project, and a way to communicate how the strategy creates value for shareholders.

Real options offer a great way to weld strategic intuition with analytical rigour— an increasingly important issue given the pace of market change — through more rigorous, robust, accurate and realistic valuations, and better informed strategic choices. Real Options Analysis provides the analytical power that standard valuation techniques lack.

In a Telco world of change and uncertainty, real option thinking is more important than ever for strategic investment decision making. Business environments are not getting more stable or any easier to compete in. But in fact, a bigger menu of uncertainties in today's dynamic business world provides innovators with new opportunities to create new kinds of value – real option value.

REFERENCES

Dixit, A. K., & Pindyck, R. S. 1994. *Investment under uncertainty*. Princeton, NJ: Princeton University Press.

Horton, Jay, 2006. *Learning to Love Uncertainty – the Practice of Scenario Planning*, Paper presented at the Australian Institute of Mining and Metallurgy International Conference.

Kahneman, D, Slovic, P, and Tversky, A. (Eds.), 1982. *Judgment under uncertainty: Heuristics and biases*. Cambridge University Press).

Kogut, B. 1991. "Joint ventures and the option to expand and acquire." *Management Science*, 37: 19-33.

Miller, Peter and Ted O'Leary, 2002. "The coordination of investment in systems of complementary assets: a clinical study of inter-firm and intra-firm mechanisms." London School of Economics and Political Science.

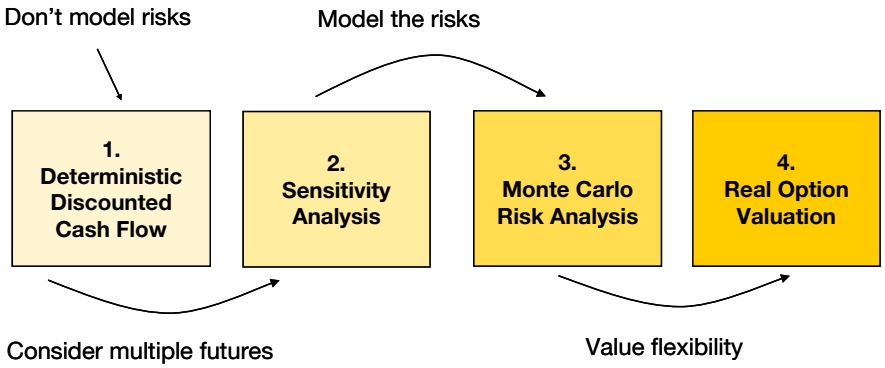
Myers, S. C. 1977. "Determinants of corporate borrowing." *Journal of Financial Economics*. 5 147–176.

Triantis, A. and Borison, A. 2001. "Real options: State of the practice." *Journal of Applied Corporate Finance*, 14 pp.8–24.

APPENDIX A – THE EVOLUTION OF VALUATION TECHNIQUES

Exhibit A.1 shows how project investment valuation techniques have evolved over the last two decades.

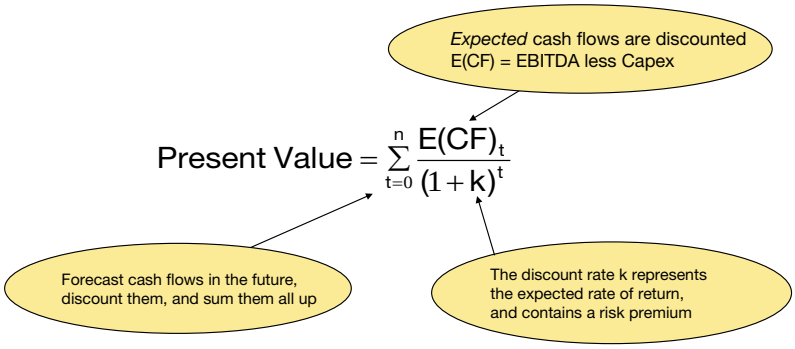
Exhibit A.1 – Evolution of valuation techniques



1. Deterministic discounted cash flow valuation

The first approach adopted by corporations, deterministic discounted cash flow valuation, relates the value of an asset to the present value of expected future cash flows on that asset, as depicted in Exhibit A.2 below.

Exhibit A.2 – The formula for discounted cash flow valuation



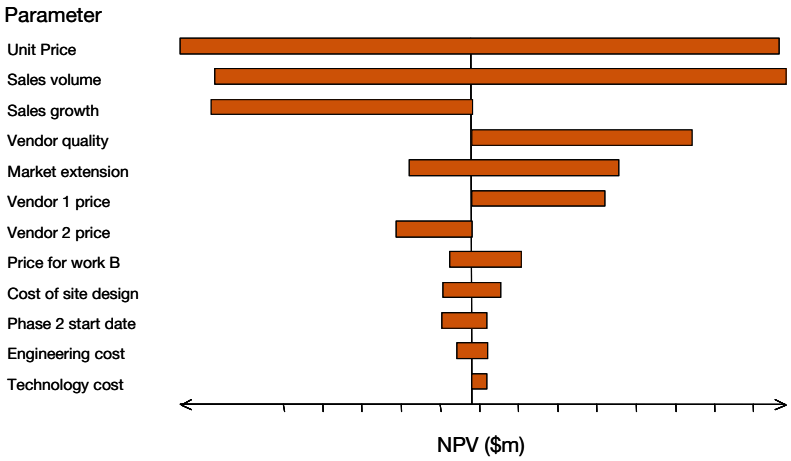
Using traditional DCF, the approach is to make a "best guess" as to how the future will pan out, lock-in the strategy, and value the project in this "expected" state of the world. So DCF asks "what are your 20 year forecasts?" trapping managers into the mug's game of prediction, when the real question should be: "given that we cannot predict the future outcomes with accuracy, what are our best positioning options?"

2. Sensitivity analysis

The second approach involves applying sensitivity analysis to the deterministic DCF model. Exhibit A.3 shows a "Tornado Diagram" which quantifies the sensitivity of the net present value by switching each of the DCF model's input parameters from its "high" value to its "low" value. The

Tornado Diagram presents the parameters in order of importance revealing the major drivers of value.

Exhibit A.3 – Tornado diagram shows sensitivity of NPV to inputs



3. Monte Carlo risk analysis

The third approach to valuation, Monte Carlo risk analysis came into vogue in the 1980s when computing power made it possible to run very quickly many thousands of valuation scenarios. Instead of single values for each input parameter, the Monte Carlo algorithm repeatedly samples values from the probability distributions of each of the input parameters – the drivers of project value and risk – to produce a probability distribution of the net present value as shown in Exhibit A.4.

Exhibit A.4 – Drivers of project value and risk

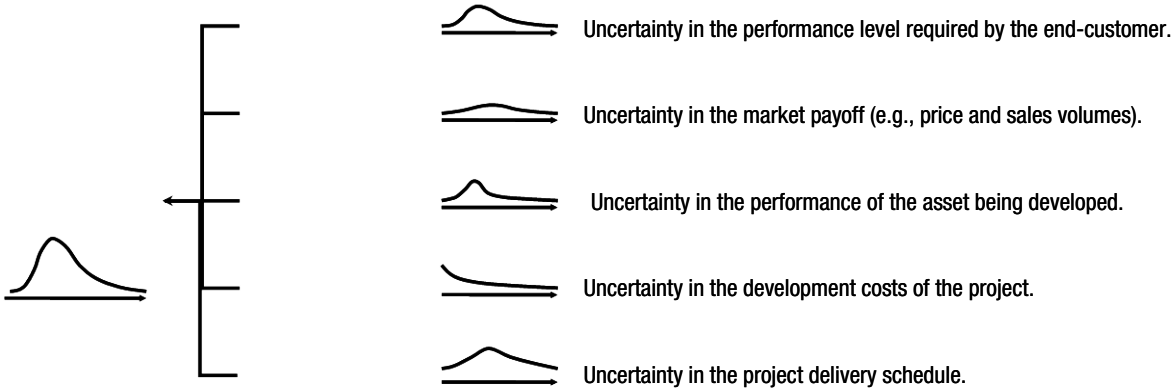


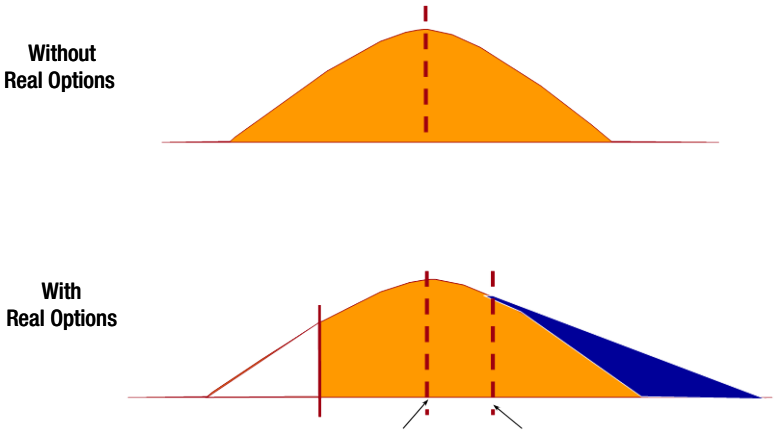
Exhibit A.4 shows the probability distribution of project value which is computed from the probability distribution of the five cost and risk drivers: market requirement, marker payoff, asset performance, cost to build, and time to build.

The chief limitation of the Monte Carlo technique, however, is that it does not take into account the fact that management can alter the strategy in response to changing conditions. In other words, the Monte Carlo valuation assumes that the strategy is set in advance, and cannot be adjusted down the track.

4. Real option valuation

The latest approach to valuation, Real option valuation (ROV) was pioneered in the 1990s in the oil and gas and pharmaceutical industries. Active management of real options creates more value by limiting the downside and capturing more on the upside, as shown in Exhibit A.5.

Exhibit A.5 – Real Options limit the downside and capture the upside



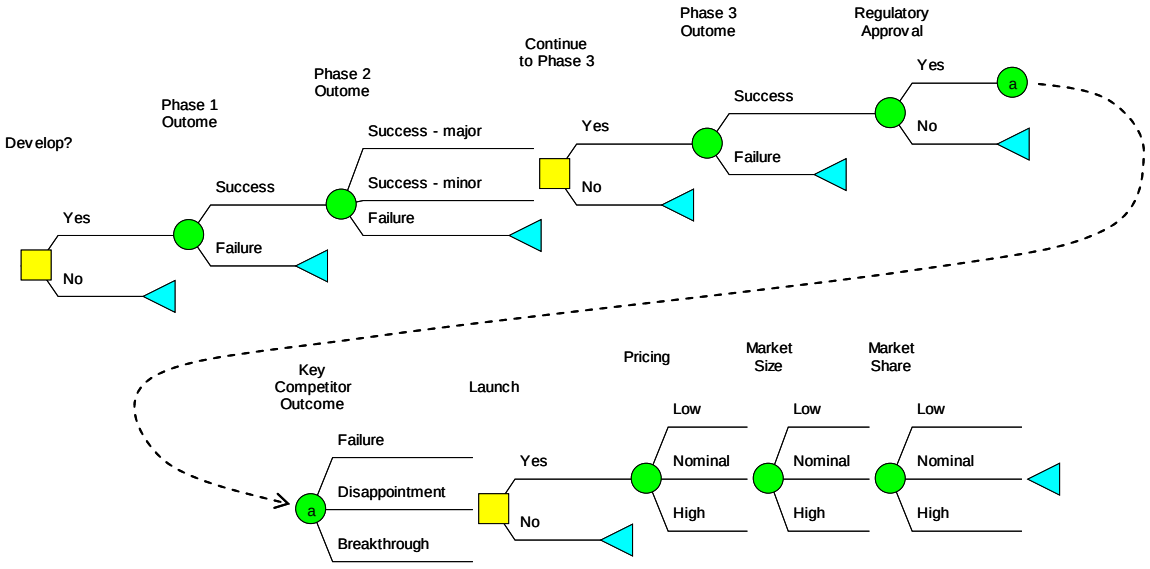
Mathematical techniques of option pricing

Financial option valuation theory such as Black-Scholes assumes that markets are complete in that all risks can be perfectly hedged by trading securities. Such techniques provide a sophisticated treatment of market risks such as future commodity prices, but cannot deal with firm-specific risks, and real investments such as developing growth businesses.

Modelling real options using decision trees

Decision tree software tools are used to build multi-stage real option valuation models with wide scope and complexity. Exhibit A.6 shows an example of a new product strategy involving three real option decisions (the yellow squares) and eight uncertainties (the green circles).

Exhibit A.6 – Example of a real options tree for a product development



strategis partners

About the Author

Jay Horton, Founder and Managing Director of Strategis Partners, is a leading adviser to Companies and Governments in Asia and Australia on strategic management issues, including scenario planning, capital investment decision making and real options analysis, and corporate strategy.

During his twenty year management consulting career, he has worked with clients in Australia, Canada, China, Japan, Hong Kong, New Zealand and South East Asia.

Jay has played a number of leadership roles, including as a Partner of PricewaterhouseCoopers, McKinsey & Company, and Managing Director of management consultancy ORG Pty Ltd. Jay was also a teacher in Malaysia under the Australian Volunteer Abroad program.

Jay is a regular guest lecturer at the Australian School of Management, the Sydney University School of Business & Economics, and the Macquarie Graduate School of Management.

Jay's qualifications include Master of Economics from Australian National University, a Bachelor of Engineering from James Cook University, and Fellow of the Australian Institute of Company Directors. He is a member of the Institute for Operations Research and Management Science.

Contact us

Sydney:
Level 57, MLC Centre
19-29 Martin Place
Sydney, NSW 2000
Phone: +612 9238 6886
Fax: +612 9238 6887

info@strategispartners.com.au

Hong Kong:
Level 19,
Two International Finance Centre
8 Finance Street
Central, Hong Kong
Phone: +852 2251 1625
Fax: +852 2251 1618

www.strategispartners.com.au