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THE UNIVERSITY OF STRATHCLYDE  
GRADUATE SCHOOL OF BUSINESS

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## Working Paper Series

*The Changing Finance Role in Strategy*  
**Greg Parrish**

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199 Cathedral Street, Glasgow, UK G4 0QU  
Tel: 0141 553 6040  
Fax: 0141 552 8851  
Email: [Valerie@gsb.strath.ac.uk](mailto:Valerie@gsb.strath.ac.uk)

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University of Strathclyde Graduate School of Business,  
199 Cathedral Street,  
Glasgow G4 0QU

Telephone: 0141 553 6040  
Fax: 0141 552 8851

## The Changing Finance Role In Strategy

### A Real Options Approach

Today companies find themselves striving to grow in an environment with increasing competition and a trend towards globalisation. From an organisational perspective, the need to co-ordinate resources and focus efforts effectively is of paramount importance. The ultimate goal being to focus the activities in a co-ordinated manner ultimately ensuring that the company maximises its competitive position and return on investment. However, there is often the need to choose between activities due to resource limitations.

Generally speaking, from a strategy perspective, Portfolio Tools were developed in order to determine how resources are best allocated. Additionally, they provide a means of looking at an organisation in terms of a collection or a 'portfolio' of units. Thus enabling the company to evaluate the portfolio in terms of:

- the strengths (or weaknesses) of the portfolio,
- potential for cash generation (or needs) across the portfolio,
- strategies for each unit.

This first step identifies the 'gaps' existing in the portfolio, the next step is to analyse the various ways in which the 'gaps' may be filled in the future.

To date, the most suitable tools available were:

- Growth – Share Matrix and
- Ansoff's Growth Matrix

### Purpose

All portfolio analysis exists in order to both assess the 'quality' of the current portfolio and then to plan how to fill the gap between the current market returns and the targets set by senior managers. The analysis is then very useful to evaluate how the balance of activities contributes to the strategic capabilities of the organisation. One fundamental flaw has been the inability to apply a financial technique that aides or mirrors this approach. However, to date the tools have lacked the financial components to link the strategic desires with the financial realities. The application of the financial models contained within the area of real options analysis provides the opportunity to link the strategy with financial rigor. The examples contained herein are based on a model created by T.A. Luehrman. The purpose is not to fully explain the underlying mathematical models, these can be understood by referencing his articles. The purpose is, however, to introduce the thinking contained in the real options approach.

### Explanation

Specifically, the purpose of the Growth-Share Matrix is to distinguish between the cash generators and the cash consumers of the portfolio, plotting the growth rate of the business portfolio against the relative market share. While Ansoff's Growth Matrix is designed to identify the possible strategic options that faces the business.

In contrast, Luehrman outlines and prescribes a technique in Investment Opportunities as Real Options: Getting Started on the Numbers (41) and Strategy as a Portfolio of Real Options (42) that enables a company to review multiple projects against each other and a set of pre-defined rules for investing now to never. Luehrman's model is designed to capture the critical underlying financial elements and place them into an option model. Specifically, this is a European Call Option. Simply stated, that means an option to buy at a specific date in the future using the Black-Scholes Model. At this stage, don't get too hung up on the mathematical calculations. Instead, focus on the inputs required for the model. In other words, the outputs required from the strategic portfolio analysis, we require the following.

**This has been derived from "Investment opportunities as real options: Getting started on the numbers"  
Timothy Luehrman, Harvard Business Review, 94804**

Key option variables	Definition	Strategic option interpretation
S	Stock price	Present value of a projects operating assets to be acquired
X	Exercise Price	Expenditure required to acquire the project assets
t	Time to expiration	Length of time the decision can be deferred
rf	Risk free rate of return	Time value of money
sigma squared	Variance of returns on stock	Rickiness of the project assets

### Multiple Projects Single Pot of Money & Resources

Executing a strategy involves making a sequence of investment decisions. Some actions are taken immediately, while others are deliberately deferred, until such times that managers can optimise the positioning as circumstances evolve (42). The first step is to apply the real options techniques. Then break the calculation down by value-to-cost versus volatility.

### Value to Cost: Deriving Measure One NPVq

Conventional NPV

$$NPV = S - X \quad \text{Equation 1}$$

However if cost > value the option is unlikely to be explored and therefore NPV rarely goes below 0.

This only has value as a snapshot variable - it does not provide an indication of value at time t, only at time=now

PV(X) Present value of X

This is a measure of the amount of money required at time=0, that is necessary to exercise the option at time=t

During this time risk-free interest can be obtained on the capital X and therefore at time t the present value of X, PV(X) is

$$X / (1+rf)^t \quad \text{Equation 2}$$

Therefore by combining (1) and (2) we can derive a modified NPV that takes into account the time to option

$$\text{Modified NPV} = S - PV(X)$$

This is a raw value, and can be converted into a quotient as follows:

$$NPVq = S / PV(X)$$

This has the value that when  $S = PV(X)$  the quotient is 1.0, when below 1 the return is negative and when above 1 the return is positive

The full equation can be written as:

$$NPVq = S * (1 + rf)^t / X$$

### Volatility: Deriving Measure Two, sigma root t

The second measure takes into account the variability of returns

For a variance of sigma squared the Sdevn is sigma. Allowing for time the variance

is given by sigma root t

$$\text{sigma} * t^{0.5}$$

This gives a sense about the urgency of the decision in terms of:

- Invest now,
- Maybe now,
- Probably later,
- Maybe later
- Probably never, and
- Never.

By taking the additional variables we are able to quantify the extra value, Measure the uncertainty, and value the option (41).

Decision points critically affect the future success of a company, it is at the point of decision that companies determine their future. The real options approach adds a financial rigor to the strategic thinking and intent of the company, manifesting itself at the decision point.

## ILLUSTRATION – Real Portfolio Analysis

### **This Case Study is based on a real example from a large multi-national company.**

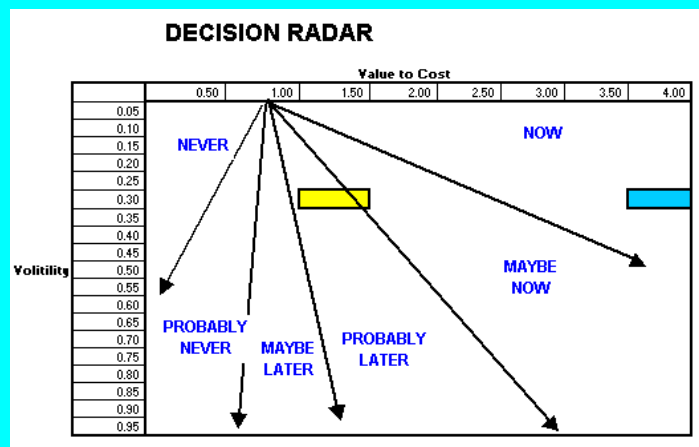
Imagine the Executive Management of a large information business that recognised the potential power (and threat) of the internet in early 1994. Much earlier than most internet start-ups, let alone large multi-nationals.

Two internal camps (options) were formed:

1. Those who wanted to shift an existing product to this new delivery platform (Blue – Invest now). &
2. Those who wanted to develop new products for a new target audience (Yellow – Probably later).

The question that the company had to answer was: “What project should we invest in?” The company had limited resources to dedicate to this strategic initiative and both projects were dependant upon the same technical resources.

Taking a Real Options Portfolio approach and applying Luehrman’s model, we would see that the company should do Option 2 initially and follow-up with Option 1 at a later date.



From a strategy perspective, we can see that the company is managing the business strategy like a portfolio of strategic options. It is important to realise that the numbers have been omitted because from a strategy perspective, this builds on the traditional portfolio approach. However, one important fact to realise is that the real options tool enables strategic managers to bridge their strategic intuition with the intelligence gained from robust financial analysis. Thus, the real options approach builds a bridge between finance and strategy.

## Viewing Investments as a Collection of Real Options

Option pricing models were used to value offshore oil reserves and determine when they should be developed. Created by Seigel, Smith and Paddock (1987), they provided a non-technical explanation of their model and its' application (37).

All writers on this area stress the importance of viewing investment decisions as a collection of Real Options. As Trigeorgis puts it, "the operating flexibility and strategic value aspects of various projects cannot be properly captured by traditional DCF techniques, because of their discretionary asymmetric nature and their dependence on future events that are uncertain at the time of the initial decision" (38).

Most investment decisions share three important characteristics in varying degrees. First, the investment is irreversible. The initial cost of the investment is at least partially sunk; the company cannot recover it if they reverse the decision. Secondly, there is uncertainty over the future rewards from the investment. At best the company could access the probabilities of the alternative outcomes that would result in greater or smaller profit (or loss) from the investment. Third, the company has flexibility over the timing of the investment (37).

To clarify: *What is meant by an option?* Simply put, an option is the right, but not the obligation to participate in an investment. In a corporate sense, this could be a new way of looking at an investment decision. A decision to invest, gives the company the right to enjoy any upside, but the downside risk is limited to the initial investment under review. Drawing from the old adage, the company places a value on keeping its' options open.

Considering this, Trigeorgis (38) explains how to frame and calculate:

- ❑ Option to Defer Investment
- ❑ Option to Expand (Growth Option)
- ❑ Option to Contract
- ❑ Option to Temporally Shut Down
- ❑ Option to Switch Use (or Salvage)
- ❑ Option to Default on Planned Cost Instalments During Construction
- ❑ Multiple Interacting Options

Leaving the financial calculations aside, the challenge is to recognise the Options Available.

## Real Uncertainty

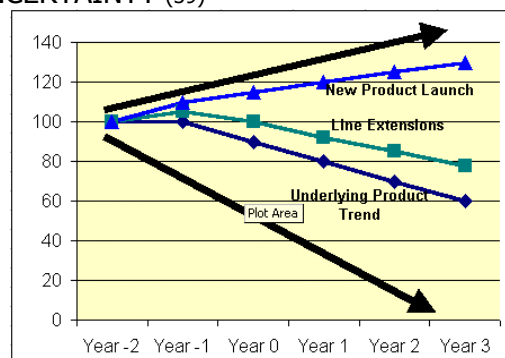
The fact is that many negotiations collapse over differences of opinion about how the future will unfold. Companies must realise that it is often better to bet on uncertain events than argue about them (45).

As with any decision, there will always be some type of uncertainty. The challenge is to identify the sources of the uncertainty. Traditional financial models allow no room for any type of emergent strategy. The financial tool most widely used, DCF valuation, assumes that we follow a predetermined plan, regardless of how events unfold (42).

Real Options captures the complexity as multiple sources of uncertainty combine. These are combined with a mixture of Market and private risk (28).

All business plans and projections have uncertainty built into them, current financial techniques (NPV & IRR) display the numbers in a way that make them appear to have an element of certainty. Amram & Kulatilaka refer to this as the cone of uncertainty (39).

TABLE – THE CONE OF UNCERTAINTY (39)



With Real Options the key is to identify the trigger for the activity that leads to the “risk event”. Thus, by questioning the Options that are available (38) and recognising the areas that trigger uncertainty, a company adds analytical rigor to both the financials and to the strategy.

### What are the Decisions and When?

Companies are faced with decisions everyday that seem to have a sense of urgency. For example, an existing product may need to be upgraded due to a legal or performance issue. In some cases this could be a very real threat with a tangible “drop dead date” as a deadline. This was the case with the Y2K problems we have recently seen (54).

However, in some cases this could be a legal relationship, such as a Value Added Reseller (VAR) agreement. In these cases, the legal contracts could be the key factor. The exact wording, legal definition and interpretation being the difference between an:

- ❑ Option to Defer (the investment decision) and the
- ❑ Option to Invest NOW!

Even within the Option to invest NOW, the company will have options.

- ❑ Do we contract this out?
- ❑ Do we partner?
- ❑ Do we allocate internal resources 100%?
- ❑ Etc...

In every case the challenge for the company is to clearly identify the strategic intent and ensure that the decisions and subsequent actions target this intent. Thus, this could be seen as taking Mintzberg’s thinking around, what he called, the entrepreneurial strategy to



another level. As complexity in the market and uncertainty increases, the need for the organisation to be more flexible also increases. The real options approach suggests that in these conditions, the company should be clear about its strategic intent and create multiple mechanisms for realising that strategic intent.

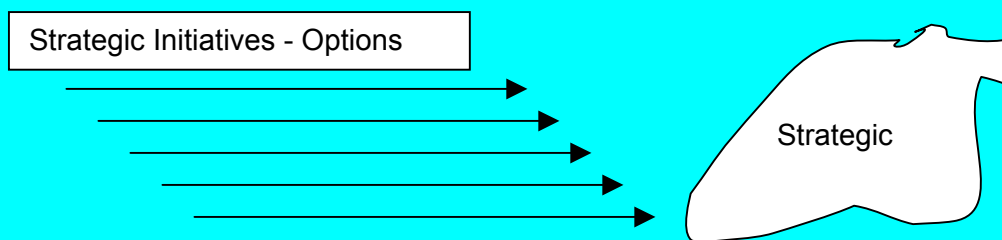
Importantly, the financial calculations from the real options approach enables the company to quantify the value of the options created. Additionally, the company can understand the option price or investment level associated with this strategic area and these specific options. In many ways companies and their executives are already placing strategic investment decisions into an options framework intuitively. For example, decisions are deferred purely on the basis that the executive responsible believes that he/she will be able to get more or better information later. This decision to defer has no analytical basis and is not part of the organised strategic structure. The real options approach captures and values these aspects. This is where real options and finance should come into play.

#### ILLUSTRATION – Collection of Real Options

**This Case Study is based on a real example from a large multi-national company.**

Imagine the Executive Management of a Roche and Genetech, a Californian Biotech company. The investment was seen by Roche to provide time to gain market knowledge and take advantage of Genetech's expertise (44). Thus, as a management team they had the strategic intent of investing in R&D, but did not limit their investments around that strategic intent to their own R&D function.

The investment decision was made to invest \$Xm in their own initiative and \$Ym in Genetech. Clearly, the management team had focused on the strategic intent. If they limited their investment to their own R&D function only, the decision has only one way of achieving their strategic goal and ignores the actions of others. The investment provides the opportunity to benefit from the up-side potential but limits the down-side to the original investment in Genetech.



Thus, investment decisions become a decision of options focused around specific areas of strategic focus. Additionally, the financial models (such as those in the Real Options by Lenos Tregorgis) articulates a methodology for calculating the value of the options and the option price. Thus, providing financial rigor to strategy development.

The real options approach clearly helps companies to better link their strategy to the financial aspects of the related decisions. However, additionally it also provides a clear area where finance can become an integral part of the organisation's strategy and decision making process. It is only through the use of advanced techniques, such as real options, that finance can ensure they actively help in the achievement of results in this ever-changing environment.

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