Project assessment and operational flexibility: VAN and more

The appearance of the first computers in 1944\(^1\) and their rapid development to today’s modern PCs, together with the emergence of software (in the 70's), have permitted the application of increasingly sophisticated techniques in the preparation of investment projects, for example by allowing investment research to make better and more accurate demand projections; optimizing production processes; enhancing the size and location of plants among others.

In evaluating projects, the development of software spreadsheets\(^2\) and simulation software\(^3\) has facilitated the calculations of cash flows, its profitability and risk treatment.

Until recent years, for managers and business owners with a good analysis and calculations of the technical variables of market research, technical, legal, environmental and administrative, plus a reasonable estimate of the cash flows, capital rate cost and finally the Net Present Value (VAN in Spanish), complemented by a good risk analysis, seemed as enough: If the investment project had a positive NPV there was no doubt that it should be implemented as it would generate wealth for their owners; and conversely, a negative NPV was a sure sign that it should be rejected for homeowners in order to not decrease their wealth.

In 1977 appeared a new concept related to investment projects: the “real options”. Term proposed by academics from the Massachusetts Institute of Technology (MIT) Stewart Myers to talk about the application of the traditional theory of financial options on the valuation of non-financial assets. In a “real choice” the underlying asset is a “real asset”, such as machinery, a company, a real estate, a car, a hydroelectric project, and so on.

But what real options provide the assessment of investment projects? To understand the contribution first we must know the main observation made to the evaluation methodology of projects through techniques such as discounted cash flows VAN (NPV) or TIR (IRR): The cash flows that the project promises to generate are replaced by their expected average values, and these are treated as known values from the start of the analysis, i.e. operational flexibility of the project is not considered; flexibility that in fact provides value to the project.

What does the company management do when in the operating life of the project the results are different to those expected? Management is not a passive investor, with new information will alter their operational strategy to try to take advantage of new opportunities (for example, if sales are outpacing the projected long, they will try to extend the initial production capacity), or, will try to reduce losses (for example, if sales are significantly lower than projected, management can reduce its production capacity, or may temporarily close the project, and in extreme cases, abandon the project). That is, the management will not stand motionless before the events occurring. The possibility of reaction increases the value of the project and is not considered in the traditional methodology; therefore,

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1 Mark I, developed at University of Harvard, had 800 kilometers of cable and a measure of 17 meters of lenght, 3 meters height and 1 meter width. It took six seconds to perform a multiplication and twelve to perform a division.

2 The first calcukus sheet developed for personal computers was VisiCalc, en 1979. It only suported 5 columns and 20 rows. Prior to them, appeared SuperCalc, Multiplán, Lotus 1-2-3, Quattro Pro, and the most known of all of them Excel.

3 The most commonly use software in projects is Crystal Ball. This works attached to Excel. Using a Monte Carlo simulation, it allowes to analyse and quantify the risks in investment projects.
usually VAN (NPV) traditional undervalues the profitability of the project when not being able to accurately model risk and the flexibility of their authorities of the company. So in order to avoid this from happening, the traditional VAN (NPV) must add the value that creates the flexibility applying the methodology of real options:

$$VAN_{\text{total}} = VAN_{\text{traditional}} + \text{Value of Flexibility (Real Option Value)}$$

Becoming the methodology of real options is not an alternative to the traditional method, but a complement to it.

Thus, it is possible that projects with negative VAN (NPV) when adding the real option become profitable. For example, many new Internet projects have a negative NPV, but have the potential to generate other opportunities in the future. In this situation, management tends to make these projects because of their strategic nature for the company although the traditional NPV does not make possible to quantify that possibility. This methodology provides Real options.

**Real options use in business**

Real options may be to postpone the investment, investment in stages, to expand, to be reduced, to temporarily shut down operations, abandon operations, change and growth. And applications in Latin America, Europe and the United States have focused on the extraction, aquaculture, agriculture and industry areas.

In a sample of 392 executives from various US companies⁴, it is seen how Real Options have been incorporated into the assessment of projects, being used in 26.59% of them. In another sample of 152 Spanish companies⁵ it is concluded that 40.9% of managers know the methodology of Real Options, but is used only by 17.9% of them. Finally, in a recent study of 300 Colombian companies⁶, it is noted that the frequency of application is 40%.

In Chile, although there is no formal study of the use of this methodology in companies, they have focused on the areas of power generation and mining. And at the level of indexed publications in addition to the above two sectors are the industrial and water sectors. There is also a set of theoretical/practical work, led by the Department of Industrial Engineering at Universidad de Concepción and Pontificia Universidad Católica de Chile.

Just as the flexibilities that private investment projects have generating value to the project, so do social projects. A social project with flexibilities would have a greater social NVP opposite to what would happen if it did not have them.

**In the future**

To the majority of the projects the NPV and IRR are simultaneously calculated, will in the future be calculated the Real Option as well? Not really. There are projects in which the traditional NPV is enough. This occurs when the project has no operational flexibility or this is minimal, or the cash

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flows are highly predictable (low risk level), or investment is totally reversible (it is recoverable by the investor).

But other projects do have flexibility and are not always considered, why?:

- It is not a known methodology to all executives. In Chile, the teaching of this is not part of the core curriculum in the formation of Industrial and Commercial Engineers. But it has been incorporated at the graduate level.
- If the project has a traditional negative NPV, but high flexibility surely a Project Manager will be very difficult to explain and justify an executive with little training, that the project is profitable and that it is not “disguised” to look profitable.
- Unlike financial options, Real Option is not an active existing in the market, but it exists only inside the company (or project), so you must be able to identify and calculate its factors, which is not always easy (particularly calculating volatility).

But the real options are here to stay and increasingly, more often, we see their application in both private investment and social projects.

Carlos A. Díaz-Contreras
Área de Ingeniería Industrial
Universidad de Tarapacá
Arica, Chile
cdiazc@uta.cl

Gabriela A. Díaz-Vidal
Departamento de Administración
Universidad Católica del Norte
Antofagasta, Chile
diazvidal.gabriela@gmail.com