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# Investment analysis of plum brandy production – methodology approach

**Lari Hadelan**

*University of Zagreb Faculty of Agriculture  
Executive MBA Training in Agribusiness and Commerce*

## Introduction

The major prerequisite of successful entrepreneurship venture is quality of decision-making process. Decision in investment is the most important financial decision. It is a part of both long-term business planning process and strategic business definition. Using available investment appraisal methods, entrepreneur should make positive or negative investment decision. Within the development of the economic theory and the practice many of methods made decision-making process rational and gave the scientific and practical base for successful project evaluation.

In practice, there are three major traditional methods of evaluating investment proposals:

- Payback period method (PP)
- Net present value method (NPV)
- Internal rate of return method (IRR)

The advantage of all these methods is, first of all, simplicity and explicit interpretation of the results. However, they have some imperfection, which can be overcome using modern option approach.

All these three traditional methods use, as the base, projected cash flow that is discounted according to the time value of money.

The largest problem for each investment is uncertainty of the future performance. Investors will never invest until future major uncertainty is cleared. In other words, investors have the opportunity or option but not the obligation to invest in a project in a period of time. They can also have flexibility to abandon, expand, contract, extend and shorten the operation of the project even after the investment. A good project evaluation methodology or model should incorporate in a quantitative way all the three characteristics: irreversibility, uncertainty and flexibility. Traditional (conventional) appraisal methodologies for project investment can hardly incorporate the three characteristics above.

In recent years, management accounting and corporate finance academics have reasoned that the conventional discounted cash flow techniques do not adequately incorporate the value of managerial flexibility to respond to the changes that can emerge during the project's life

(*Herath, Bremser, 2005*). Furthermore, they do not take in account properly risks and uncertainty in investment and operating decisions. An emerging method of research in capital budgeting called real options has been developed to overcome these limitations (*Herath, Bremser, 2005*).

Real options techniques value managers' options to make some adjustments according to the current market situation. Once projected business plan does not have to be eternal and unchangeable. Each project can be expanded if circumstances enable it, it can be cancelled if market condition become worse and it can be delayed for some better business condition period.

Real option methods for investment appraisal includes possible volatilities during the project life by identification of all options that entrepreneur have and adding this option value to the total project value. On this way some project that traditional investment appraisal methods reject can be accepted if has some potential (optional) value.

It is important to notice that real option methods are not substitute for traditional investment appraisal methods but their complement that enable wider insight of investment judgment (*Dixit, Pyndick, 1995*).

Expanded (Strategic, Real option) NPV = Static (Passive)  
NPV + Value of Options from Active Management

In this paper traditional and real option investment appraisal approach will be presented on the plum brandy production in continental Croatia.

## Objectives and hypothesis

The aim of this paper is to research increased significance of the real option as modern investment appraisal methods that have starting point on traditional investment analysis with addition in form of project flexibility estimation.

According to the financial theory quantifying the main investment scheme, this paper will compare results of the traditional and modern real option investment analysis on example of the plum brandy production. Author will with that respect explore the next hypotheses:

- TRADITIONAL METHODS OF INVESTMENT ANALYSIS CAN UNDERVALUE INVESTMENT OPPORTUNITIES BECAUSE THEY DO NOT TAKE IN CONSIDERATION AN OPTIONAL VALUE (POTENTIAL) OF INVESTMENT.
- ONLY TRADITIONAL METHODS FOR INVESTMENT ANALYSIS ARE NOT ENOUGH BECAUSE MODERN MANAGEMENT IS FLEXIBLE. IT ACTIVELY TRIES TO FIND ALL OPTIONS AND BENEFIT FROM THE CURRENT BUSINESS POSITION.

These hypotheses can be divided on the next sub-hypotheses:

1. Decision on investment is the most important financial decision. It is a part of long-term business planning process as well as strategic business definition.
2. Traditional methods of the investment appraisal are often used for the tactical decision making level, not in strategic level. These methods have the major importance for the small, individual, irreversible and independent project appraisal. Traditional methods are not enough for the complex, independent and multiphase projects appraisal.
3. Strategic of the capital planning that apply option approach is the way of management flexibility quantifying as well as measure of all interdependent projects aspects.

In order to confirm or reject specified hypotheses this paper is asking to offer the answers on the next questions:

1. What methods for investment appraisal purpose traditional (conventional) investment analysis use?
2. What are advantages and disadvantages of the traditional investment analysis?
3. What are the major characteristics of the modern investment analysis approach, generally real option analysis?
4. What advantages and disadvantages of real option analysis can be noticed?
5. What is the result of the traditional investment analysis of the plum brandy production?
6. What is the result of the real option investment analysis of the plum brandy production?

## Final valuation of the project

As maintained before, the adjusted value of the project should take in consideration an option value of the extended project. In case of plum production it was identified that plum plantation gives an option for distillery investment, which will use the plum from the plantation as the input source. Because of that, real value of plantation consists of NPV of the future net cash flow as well as call option value for distillery establishment.

$$\text{Strategic NPV} = \text{Real option NPV}_{\text{plam plantation}} = \text{NPV} + \text{call option}$$

$$\text{Real option NPV}_{\text{plam plantation}} = -2.036,18 \text{ EUR} + 4.986,72 \text{ EUR} = 2.950,54 \text{ EUR}$$

(Black-Scholes option valuation)

or

$$\text{Real option NPV}_{\text{plam plantation}} = -2.036,18 \text{ EUR} + 5.184,17 \text{ EUR} = 3.147,99 \text{ EUR}$$

(Binomial option valuation)

Real option calculation of NPV adjusted by the next investment option value, gives considerably different results than conventional NPV calculation. While the NPV without option value indicates that plum production is not profitable enough, this extended approach found that NPV is positive. Therefore, investment in plum production with option of distillery extension should be accepted.

If the whole project consisted of plum and plum brandy production should be evaluated, the investment appraisal is also enlarged by option value.

$$\text{Real option NPV}_{\text{project}} = \text{NPV} (\text{plum}) + \text{call option}$$

(brandy production) + NPV (plum brandy)

$$\text{RO NPV}_{\text{project}} = -2.036,18 \text{ EUR} + 4.986,72 \text{ EUR} + 2.996,18 \text{ EUR} = 5.946,72 \text{ EUR}$$

(Black-Scholes)

$$\text{RO NPV}_{\text{project}} = -2.036,18 \text{ EUR} + 2.996,18 \text{ EUR} + 5.184,17 = 6.144,17 \text{ (Binomial method)}$$

## Recapitulation of the calculation

On example of plum brandy production, the call option that exists in the plum plantation has been determined. Using only traditional methods of project evaluation, the plum plantation of 1 ha in current market condition hasn't showed satisfied results. But, traditional methods have ignored hidden (potential) value that investment has. Traditional methods neglect flexibility of management decision-making, which is in compliance with actual market situation.

*Plum plantation owner has different options:*

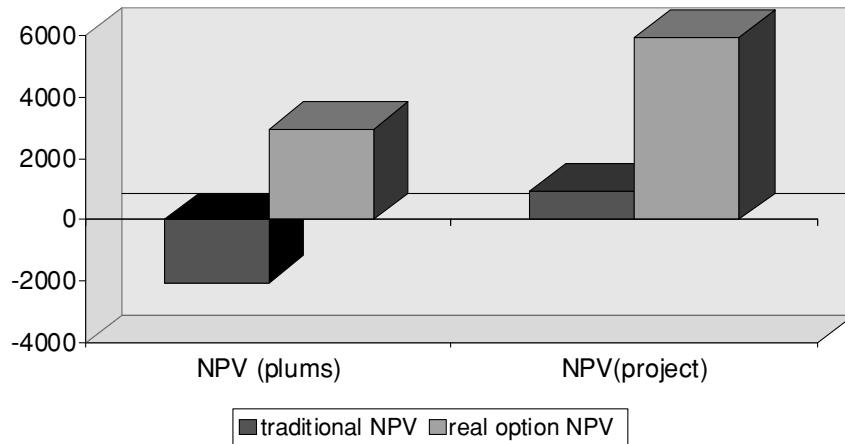
- To withdraw the plantation after first negative results caused by, for example, decrease of plum price.
- To enlarge a plantation hoping that results will be better with higher production surface (economy of scale).
- To change a technology in order to change target from proceeding plum to fresh consumption plum.
- To expand plum production to plum processing products (plum brandy, plum jam).

In our example, the option of plum brandy, as one of the options, has been tested. Considering separately, plum brand production ensures positive business performance, much better than plum production only. Logically, plum plantation has a certain optional value that raises a first project appraisal.

**Table 1:** Comparison of traditional and real option appraisal

	Traditional appraisal	Real option appraisal (Black-Scholes)	Real option appraisal (Binomial method)
NPV – plum plantation	-2.036,18 EUR	2.950,54 EUR	3.147,99 EUR
Investment appraisal	Not accepted	Accepted	Accepted
NPV - aggregated	960,00 EUR	5.946,72 EUR	6.144,17 EUR
Investment appraisal	Accepted	Accepted	Accepted

Source: Author's calculations

**Graph 1: Traditional and RO NPV**

Source: Author's calculations

Using exclusively traditional approach there is no possibility to evaluate this extension opportunity value. Because of that, the project of plum production would be rejected. Real option can overstep this shortage increasing the project value by option value.

## Consultation

A present business environment is very dynamic and it takes a much of decision making, fast but rational. Because of the irreversibility of the investment projects it is strongly important to notice all the business opportunities that exist. Traditional methods of investment appraisal cannot evaluate these options and managerial flexibility appropriately. High potential projects, that might turn out to be a valuable part of future project portfolios might be abandoned completely using a conventional NPV methodology. Therefore, real options theory, a complement to DCF, needed in such cases, adds that necessary flexibility. In the process, real options theory addresses important strategic and financial issues.

Thanks to the analogy between financial instruments investments and real projects, the real option valuation methods have been developed during 1970s'. In spite of some critics that found different constraints of the real option approach, today, it is unique methods for the option valuation. However, only 10% of all American CFO use real option model in they project planning.

Presented sample has been used for simple understanding of the basic principles of the real option model. The only feasible way to value more complicated projects is by using a computer programmes. In this case a project of the plum brandy production has been tested with traditional and real option methods as well. Traditional methods of plum plantation investment appraisal haven't given acceptable estimation. Option's methods have taken in consideration optional value that emerges from the plum plantation. In case where plum brandy production is offering an acceptable business result, plum plantation value, as the

first phase of the brandy production should be increased by its optional value. With this new perspective, the plum plantation investment should be taken.

The main problem for faster real option acceptance is its appliance in practical, not only in academics' level. Hence, academics must listen carefully to the critiques of practitioners and allow them to influence the kinds of problems that are addressed in academic research.

As the prerequisite for developing of the real option approach it is needed to educate a student and entrepreneurs about benefits of the real option methods and to recognize the options in each practical sense. In this respect, I hope that this thesis can provide an option to improve financial management knowledge and increase the goodwill of its author and readers as well.

## References

**Dixit, A, Pyndick, R.S. (1995):** The Options Approach to Capital Investment, Harvard Business Review, May/June, pp. 105–115.

