APPLICATION OF CONDITIONAL AND UNCONDITIONAL TERMS OF CONSTRUCTION PRODUCTS

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Keywords: *real options, binomial model, investment projects, construction products, conditional and unconditional contracts*

Abstract: *The use of real options for evaluating investment activity in the implementation of construction projects has its specific features and parameters, as well as some limitations, but at the same time – and the possibility of using this approach as a complement to traditional dynamic models. This allows for making flexible investment decisions in conditions of uncertainty and ambiguity. The approach to real options in construction projects provides an opportunity for choice, but not an obligation to take specific investment actions.*

The binomial model for evaluating real options in construction projects, through options for determining the value of options, shows that the application of option theory in making decisions about the implementation of investment projects makes it possible to evaluate and justify investment costs.

This article is aimed at examining the possibilities for applying conditional and unconditional term contracts in the implementation of construction products, through real examples from practice. The aim is to deduce the advantages of applying option theory to evaluate real options in construction projects in order to determine the extent to which the investment is appropriate.

The main conclusions in the article are made on the basis of a review of relevant sources on the researched issues, a study of international practice, as well as the author's personal applications of option theory and, more specifically, practical applications of the theory for evaluating real options in construction projects.

ПРИЛОЖЕНИЕ НА УСЛОВНИ И БЕЗУСЛОВНИ СРОЧНИ ДОГОВОРИ ПРИ РЕАЛИЗАЦИЯТА НА СТРОИТЕЛНИ ПРОДУКТИ

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Ключови думи: *реални опции, биномиален модел, инвестиционни проекти, строителни продукти, условни и безусловни договори*

Резюме: *Използването на реални опции за оценка на инвестиционната дейност при реализацията на строителни проекти има своите специфични характеристики и параметри, както и определени ограничения. Същевременно този подход може да се използва като допълнение към традиционните динамични модели. Това позволява вземането на гъвкави инвестиционни решения в условията на несигурност и неопределеност. Подходът на реалните опции при строителните проекти предоставя право, но не и задължение за предприемане на конкретни инвестиционни действия.*

Биномиалният модел за оценка на реални опции в строителните проекти позволява определянето на стойността на опциите и показва, че прилагането на опционната теория при вземането на решения за реализация на инвестиционни проекти дава възможност за оценяване и обосноваване на инвестиционните разходи.

Настоящата статия разглежда възможностите за прилагане на условни и безусловни срочни договори при реализацията на строителни продукти чрез конкретни примери от практиката. Целта е да се изведат предимствата на опционната теория при оценяването на реални опции в строителни проекти, за да се определи доколко инвестицията е целесъобразна.

Основните изводи в статията са направени въз основа на преглед на релевантни източници по изследваната проблематика, проучване на международната практика, както и на личния опит на автора в прилагането на опционната теория и по-конкретно – в практическото ѝ използване за оценяване на реални опции в строителни проекти.

Introduction

Today, more and more organizations are approaching effective management of opportunities in the implementation of investment projects, applying the idea of moving from a limited focus on risk as a threat to the management of those of its sources that can lead to positive impacts and opportunities, in order to get the most out of the overall risk management of the investment project. At the corporate level, organizations are required to create and maintain investment opportunities that are aligned with both their potential and their need for growth, but also with taking on appropriate levels of risk in order to grow. At the same time, in order to build a secure and working strategy, options are needed that facilitate the maintenance of a portfolio of investment opportunities (from low risk, low return to higher risk and higher return) depending on the forms of investment and the potential of the organizations.

Specialized literature indicates that the value of each asset represents the present value of the cash flows expected from this asset. If assets are attributed two specific characteristics, this basic rule would have an exception. These characteristics are related to the fact that: (1) assets derive their value from the values of other assets and (2) the cash flows on assets depend on the occurrence of specific events (Rau, R., 2016).

The specified assets are called “options”, and it is characteristic of them that the present value of the expected cash flows from these assets will underestimate their true value. In the focus of investment project management, it is important to determine and analyze the characteristics of the cash flow of options, to consider the factors that determine their value and to explore the possibilities of how and in what way they can be best valued.

From this perspective, the purpose of this article is to present what are the possibilities for the application of conditional and unconditional term contracts in the realization of construction products. By providing real examples from the practice of construction businesses, the presentation attempts to show the advantages of applying option theory to the evaluation of real options in construction projects.

Statement

1. Fundamentals of Option Pricing

The theoretical framework for option pricing is that “options” give the holder the right to sell or buy a given quantity of an underlying asset at a fixed price (“strike price” or “exercise price”) on or before the date the option expires (Rau, R., 2016, p. 98). Another definition states that options are the right over another asset, other right or economic element, with an option giving the holder the right to buy or sell a specific asset at a price previously agreed upon between the issuer and the holder of the option (Prodanov, St., 2009, p. 369).

Since this is a right, not an obligation, the holder can choose not to exercise the right and let the option expire. According to the specialized literature, there are two types of options (Prodanov, St., 2009, pp. 369–370):

- A call option is called a “call option”. It is similar to a “long” position, as it gives the holder the right to buy an asset (real, financial) at its exercise price (fixed). This happens on a date that is determined in advance.
- A put option is called a “sell option”. It is similar to a “short” position, as it gives the holder the right to sell an asset (real, financial) at its exercise price (fixed). This also happens on a date that is determined in advance.
- A call option gives the right to buy the underlying asset at the exercise price. This can happen at any time before the option expires. The buyer pays a price for this right. If at the expiration of the option, the value of the asset is less than the strike price, the option is not exercised and expires worthless. On the other hand, if the value of the asset is greater than the strike price, the option is exercised – the buyer of the option buys the asset at the strike price. The difference between the value of the assets and the strike price includes the gross profit from the option investment. The net profit from the investment is the difference between the gross profit and the original price paid for the call option.
- A put option gives the buyer of the option the right to sell the underlying asset at a fixed price at any time before the expiration date of the option. The buyer pays a price for this right. If the price of the underlying asset is higher than the strike price, the option will not be exercised and will expire worthless. On the other hand, if the price of the underlying asset is lower than the strike price, the owner of the put option will exercise the option and sell the stock at the strike price, receiving the difference between the strike price and the market value of the asset as gross profit. Again, netting out the initial costs paid for the put option gives the net profit. A put option has a negative net profit if the value of the underlying asset exceeds the strike price,

and a gross profit equal to the difference between the strike price and the value of the underlying asset if the value of the asset is less than the strike price.

- Another traditional form of options should be mentioned, known as a "double option", although it is less commonly used. It gives the holder the right to buy or sell a real or financial asset at the price of its exercise. This again happens on a date that is determined in advance. It is important to note that the two rights (to buy or sell) are not given simultaneously. This type of options is characteristic mostly when unlisted commodity options are traded, as the exercise of the call option leads to the expiration of the put option, and the exercise of the put option – to the expiration of the call option, respectively (Prodanov, St., 2009, p. 370).

2. Determinants of the value of the option

The value of a given option is determined by a number of variables related to the underlying asset and the financial markets. The following are the determinants of the option value (Rau, R., 2016):

1. ***The current value of the underlying asset***: options are assets that derive value from the underlying asset. Therefore, changes in the value of the underlying asset affect the value of options for that asset. Since call options provide the right to buy the underlying asset at a fixed price, an increase in the value of the asset will increase the value of the call option. Put options, on the other hand, become less valuable as the value of the asset increases.
2. ***Difference in the value of the underlying asset***: the buyer of an option acquires the right to buy or sell the underlying asset at a fixed price. The greater the variance in the value of the underlying asset, the greater the value of the option. This applies to both call and put options. However, it should be borne in mind here that higher variance can reduce the value of the underlying asset. The further a call option enters the profit zone, the more it resembles the underlying asset itself. For call options that are deeper in the profit zone, higher variance can reduce the option's value. Although it may seem counterintuitive at first glance that increasing the measure of risk (variance) should increase value, options are different from other securities in that option buyers can never lose more than the price they pay for them; in fact, they have the potential to make significant profits from large price movements.
3. ***Dividend payments on the underlying asset***: The value of the underlying asset can be expected to decrease if dividends are paid during the life of the option on it. As a result, the value of a call option on that asset is a decreasing function of the amount of expected dividend payments, while the value of a put option is an increasing function of expected dividends. There is another way to understand the effect of dividend payments on call options – they represent a cost of postponing the exercise of the option when it is in the profit zone. To better understand this, an example can be given with an option on a traded stock. Once the call option moves into the profit zone, i.e. its holder would make a profit upon exercising it, exercising the option will provide the investor with the stock itself and the right to receive dividends from it in subsequent periods. If the option is not exercised, these dividends will be lost.
4. ***Strike price of the option*****:** one of the key characteristics used to describe an option is its strike price. In the case of call options, where the holder acquires the right to buy at a fixed price, the value of the option decreases as the strike price increases. In the case of put options, where the holder has the right to sell at a fixed price, the value of the option increases as the strike price increases.
5. ***Time to expiration***: Both call and put options become more valuable as the time to expiration increases. This is because a longer period allows more time for the value of the underlying asset to change, which increases the value of both types of options. Furthermore, in the case of a call option, where the buyer must pay a fixed price at expiration, the present value of this fixed price decreases as the life of the option increases, which increases its value.
6. ***The risk-free interest rate corresponding to the term of the option***: Since the buyer of an option pays its price in advance, an opportunity cost (opportunity cost) arises. This cost depends on the level of interest rates and the time to expiration of the option. The risk-free interest rate also plays a role in the valuation of options, since the calculation of the present value of the exercise price takes into account that this price must be paid (in the case of call options) or received (in the case of put options) only at expiration. An increase in interest rates increases the value of call options and decreases the value of put options.

It is pointed out that the relationship between the price of the underlying asset and the profit or loss when issuing call and put options at the expiration date is opposite: other things being equal, the loss on call options is not limited, and its size coincides with that of the profit of the option buyer; the profit on put options is limited to the option price, and the loss – to the minimum price of the underlying asset (in the most pessimistic version, this loss is equal to zero) (Prodanov, St., 2009, p. 372).

The right of the owner for a certain period of time, which gives the call option, is associated with the payment of the exercise price, and in return he receives an asset with a certain value. It should be noted that the exercise of the call option is irreversible. Although investors can sell the asset

to other investors, they cannot recover the option or the money they paid for it to exercise it. Similarly, a company that has an investment opportunity has the option to spend money (the exercise price) now or in the future in exchange for an asset (e.g., a project) of some value. Again, it can sell the asset to another company, but it cannot get its investment back.

As with financial options, a call option to invest in real assets is valuable because of the potential for increasing net profit if the value of the asset increases. If the value of the asset decreases, the company does not have to invest and will lose only what it spent to obtain the investment opportunity. Large corporations usually obtain investment opportunities through patents, land ownership, or natural resources. In a general sense, they arise from the company's managerial resources, technological expertise, reputation, market position, and possibly scale, which allow the company to undertake investments that individuals or other firms could not undertake.

Recent studies have shown that the opportunity costs of investing can be large and investment rules that ignore them can be wrong (Reside, R., 2022). In addition, the opportunity costs of investing are highly sensitive to the future value of the investment project, so changing economic conditions affecting the perceived risk of future cash flows can have a large impact on investment costs.

3. Application of conditional and unconditional forward contracts in the realization of construction products – real examples from practice

The above statement made it clear that, like financial options, real options also give the right to "buy" or "sell", i.e. to continue an investment activity or to terminate it. At the same time, the valuation of real options is analogous to the valuation of financial options, although there are some differences between them. The analogy is usually associated with the parameters for evaluating options in the Black-Scholes model with the parameters for evaluating real options. In many cases, the differences between financial and real options are not discussed in depth and do not reflect the practical problems of valuing real options.

In practice, for example, the values of financial options are not negative, while some real options may have negative values for the underlying asset. If the valuation does not take this into account, the applied method gives strange and misleading results. Another reason for the difference is that information about financial options is available in all markets. This is not the case for real options, and this ambiguity must be taken into account both in the valuation in real conditions and in the analysis of the results. In addition, the length of the investment periods is usually very different. As a result, uncertainty changes (usually decreases) during the investment in real options.

Another common problem is that real options valuation models are complex to use and difficult to explain, especially without serious specialist training (Triantis, A., 2005). Real options are often analyzed through the prism of financial options and to be justified by an equivalent portfolio or a risk assessment approach in a neutral market. In practice, both approaches require information about the underlying asset and its parameters for a given market.

Increasingly, the requirement that input data be based on market conditions is required in practice, and real options are accepted as a way to apply the binomial model. Analyses show that the requirements for the valuation of financial options and real options are met by assessing the results of the net present value (NPV) for comparable investments. In this regard, real options are considered as a complement, not a substitute, in the calculation of discounted cash flows, which is a positive point in their application (Woolley, S., F. Cannizzo, 2005).

The results obtained for the real options are subjected to detailed analysis in order to make the right management decisions. In addition, when it comes to investment projects, the evaluation of patents and technologies is mandatory. This is essentially a difficult task, because the types of uncertainty exclude the possibility of precise evaluation results.

Some main differences between financial and real options in the implementation of investment projects in construction are presented below depending on:

First – type of assets:

- Financial options refer to financial assets that have well-defined market prices and can be traded on financial markets. They have a real market value that is easily accessible and measurable;
- Real options refer to physical assets or investment projects (for example, construction sites), the value of which depends on future market conditions. They cannot be easily traded on markets and are often valued based on market forecasts.

Second – access to information:

- Financial options have clear and publicly available data about their parameters (prices, liquidity, volatility, etc.), which can be used to accurately and precisely calculate their value;

- Real options often lack accessible information, and their valuation is based on forecasts and modeling of future market conditions, which introduces uncertainty, increases the difficulty of their valuation and requires careful risk management.

Third – future forecasts:

- Financial options are based on financial assets with predictable risks and returns, which facilitates their evaluation with mathematical models;
- Real options have greater uncertainty and complexity in terms of future forecasts, especially in the context of investment projects in construction, where many factors operate (market conditions, regulations, technological innovations).

Fourth – duration of the investment period:

- Financial options usually have shorter execution periods, as the terms for exercising the options can be from a few days to months;
- Real options in construction involve longer investment periods (years), as uncertainty and market conditions during these longer periods change enormously (usually decrease).

Fifth – accuracy of assessment:

- Financial options have a more precise and reliable measurement of value thanks to the available data, the stability of the markets and shorter execution periods;
- Real options are often more vague and less precise because they involve higher levels of uncertainty that are difficult to predict or quantify. Estimates depend heavily on the quality of the forecasts and data used.

Sixth – risk assessment and management:

- Financial options require the use of strict assumptions of risk neutrality and rational market behavior;
- Real options cannot always be valued under these assumptions, as their value and applicability often depend on strategic thinking that is less related to purely financial valuations. Risk in real options is assessed and managed differently (for example, by hedging or transferring risk to partners such as real estate agencies).

Real options are not hedged in the same way as financial options, as this requires specific information about the underlying asset and the state of the market. They do not have fixed and easily measurable payment functions, as in financial options. In addition, financial options are mainly used in liquid and stable markets, where assets are standardized. Real options are mainly used in areas with long-term and capital investments, such as construction, where there is a certain uncertainty and longer investment periods. They are used as part of the strategic planning of investment projects, which allows flexibility in decision-making and adaptation to changing conditions.

It can be summarized that the main difference between financial and real options in the construction sector is related to the specificity of the assets, market information, the complexity and uncertainty of the valuation, as well as the length of the investment period. While financial options are more precise and easily applicable in regulated markets, real options offer strategic flexibility in conditions of high uncertainty and long-term investments in construction.

The described differences between financial and real options in construction investment projects emphasize the importance and role of company management in making investment decisions under conditions of uncertainty. While financial options are standard and tradable, real options provide the opportunity to adapt investments to changing market conditions. This adaptability makes real options a valuable tool for managing construction projects, including risk management, allowing companies to control and minimize it. In this context, the different types of real options also play a specific role in the investment planning process. They provide construction companies with options to postpone, expand, cancel or modify the project, which allows for better management of uncertainty. The main types of real options that can be applied in construction, as well as their importance for the investment process, can be distinguished as follows (Urvashi, V., 2011):

- Option to defer/postpone – the company postpones the implementation of its investment intentions until market uncertainty decreases and more information is available for decision-making. This type of option is useful when capital expenditures are significant;
- Option to abandon/exit option – the company abandons the project in order to reduce its losses in the event of a significant deterioration in market conditions. This type of option is applied when there is an opportunity to redirect resources or sell assets;
- Option to contract/divestiture option – the company sells a share of its business or has the opportunity to reduce the scale of its activities, especially in unfavorable market conditions for

it. This type of option is applied in connection with risk management, as it provides an opportunity to provide more flexibility;

- Option to expand – the company increases its scale or has the opportunity to invest further when market conditions are favorable for it.

Of the existing combined models of real options, the specialized literature pays most attention to (Lee, Meng-Yu, et al., 2006):

- Switching options – the company has the opportunity to change the scale of its production or to use various technological innovations quite flexibly, depending on market conditions. Such types of combined options are usually used by sectors that are characterized by stronger dynamics and higher risk;
- Compound options/sequential options – companies apply them in the implementation of projects consisting of several interconnected stages. In this way, each decision that follows depends on and is tied to the goals and results achieved in the previous stage. Accordingly, the company analyzes the completion of each stage and decides whether to continue or terminate the project.

These models are used to evaluate investment projects in construction, industry, high-tech industries and the pharmaceutical sector, where uncertainty is high and strategic flexibility is a key factor for success.

The analysis of the main features in the application of real options for risk management within conditional and unconditional term contracts requires a comparison of the expected profit of the construction company in different future states of the real estate market depending on the type of contract concluded.

Let us assume that the value of the real option is 1,500 EUR/m², and a real estate agency offers a price of 1,455 EUR/m² for concluding an unconditional term contract (forward). In this case, the profit of the construction company is fixed and does not depend on the dynamics of the market. It is assumed that the company's profit per square meter is 160 EUR, and the developed built-up area (GFA) amounts to 1,860 m².

Therefore, the total profit of the construction company will be:

1,860 * 160 = 297,600 EUR

When concluding an unconditional fixed-term contract, the construction company guarantees a gross profit (before taxes) of 297,600 EUR.

However, if the company chooses a real option, it reserves the right to fulfill or not fulfill the terms of the contract depending on the state of the housing market. In the event of an increase in housing prices, the construction company will prefer to sell on the open market, while in unfavorable conditions it will choose to exercise the real option.

In an optimistic market scenario, the expected profit of the construction company per square meter will be:

$Ca = 1.460 - 1.295 = 165$ EUR/m²

In a pessimistic market scenario, the profit from exercising the real option will be minimal:

$Cb = 1.320 - 1.295 = 25$ EUR/m²

From this, the following conclusions can be drawn:

- In an optimistic scenario, concluding a real option contract means a higher profit for the construction company compared to the risk-free profit guaranteed by the unconditional forward contract. Therefore, the price of the real option contract would be higher than that of the unconditional contract, while at the same time the risk is lower.
- In a pessimistic scenario, the profit from a real option contract would be lower than that of the unconditional contract. Therefore, the fixed price of the forward contract provides greater security for the construction company.

Risk management can be carried out through three main approaches:

1. Refusal to conclude a contract, in which all uncertainty related to price changes is fully borne by the construction company;
2. Conclusion of an unconditional fixed-term contract, providing a fixed return, regardless of market conditions;
3. Use of a real option or a conditional fixed-term contract, which allow for flexibility in adverse market changes.

The analysis of the results reveals different options for management decisions for the construction company's management team:

- First, if the company assumes all the risk without concluding preliminary contracts, with an increase in prices on the real estate market, the expected profit of 165 EUR/m² will be maximum.
- Second, the construction company is faced with the choice between the two types of fixed-term contracts. In this case, the unconditional fixed-term contract guarantees a fixed profit of 160 EUR/m², which is higher compared to the profit when using a real option in conditions of a pessimistic scenario of housing market development (25 EUR/m²).

When concluding a real option contract and the presence of favorable market conditions, the expected profit from the option will amount to 165 EUR/m², which makes it higher compared to the unconditional contract providing 160 EUR/m². On the other hand, the unconditional fixed-term contract will provide higher protection in the event of negative developments in the housing industry. In this case, the real option contract will provide better opportunities in the event of an increase in prices in housing construction. Both approaches carry risk, therefore the final choice depends on the expectations of the management team regarding future market dynamics.

In this case, it is important to compare the total investment for the acquisition and renovation of the housing (2,328,000 EUR) and the expected profit that can be realized by concluding term contracts at different future market prices per square meter.

In order to assess the impact of risk and a strategy for its management, we determine the revenue of the construction company from the sale of the housing. This is the sum of the costs of purchasing the buildings, repairing the housing and the profit per m², that will be realized upon sale. With this information, the management team will decide on the best option for risk management when implementing investment projects in construction.

Table 1. Revenue from operations and profit of the construction company under different hypotheses for the state of the housing market in one year (euro/m²)

Hypotheses about the state of the housing market in a year	**Own risk**	**Unconditional contract**	**Real option**
Optimistic			
• revenue growth	1,600	1,455	1,460
• profit	305	160	165
Realistic			
• average revenue	1,360	1,455	1,390
• average profit	165	160	95
Pessimistic			
• revenue decline	1,320	1,455	1,321
• profit decline	25	160	25
Option value	**-**	1,455	1,500
Maximum contract value	**-**	1,547	1,547

Table 1 presents the results of the calculations for making management decisions and various strategy options for the construction company. The results for the realistic variant of the hypothesis for the state of the housing construction market within the next year are determined as average values of the results for the optimistic and pessimistic hypotheses. In possible variants for the next one-year period, however, they may fluctuate within about +5% to -5% of the calculations made at the present time.

As for the other data (Tab. 1), when pessimistic market conditions arise, the profit for an unconditional fixed-term contract increases by more than six times compared to the risk for own account. At the same time, the revenue from the sale of a square meter when concluding an unconditional contract (under the same market conditions) increases the income by only 10.2%. Similar conclusions can be drawn for the other contract variants, with different levels of risk leading to different financial results.

The example under consideration illustrates protective strategies when making risky decisions. Thus, the propensity of management teams to take or avoid risk varies depending on the specific economic conditions, which in turn leads to the choice of different strategies. In one of the cases, the information shows a reason for the construction company to take risk on its own account, without the need to negotiate with a real estate agency. At the same time, the results support the choice of an unconditional fixed-term contract in a negative (pessimistic) market situation, as this would allow for a partial transfer of the risk to the real estate agency in cases of price changes.

In conclusion, it can be stated that the choice of an appropriate strategy will depend on several significant factors:

- Amount of expected profit;
- Amount of total revenue;
- Value of investment costs;
- Value of realized revenue;
- Whether the investment projects under consideration are part of a larger business or stand-alone;
- Strategic, economic and social significance of the investment projects;
- Propensity to take or avoid risk;
- Expectations of owners, investors, managers for the future development of the business.

Based on these factors, the final decision to conclude conditional or unconditional fixed-term contracts should be made after careful analysis and consideration of the specified circumstances.

In conclusion, it can be summarized that the use of real options for assessing investment activity in the implementation of construction projects has its specific features and parameters, as well as some limitations, but at the same time – and the possibility of using this approach as a complement to traditional dynamic models. This allows for flexible investment decisions to be made in conditions of uncertainty and ambiguity. The approach to real options in construction projects provides an opportunity for choice, but not an obligation to take specific investment actions. Traditionally, investments for the development of a given industry or business are based on the analysis of the net present (current) value, and the assessment of investment projects through real options is this additional perspective through which the activities of the investment can be assessed in a different way.

At the same time, the shortcomings and negatives in the application of the real options approach are dictated by possible limitations and assumptions related to the collection of new information, costs, market conditions and changes in them, etc. In the application of option contracts for the implementation of construction projects, some of the shortcomings can be mitigated by using more conservative estimates, which, although they reduce the value of the option, can justify the implementation of the project in the event of a positive result. Another approach used in practice is the scenario approach, which shows possible options in conditions of positive (optimistic) or negative (pessimistic) market conditions.

Conclusion

As a result of the issues considered and the presented real examples from the practice in construction for the application of conditional and unconditional term contracts in the realization of construction products, as well as in accordance with the goal set for this article, the following conclusions and inferences can be drawn:

First. In the modern corporate environment, option theory provides new opportunities for managing investment projects, allowing for risk assessment and flexible adaptation to market conditions. Since this is a right, not an obligation, the holder can choose not to exercise his right and let the option expire.

Second. Option contracts can be conditional or unconditional, with conditional ones providing flexibility in investment decisions, while unconditional ones commit the parties to certain obligations.

Third. Real options play a key role in investment projects, as they enable strategic planning and management flexibility in the face of changes in the economic and market environment. Binomial models are effective for valuing risky assets in construction projects, as they offer a flexible approach to modeling uncertainty and making investment decisions.

Fourth. The use of term contracts in construction projects contributes to better risk management by allowing the transfer of part of the uncertainty to third parties through various option strategies.

Fifth. Option methods provide a competitive advantage in project management by enabling dynamic adaptation to market conditions and optimizing the value of investments.

In conclusion, it can be added that models for valuing real options in construction projects, through options for determining the value of options (equivalent portfolio, real option, unconditional term contract) show that the application of option theory in decision-making for the implementation of investment projects makes it possible to assess and justify investment costs. The advantage of applying option theory to assess real options in construction projects is that even at the initial stage of forecasting the expected results and benefits, it is possible to determine the feasibility of the investment, by examining the possibilities for its postponement, modification or termination. This allows flexibility in making decisions about project implementation (unlike the analysis of the net present value).

References:

1. Lee, Meng-Yu, et al. (2006). The Sequential Compound Option Pricing with Random Interest Rate and Application to Project Valuation. Proceedings of the 9th Joint Conference on Information Sciences, JCIS, doi: 10.2991/jcis.2006.98.
2. Rau, R. (2016). Option Pricing Theoryand Models. In: Short Introduction to Corporate Finance (pp. 98–125). Cambridge Short Introductions to Management. Short Introduction to Corporate Finance: Cambridge University Press, doi: https://doi.org/10.1017/9781316105795.006.
3. Reside, R. (2022). Real options: A review of select theories and applications, UPSE Discussion Paper, No. 2022-02, University of the Philippines, School of Economics(UPSE), Quezon City, doi: https://hdl.handle.net/10419/266064
4. Prodanov, St. (2009). Options - an instrument of investment in securities. In: V. Adamov, St. Prodanov. Investments (pp. 369–382). Svishtov, Al "Tsenov".
5. Triantis, A. (2005). Realizing the potential of real options: does theory meet practice? Journal of Applied Corporate Finance, 17(2), 8–16, doi: https://doi.org/10.1111/j.1745-6622.2005.00028.x
6. Urvashi, V. (2011). A Review of Real Option Practices Followed by Corporate for Expansion and Deferral Decision. The IUP Journal of Financial Risk Management, Vol.VIII, No.1, 7–22, doi: https://ssrn.com/abstract=1869863
7. Woolley, S., F. Cannizzo (2005). Taking Real Options Beyond the Black Box. Journal of Applied Corporate Finance, 17(2), 94-98, doi: 10.1111/j.1745-6622.2005.00036.x.