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# Continuous valuation model for work-in-progress investments with fuzzy logic method

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## Abstract

Currently, banks and other financing institutions ask for detailed project documentation in order to finance major building projects. Among other requirements, continuous valuation reports are to be provided by investors under the term of building works to prove current Market Value of the project. There is no scientific model for work-in-progress valuation, so appraisers are forced to use subjective judgments<sup>1</sup>. A credible and objective valuation method should help to minimize banking risk and, as a result, to increase lending activities. In the scientific literature, the fuzzy logic concept has been suggested to utilize for valuation purposes, but until now, it has not been investigated for work-in-progress situations. Under the term of building, non-defined (“fuzzy”) variables are usable and appropriate to predict the future. In this article, the author will describe and present a valuation model, which - in conjunction with automated project management tool - gives the best estimation of the actual Market Value of the project. The proposed model is based on Discounted Cash Flow (DCF) analysis. The article will also cover a case study to demonstrate the strengths of the model.

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## 1. Introduction, the reasons of research

Nowadays, after the great collapse of real estate market, financial institutions and other organizations dealing with real estate finance (including the providers of certain community sources) demand the submission of excessively detailed project documentations. The documentation has to contain the market appraisal being monthly or quarterly updated during the construction works. There are no standard, scientifically established models for the statements of Market Value<sup>\*</sup> of on-going projects; experts, while recording technical parameters, are enforced to

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<sup>1</sup> In present study I use the Market Value according to the definition of RICS as follows: „Market Value is the estimated amount for which an asset or liability should exchange on the valuation date between a willing buyer and a willing seller in an arm’s length transaction, after proper

evolve the Market Value by their own personal opinions. The technical literature of project management does not discuss the Market Value, however deals with the changes and monitoring of built-in technical contents. The latest method nevertheless does not follow the changes of the real estate market and the actual Market Value of the on-going development. The introduction of fuzzy logic into the practice of valuation still provides the possibility of keeping the subjective (soft) elements of the experts' opinions however provides a well-organized calculation model for the hard facts being taken into account.

## 2. Valuation models and methods at a work-in-progress investment

The banking practice of great-volume commercial real estate projects before the crisis did not consider essential the market valuation of the development period. Investors considered it enough, in case the main indices, f.e. occupancy rate, and completion level, quality, followed the regulations of the loan agreements [1].

The EVA-method (Earned Value Analysis) is a common and well-known project management tool, suitable to measure the financial and temporal performance of the project. Many technical articles discuss the suitability and enlargement of this method. A comprehensive analysis is published by Anbari [2] for instance. The EVA approach investigates the project focusing only on financial and technical progression during the construction works, its assessment bases are the planned budget and the scheduled time. In this examination, the market evaluation of the project and the changes of market data and according to these, the changes of everyday Market Value are not enlisted; we would say that the examinations of EVA are suitable for the control of the suitability of the static, technical criteria. At the same time, the indices generated by the EVA are input information for the valuation process.

It is interesting that at the time of development of EVA methodology, the utilization of fuzzy language had been risen using soft descriptive variables instead of the usual discrete quantitative quantities [3].

## 3. Valuation based on fuzzy logic

The fuzzy logic was established in 1965 by Zadeh, when he described the so-called fuzzy set theory and defined the different operations [4]. Many used his works in the past fifty years, and by today, fuzzy logic has become a general practical application in control system [5]. The basic idea is that one certain element might belong to an set at different levels; this theory maps the vague nature of human thinking and the grammatical means of expression [6].

Different authors have examined the possibility of appliance of fuzzy logic in real estate appraisal. (F.e. [7], [8], [9], [10], [11], etc). All articles are common in that the authors consider the fuzzy method, the "soft" descriptions much more appropriate to real estate market forecasts, than valuations given by concrete data or ranges. For example for estimation of apartments' prices in Turkey, Yalpir introduces a simple correlation that describes the market better than the usual hedonistic model [10]. Real estate variables are partly coherent, partly based on opinions and intuitions, therefore, their quantifications and processing by discrete models bring along significant reduction of experts' knowledge. Glumac and his co-author [8] has worked out the system of a questionnaire based on the Fuzzy Delphoi method, to find the extra information in aggregated experts' opinions, supporting the evaluation of brown field investments. The method of fuzzy logic also suitable to provide information about the risks of the market for investors, as also in this case, it is to model the common effects of vague forecasts [12]. Authors have found the fuzzy logic also in the valuation process, and developed a method to measure the environmental output of the contractors for example [13]. Lee and his co-authors have worked out a complete mathematical real estate appraisal model, where the ranking of the variations were considered as experts' exercises. Out of this rank, they calculated an approximation for Market Value with the tool system of the fuzzy logic [14].

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marketing and where the parties had each acted knowledgeably, prudently and without compulsion"

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