Classification of the Investment Risk in Construction

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Abstract. The determination of the investment project risk is an important stage in cooperative decision-making and in choosing the most profitable project with the lowest risk level in engineering and construction. Risk management is a systematic process for integrating professional judgments about relevant risk factors, their relative significance and probable adverse conditions and/or events leading to identification of auditable activities. The paper aims to present a verbal method of determining investment risk in construction. The main problem considered is the assessment of investments, which depend on the risk level. This article presents a new way to solve the problem - the CLARA expert verbal method. Formally, the problem is stated as one of multicriteria classifications. A hierarchical approach to the considered effectiveness indicators is proposed. The proof of the method effectiveness is presented. The process of method's practical application is described.

Keywords: expert verbal method, engineering and construction, cooperative decision making.

1 Introduction

Risk management is a systematic process for integrating professional judgments about relevant risk factors, their relative significance and probable adverse conditions and/or events leading to identification of auditable activities [1, 10, 15].

Risk management at the construction stage of the project life cycle influences not only the economic effect of the investment [11], but also efficient functioning of the building in the future [5]. The lack of proper actions in construction can increase the probability of defects, failures, accidents or even catastrophes and eventually ruin the whole project.

In multicriteria environment it is hardly possible to achieve this without resorting to special techniques [12, 13, 14]. This article presents review of the verbal expert methods, because they very efficient in multicriteria environment.

In practice, the task of getting expert knowledge in many cases can be formulated like the task of classification because expert intelligence helps to sort objects (alternatives, states of object) through classes of decision. Elements that comprise the

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whole to be classified may have a different origin. They can be different physical objects, cases of choice or conditions of some object.

Describing the method of prescription of the object to a certain class of decision is complicated because of inverbality of the strategy expert uses. When the expert solves the task of classification in his sphere of knowledge, these inverbal skills are effectively and promptly used. One of the tasks preparing the base for classification is the setting of numerous criteria (attributes), which can be used to describe any object [3]. The scale of all criteria is formed by setting a finite set of possible values. If in a certain task the scale of values of one or more criteria is infinite, it can be modified to finite by cutting it to a finite set of intervals. Finally, a classification of definite intervals and its components must be organized, i.e. the rules, according to which any object can be prescribed to one of the predefined classes, based on the expert knowledge, must be formulated. Classified projects are described by assessing various efficiency criteria that could be both qualitatively and quantitatively expressed.

The purpose of this article is to demonstrate how multiple criteria can be used in analyzing the facility location problems.

The paper is structured as follows. The next section presents the formal problem statement and overview, where explains the most popular international multiple objective analysis methods, and demonstrates their application on real problems. Section 3 discusses the CLARA (verbal expert method) framework architecture, the system components, and how single-user application can be extended by CLARA. In section 4 the consistency model that is applied in the default implementation of the CLARA is briefly discussed. In section few requirements, limitations and future work is discussed and in the last section research findings and contributions in this paper are summarized.

2 Formal Problem Statement

Very often investment decision-making and research planning are referred to non-structured problems. Since the essential characteristics of such problems are qualitative, they can hardly be used in the analysis. On the other hand, the quantitative models are not sufficiently reliable. Non-structured problems have the following common characteristics. They are unique decision-making problems, i.e. every time a decision-maker is faced with an unknown problem or the one having new features compared with the previously considered case. These problems are associated with the uncertainty of the alternatives to be evaluated, caused by the lack of information for making a decision. The evaluation of the alternatives is of qualitative nature, being usually expressed verbally (in statements). Classification is a very important aspect in decision making [9]. Classes in decision making are determined by the particular parameters, i.e. the efficiency of technical and technological decisions concerning the subject individuality. Formalizing the considered problem step by step, the analysis was performed.

Given [5, 6, 9]:

1. G is a feature, corresponding to the target criterion (e.g. treatment effectiveness).
2. $K = \{K_1, K_2, ..., K_N\}$ is a set of criteria, used to assess each alternative (course of treatment).