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## Assessment of the risk of the project's contractor bankruptcy using the Partial Least Squares approach

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### Abstract

The project owner or authorized entity (e.g. project manager) is at some point before the decision problem of the delegation execution professional specialist. Typically, on the services market, operates a number of contractors capable of carrying out the intended tasks, and each of them can provide different bid. Regardless of decision-maker's structure of the contracting preferences and number of evaluation criteria, it is necessary to verify whether the selected contractor is actually capable of completing contracted tasks. Very cheap offer may e.g. one be submitted by the bidder threatened with bankruptcy, fighting for survival. Described in this paper, method for assessing the reliability of contractors based on Partial Least Squares approach is fast and effective method to classify them in terms of risk of bankruptcy. Proposed operating model has been validated on publicly available financial data of construction companies listed on the Polish Stock Exchange.

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## 1. Introduction

During the economic downturn a growing number of bankrupt companies is observed. It's reason due to the non-revenue generating contracts with the need to incur the fixed costs of maintaining capacity, delays in payment for loss of liquidity and insolvency of customers, resulting in a lack of payment for the order or the products delivered. Failure to pay for the contractor is in the best case, the need for temporary financing funds from other sources, at the expense of the use of debt financing or destination of their income from other contracts to cover costs already incurred manufacture of a product or completion of the service that is not covered by the customer. On the other hand, the project owner or the general contractor is exposed to the risk of bankruptcy of its subcontractors. In this case, the money involved in the project in the form of an advance or partial payments made yet are usually very difficult to recover. Depending on the legal structure of the contract, owner of the project may also be forced to settle certain liabilities incurred by the bankrupt contractor for the project. Another problem is the suspension of the work on the project, resulting in the need to secure yet realized the extent the selection of a new contractor, sometimes changing technology and project parameters.

The problem of contractors pre-selection has been recognized and supported by optimization methods based on different classes of models. El-Sawalhi *et al.* [3] Made a review and pointed out the following:

- Dimensional Weighting Aggregation (DWA)
- Knowledge Based System (KBS),
- Multi-attribue Analysis (MAA),
- Fuzzy set Pre-qualification,
- PERT model for contractor pre-qualifiacion,
- Analytical Hierarchy Process (AHP),
- Multi-attribute utility,
- Case-based reasoning
- Artificial Neural Networks (ANN)

In this review El-Sawalhi *et al.* [3] indicate main model's advantages, disadvantages and compare them in terms of applicability to group decision making, non-linear behavior, deal with subjective judgment, deal with both qualitative and quantitative criteria, simultaneous Multi-criteria decision making, concern of uncertainty and risk, adaptiveness, needs of system training and high knowledge of the user, understanding the mathematical behavior, and results interpretation ability. Based on this comparison, it can be stated that user expectations in the highest degree meet models based on the methods of Artificial Neural Networks and fuzzy sets. The ANN approach disadvantages came from the need of system training (here it is necessary to remember than in repeated evaluations of the same market players with unchanged selection criteria system needs be learned only once at the beginning), understanding of mathematical behavior and results interpretation. The negative impact of this last two features may be minimized by using the simple classification rule assigning bidders into clear and easy to understand classes (e.g. reliable and non-reliable companies). The unified criterion of "reliability" must be aggregated on the basis of several criteria, where values are clear and accessible for all bidders. Different sets of criteria are defined by several authors. El-Sawalhi *et al.* [3] proposed 31 attributes grouped in seven classes (financial stability, management and technical ability, experience, historical non-performance, resources, quality, health and safety). Shen *et al.* [10] focuses on social influence and technical ability group of criteria to calculate the total competitiveness value. Lam and Yu [7] indicate scoring standard for three quantitative criteria (human resource, financial strength, current workload) and eight qualitative (equipment resources, environmental considerations, claims history, management capacity, quality management potentials, safety and health aspects, past experience and past performance) criteria for their Decision Support System. Palaneeswaran and Kumaratswamy [8] proposed ten criteria in three groups (responsiveness, responsibility, competency) for construction projects. The PMI (Project Management Institute) standard PMBoK Guide [9] introduces the "Evaluation Criteria" as a result (output) of contract planning

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