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2010 : January 2010 - New Hot Papers : Edmundas Kazimieras Zavadskas and Colleagues on the COPRAS Method

**new hot papers - 2010**

**January 2010**



**Edmundas Kazimieras Zavadskas, Arturas Kaklauskas, Zenonas Turskis, and Jolanta Tamosaitiene talk with *ScienceWatch.com* and answer a few questions about this month's New Hot Papers in the field of Engineering.**



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**Article Title: Selection of the effective dwelling house walls by applying attributes values determined at intervals**  
**Authors: Zavadskas, EK;Kaklauskas, A;Turskis, Z;Tamosaitiene, J**  
 Journal: J CIV ENG MANAG, Volume: 14, Issue: 2, Page: 85-93, Year: JUN 2008  
 \* Vilnius Gediminas Tech Univ, Fac Civil Engn, Dept Construct Technol & Management, Sauletekio Al 11, LT-10223 Vilnius, Lithuania.  
 (addresses have been truncated.)

**SW: Why do you think your paper is highly cited?**

Currently, decision-making assessment by multiple attributes is a relevant and widely investigated topic. Multi-attribute decision making (MADM) methods are widely analyzed in academic literature and are applied to problem solving in real-life situations. The proposed methodology and analyzed problem are quite relevant at the present time.

Our research describes and applies a novel multi-attribute decision-making method titled the COMplex PROportional ASsessment of alternatives with Grey number (COPRAS-G). The COPRAS method or intelligent and biometric systems based on this method may be used to analyze different alternative variants, to determine their utility degree and their market value, as well as to get diverse recommendations. Other MADM methods do not have such features. We believe that is the reason why this article is highly cited.

**SW: Does it describe a new discovery, methodology, or synthesis of knowledge?**

Prof. Zavadskas has worked in the area of MADM since 1976 and Prof. Kaklauskas since 1997. They have developed four new multiple criteria decision-making methods:

1. A new method of complex determination of the weight of the criteria, taking into account their quantitative and qualitative characteristics, was developed. This method allows one to calculate and coordinate the weights of the quantitative and qualitative criteria according to the above characteristics.

2. A new method of multiple criteria complex proportional evaluation of the projects, enabling the user to obtain a reduced criterion, determining complex overall efficiency of the project, was suggested. This generalized criterion is directly proportional to the relative effect of the values and weights of the considered criteria, on the efficiency of the project.

3. In order to discover what price would enable a project to be evaluated as competitive in the marketplace, a method of determining the degree of utility and the market value of objects, based on a complex analysis of all their benefits and drawbacks, was suggested. According to this method, the projected degree of utility and their estimated market value are directly proportional to the system of the criteria used to adequately describe them and the values and significances of these criteria.

4. A new method of multiple-criteria multivariant designs of a building life cycle, which enables the user to make computer-aided designs of up to 100,000 alternative project versions, was developed. Any building life cycle variant obtained in this way is based on quantitative and conceptual information.

*"To design and achieve the effective life cycle of a project, a complex analysis of its proposed stages, as well as an evaluation of the interested parties, along with their aims and potentialities, is needed."*

The above second and third methods taken together are referred to as the COmplex PROportional ASsessment (COPRAS) method. Various publications in journal listed in listed in *ISI Web of Knowledge*<sup>SM</sup> from Thomson Reuters describe the COPRAS method extensively. Two aspects that make the COPRAS method superior to the available MADM methods are as follows:

- This method may be used to estimate the utility degree of alternatives, showing, as a percentage, the extent to which one alternative is better or worse than other alternatives taken for comparison.
- This method may be used to estimate the market value of alternatives.

The COPRAS method was applied in practice during the Framework 5 project CONSTRINNONET and the Framework 6 project BRITA in *PuBs*. Zavadskas, together with Kaklauskas and other coworkers, used this method to develop different web-based intelligent and biometric systems for real-world applications.

Zavadskas, on the basis of his long-term scientific studies, including this article, initiated a new EURO Working Group "OR in Sustainable Development and Civil Engineering" (EWG - ORSDCE) and, in July 2009, it was established.

The research noted in our New Hot Paper for January 2010 proposes and explains a novel multi-attribute decision-making method titled the "COmplex PROportional ASsessment of alternatives with Grey relations (COPRAS-G)." The COPRAS-G deals with attributes determined by the grey relational grade. The attribute values are expressed in intervals. A "real-life" case study was used. It is a relevant problem of the refurbishment process in Lithuania.

**SW: Would you summarize the significance of your paper in layman's terms?**

The COPRAS method, or the intelligent and biometric systems based on this method, may be used to analyze any alternatives (books, loans, entertainment, employers, living conditions, vacations, friends, governments, social policies, ethical alternatives, etc.), to determine their degree of utility and shows, as a percentage, the extent to which one alternative is better or worse than other alternatives when taken

for comparison, priority, and market value, as well as to gather various recommendations.

Quantitative and qualitative assessments are often required in order to deal with the uncertainty caused by subjective and imprecise data. Decision-making problems in construction management often involve a complex process in which multiple requirements and conditions have to be taken into consideration simultaneously when the available information is incomplete.

However, many papers also discuss decision-making as it relates to an assessment of uncertainty and the finding of an optimal solution. COPRAS-G aims to assist decision-makers in finalizing their decisions and also outlines the uncertainty of a particular solution in a more precise manner. The problems of dealing with uncertainty, subjectivity, and imprecise data can be overcome by applying the newly developed method, COPRAS-G.

### How did you become involved in this research, and were there any problems along the way?

Edmundas Kazimieras Zavadskas started researching the MADM methods using the utility function in 1979. In 1987, he completed his post-doctoral thesis "Multiple Attribute Decision-making in Construction Technological Processes." In 1989, he was appointed to a professorship at the Vilnius Gediminas Technical University. He is the author of over 50 books published in Lithuanian, Russian, German, and English. He has published more than 350 scientific papers. In 23 years, he has acted as an academic adviser to 31 doctoral students and nine of them have defended or passed their post-doctoral procedures, including Arturas Kaklauskas, Zenonas Turskis, and Jolanta Tamošaitiene.

In June 2009, Thomson Reuters selected an article by Zavadskas *et. al.*, as a **Fast Breaking Paper** in the field of Mathematics.

Arturas Kaklauskas is Chair of the Department of Construction Economics and Real Estate Management and also Vice-Director of the Institute of Internet and Intelligent Technologies at the Vilnius Gediminas Technical University (VGTU). He has participated in more than 20 European Asian and US international projects. The COPRAS method was employed in many of these projects.

*"Our research describes and applies a novel multi-attribute decision-making method titled the COmplex PROportional ASsessment of alternatives with Grey number (COPRAS-G)."*

One of the main areas of our current research is an application of the COPRAS method in the development of new and improved versions of existing intelligent and biometric systems. In 1999, Kaklauskas completed his post-doctoral thesis "Multiple Criteria Decision Support of Building Life Cycle." He has published over 90 scientific papers.

In 2009, Zenonas Turskis completed his post-doctoral thesis "Multi-attribute Assessment Modelling of Buildings' Life Cycle." He is the author of over 70 scientific papers. In June 2009, Thomson Reuters *ScienceWatch.com* selected an article by Turskis as the **Fast Breaking Paper** in the field of Economics & Business.

In 2009, Jolanta Tamošaitiene defended her Ph.D. thesis "The Multi-attribute Assessment of Management Decisions at the Stage of Construction Planning." She is the author of about 20 scientific papers.

### **SW:** Where do you see your research leading in the future?

We intend to further develop and improve the methodology and its application by using new multi-attribute decision making (MADM) techniques, in intelligent and biometric systems. We

will expand this potential to apply developed methods for the solution of problems within different fields of real-world applications.

**SW: Do you foresee any social or political implications for your research?**

To design and achieve the effective life cycle of a project, a complex analysis of its proposed stages, as well as an evaluation of the interested parties, along with their aims and potentialities, is needed. The effect of micro and macro environmental factors should also be taken into account. Besides economic, political and legal/regulatory decisions, other aspects, e.g., social, cultural, ethical, psychological, educational, environmental, provisional, technological, organizational, and managerial, can be analyzed using the COPRAS method.

A formalized presentation of research shows just how various changes in the environment and the extent to which the goals pursued by various interested parties are satisfied, causing corresponding changes in the value and degree of utility in the life cycle of a project. With this in mind, is it possible to solve the problem of optimization concerning the satisfaction of requirements at reasonable expenditures? This requires the analysis of a project life cycle's versions, allowing the discovery of an optimal combination of goals pursued and available finances.

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COPRAS.

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