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Comparative analysis of multiple criteria evaluations of suppliers in different industries

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Abstract

The paper presents the comparative analysis of suppliers' selection problems in different industries, formulated as multiple criteria ranking problems. The evaluation of logistics service providers (LSPs) in a household chemistry industry and meat suppliers in a food industry are carried out. The author compares both the alternative formulations of the decision problems (input) and generated results – output rankings of suppliers. On the input side he confronts: alternative definitions of variants, construction of different families of evaluation criteria, various ways of modelling of the DM's preferences. On the output side the results of computational experiments performed with the application of ELECTRE III/IV and AHP methods are demonstrated. Different aspects of the decision processes concerning the selection of suppliers are thoroughly discussed.

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1. Introduction

The **process of procurement** has a critical significance for the daily operations of almost all manufacturing and service companies all over the world. Different entities order and purchase various categories of raw materials, components, semi-finished goods, final products, by-products, utilities and services. They search for the most efficient arrangement of their deliveries, which translates into the overall profitability and competitive position of individual companies and whole supply chains. It also has a strong impact on satisfaction and trust of their customers. The smooth delivery process strongly depends on the **proper selection of appropriate suppliers**.

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The **selection and evaluation of suppliers** is a widely discussed topic in the literature (Brewer A., et al, 2006; Coyle J. et al, 2010). Different procedures have been developed to recognize strengths and weaknesses of suppliers, evaluate their experience and market position, assess their organizational capabilities and compatibility with the customer (Coyle J. et al, 2010, Rushton A., 2006). The suppliers' evaluation process should include (Galinska B., et al, 2015; Zak J., 2005, Brewer A., et al, 2006) different functional segments of the supplying company and various aspects of their activities. Some researchers (Sawicka H., Zak J., 2014; Galinska B. et al, 2015) claim that the evaluation of suppliers should include the analysis of their potential to build long-term, stable cooperation, cultural and organizational integrity with the customer, capabilities for innovation and development, reliability and trustworthiness in other partnerships, willingness to share risk and profit with the cooperating institution. Based on the universal logistics principles, the suppliers are obliged to satisfy a widely known standard of the "7 Rights Rule" - **right** product, condition, quantity, time, customer, place and costs. (Shapiro R., Haskett J., 1985).

As discussed above and also supported by other reports (Galinska B., et al, 2015; Zak J., 2005, Brewer A., et al, 2006; Rushton A., 2006) the assessment and selection of suppliers **has a multiple criteria character**. It should include various aspects of technical, economic, social, organizational, market-oriented and environmental character and the interests of different stakeholders (interveners). Thus, in such a context, the natural trade-offs and contradictions should be taken into account and the effort must be focused on searching for the compromise solutions that would balance them. Some of the papers [Anders W., 1992] present different approaches for short- and long-term selection of the suppliers, also modified for local and global markets. In other works [Galinska B., et al, 2015, Brewer A., et al, 2006; Rushton A., 2006] the analysis of suppliers refers to the comprehensive problem of developing a stable, extended supply network.

In this paper the author carries out a comparative analysis of multiple criteria evaluations of suppliers in two different industries. The **goal** of this paper **is to find similarities and differences in the evaluation processes of suppliers in different industries**, based on the principles of multiple criteria analysis. The author assumes that the presented article should contribute in the future to the development of a universal, generic methodology of selecting the suppliers for different environments, supply conditions and external circumstances. The challenge and the novelty of this work is to present the comparison of the evaluations of suppliers across different industries, where the nature of the selection process and the profile of suppliers are entirely different. The originality of this work consists also in the description and confrontation of all components of multiple criteria analysis of suppliers in different industries. To the best of the author's knowledge such a contribution have not been reported in the literature, so far.

The paper is composed of 5 sections. In the first one the background of the analysis is presented and the principles of the suppliers' selection are discussed. In addition, objectives of the research are defined. The second section includes the description of the Multiple Criteria Decision Making/Aiding (MCDM/A), including the presentation of the applied MCDM/A methods. Section 3 is focused on the presentation of two case studies. Each of them refers to the selection of suppliers in a different industry. Section 4 presents the results of computational experiments generated with the application of Electre III/ IV and AHP methods, followed by their analysis. Section 5 includes the comparison of the considered decision processes focused on the selection of suppliers and final conclusions. The paper is supplemented by a list of references.

2. Multiple Criteria Decision Making/Aiding (MCDM/A)

2.1. General features of MCDM/A

Multiple Criteria Decision Making/Aiding (MCDM/A) is a field of study that develops rules, tools and methods supporting the decision maker (DM) in solving complex decision problems, in which several – often contradictory – points of view must be taken into account (Figueira J. et al, 2005, Vincke P., 1992; Zak J., 2005). The methodology of MCDM/A has a universal character and can be applied in various cases when the DM solves a so called **multiple criteria decision problem (MCDP)**.

MCDP is a situation in which, having defined a set of actions/variants/solutions A and a consistent family of criteria F the DM tends to (Figueira J. et al, 2005, Vincke P., 1992; Zak J., 2005):

- determine the best subset of actions/variants/solutions in A according to F (choice problem),

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