Chapter 7
A Multi-Criteria Vendor Selection and Order Allocation GDSS using a Mixed Alternative and Value Focused Thinking Approach

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ABSTRACT
Vendor selection and order quantity assignment plays a central role in the purchasing activity of manufacturing and trading companies. Evaluation of product and service suppliers for procurement planning requires, on the one hand, accurate identification and exploration of all decision relevant parameters. On the other hand, effective agreements must tackle all parties’ rights, obligations, interests, motives, and values, which are usually conflicting in nature. In this chapter, the authors address the problem of expert group structuring and formalization of participant competences by distinguishing among the α-, β-, and γ-level experts responsible for the value system establishment, alternatives assessment and auxiliary objects evaluation, respectively. Experts can belong to more than one task community. The triples of α-, β-, and γ-voting power indices are assigned to the individuals depending on their competence/authority. Moreover, the presented Multi-Criteria Decision Analysis (MCDA)-based framework facilitates selecting appropriate suppliers by the distributed expert groups and improves the quality of order allocation decisions. The usefulness of the proposed approach is demonstrated for the fuel oils and crops purchasing activities in the trading department of Raiffeisen Westfalen Mitte eG in Germany.

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INTRODUCTION
The formalization of complex decision problems requires comprehensive and accurate modeling of the problem environment, its elements and their interactions. Selection of the valid solution methods for such problems is a very challenging task. Fictitious simplifications of real decision situations lead to inaccurate results, and as a consequence, to management debacles and severe risks of financial losses. To avoid this, the research efforts should be focused on the flexible decision-aiding frameworks enabling problem-oriented modeling and modularization of the decision processes, their exhaustive analysis by a set of suitable and consistent methods and generation of concrete, robust solutions or policy recommendations. Traditionally in decision analysis, it is required to identify all factors relevant for different stakeholders in order to create a full picture of the problem at hand, which is a difficult task in practice. We show how to facilitate practical identification of decision-relevant criteria by applying the mixed Alternative- and Value-Focused Thinking Approach. On the one hand, the efficacy of the criteria identification process can be enhanced by employing the value-focused thinking (VFT) approach in the interviews with organizational strategists. On the other hand, the alternative-focused thinking (AFT) is advantageous for purchasing and operational executives as well as suppliers. A combination of the VFT and AFT approaches is most proper for the ultimate customers.

A variety of empirical studies have been conducted to improve evaluation process and decision making in teams. Still, the complex nature of decision groups has been left without proper attention in the analytical decision science. To fill this gap we introduce notions of Multilevel Group Decision Making (MLGDM) to distinguish between the \( \alpha \), \( \beta \), and \( \gamma \)-decision makers (DMs). \( \alpha \)-voting power reflects the DMs’ contribution to criteria prioritization; \( \beta \)-voting power is a measure of experts’ ability to evaluate performance of alternatives with respect to the set of decision criteria; \( \gamma \)-voting power reflects the DMs’ expertise in evaluation of auxiliary decision components. Ultimately, we formalize and describe an integrated decision support framework comprised of 16 steps derived from the research of practical fuel oils and cereals vendor selection and order allocation in Raiffeisen Westfalen Mitte eG, an agricultural cooperative society operating in Germany since the 18th century, with annual turnover exceeding 300 Mio. Euro. One of the largest trading companies of crops, animal feed and fertilizers also selling fuel oils is a significant aspect of the company’s strategy. As a result, the framework helps to align strategic and tactical priorities of trading stakeholders with operational purchasing decisions.

VENDOR SELECTION AND ORDER Allocation FRAMEWORK
Commodity purchasing is a consequent multistage process. We designed the algorithm based on our practical observations that includes 16 steps summarized in the following section.

1. Identify Overall Decision Objectives

Decision theory deals, in general, with three types of problems: choice, ranking and classification (Zopounidis, 2002). Choice is selection of the most appropriate alternative or set of alternatives. There are two typical approaches to the choice of suppliers: single and multiple sourcing. Single sourcing refers to the selection of one supplier who can meet all decision makers’ (DM) requirements. Multiple sourcing is a choice of the most effective combination of suppliers (Sanayei et al., 2008). Ranking of suppliers means their ordering with respect to the benchmark. Classification is division of suppliers into predefined homogeneous