



A review of methods supporting supplier selection

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Abstract

In this paper we present a review of decision methods reported in the literature for supporting the supplier selection process. The review is based on an extensive search in the academic literature. We position the contributions in a framework that takes the diversity of procurement situations in terms of complexity and importance into account and covers all phases in the supplier selection process from initial problem definition, over the formulation of criteria, the qualification of potential suppliers, to the final choice among the qualified suppliers. Moreover, we propose decision methods and techniques that previously have not been suggested in a purchasing context. The proposed methods specifically accommodate for buying situations for which few or no decision models were published so far. This paper extends previous reviews by Weber et al. (Eur. J. Oper. Res. 50 (1991) 2), Holt (Int. J. Project Manage. 16 (1998) 153) and Degraeve et al. (Eur. J. Oper. Res. 125 (1) (2000a) 34) in that it classifies the models in a framework developed by De Boer (Ph. D. Thesis, University of Twente, Enschede, The Netherlands, 1998) which recognises more steps in the buying process than only the final among qualified suppliers and accommodates for the diversity of procurement situations. © 2001 Published by Elsevier Science Ltd.

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1. Motivation for the review

With the increasing significance of the purchasing function, purchasing decisions become more important. As organisations become more dependent on suppliers the direct and indirect consequences of poor decision-making become more severe. For example, in industrial companies, purchasing's share in the total turnover typically ranges between 50–90% (Telgen, 1994), making decisions about purchasing strategies and operations primary determinants of profitability. In addition, several developments further complicate purchasing decision-making. Globalisation of trade and the Internet enlarge a purchaser's choice set. Changing customer preferences require a broader and faster supplier selection. Public Procurement regulations demand more transparency in decision-making. New organisational forms lead to the involvement of more decision-makers. Fig. 1 shows how

these developments impact on the complexity and importance of purchasing decisions.

These developments strongly urge for a more systematic and transparent approach to purchasing decision-making, especially regarding the area of supplier selection (see e.g. Carter et al., 1998). Contemporary operations research (OR) offers a range of methods and techniques that may support the purchasing decision-maker in dealing with the increased complexity and importance of his/her decisions. Examples of such techniques are multi-criteria decision aid, problem structuring approaches, mathematical programming and data mining techniques. OR-models may enhance the *effectiveness* of purchasing decisions by:

- aiding the purchaser in solving the 'right problem', e.g. refraining from dropping a supplier when the delivery problems are actually caused by feeding the supplier with outdated information;
- aiding the purchaser in taking more and relevant alternatives criteria into account when making purchasing (management) decisions, e.g. more long-term considerations when deciding on make-or-buy;

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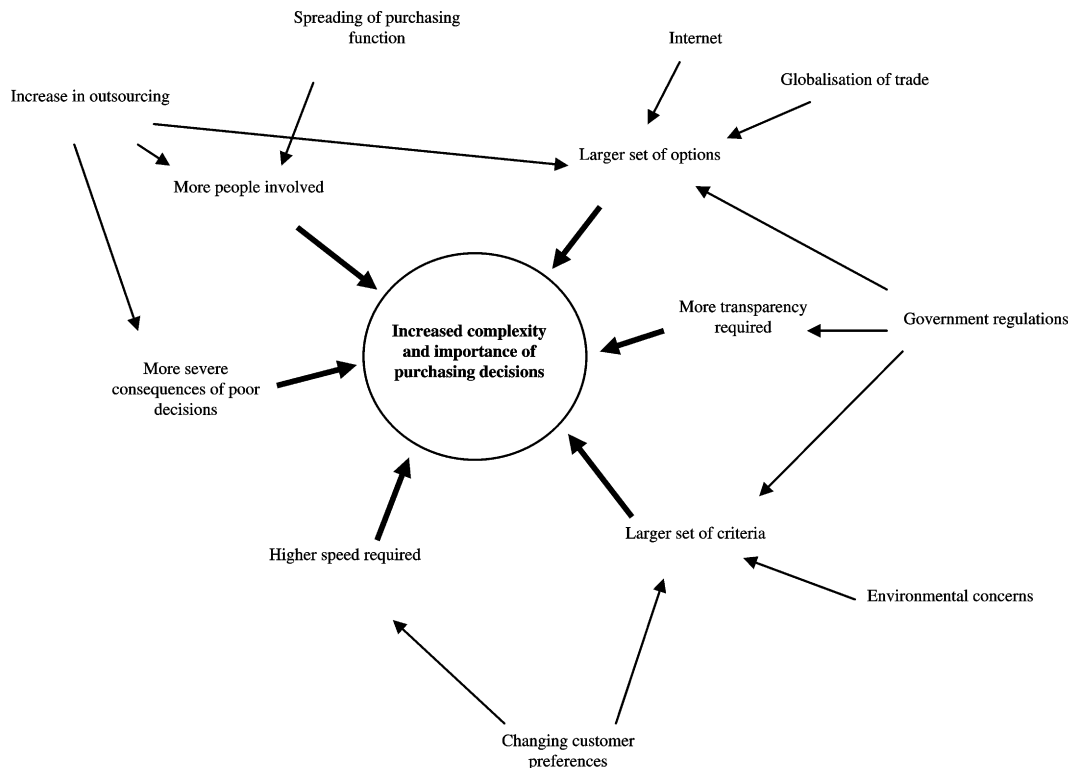


Fig. 1. Impact of developments on the complexity of initial purchasing decisions (De Boer, 1998).

- aiding the purchaser to more precisely model the decision situation, e.g. dealing specifically with intangible factors and group decision making.

In addition, OR-models may improve the *efficiency* of purchasing (management) decision making by:

- enabling automated and faster computation and analysis of decision making information, e.g. data on suppliers found on the Internet;
- enabling more efficient storage of purchasing decision making processes and access to this information in future cases, e.g. saving files that contain criteria-structures for supplier evaluation;
- eliminating redundant criteria and alternatives from the decision or evaluation process, e.g. in extensive and expensive supplier audit programmes;
- facilitating more efficient communication about and justification of the outcome of decision-making processes, e.g. when reporting to management or suppliers.

Moreover, we dissociate ourselves from the traditional scepticism towards the use of decision models in purchasing implying that the mathematical nature of the models is incompatible with the highly emotion and intuition driven practice of purchasing decision-making. Various researchers have reported on the benefits of a systematic approach to supplier selection decision-making (see e.g. Vonderembse and Tracey, 1999; Weber, 1991; De Loeff,

1997). The key-point is to consider decision models as instruments for eliciting, communicating and scrutinising one's personal and subjective preference structures and uncertainties rather than a rigid format replacing this all.

Apart from covering the state-of-the-art decision models available at present, this paper extends previous reviews by Weber et al. (1991), Holt (1998) and Degraeve et al. (2000) in three ways.

First, we not only consider the final choice phase in the supplier selection process as Weber et al. (1991), Holt (1998) and Degraeve et al. (2000) do, but recognise several decision-making steps prior to the ultimate choice phase such as the formulation of criteria and the pre-qualification of (potential) suppliers.

Secondly, in the prescriptive framework we accommodate for the diversity of purchasing situations in recognising differences between first time buys, modified rebuys and straight rebuys of routine or strategic items. Degraeve et al. (2000) only evaluate the existing decision models for rebuy purchases. Weber et al. (1991) categorise the literature on supplier selection with regard to (1) the particular criteria mentioned in the article, (2) the purchasing environment and (3) the decision technique used. This approach may not be the most effective one for helping a purchaser to find an adequate decision method in a particular situation as a specific set of criteria may be accommodated by more than one method. Furthermore, the criteria mentioned by Weber et al. (1991) are highly situation specific. Also, Weber et al.

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