

Model of Multi-Criteria Selection of Traditional Suppliers

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Abstract

Efficient supply chain management is based on the strategic cooperation of many companies (suppliers and consumers), which involves long-term interaction with business partners. To ensure a reliable supply, most of the modern companies simultaneously interact with multiple suppliers of identical products, distributing the orders between them depending on many factors characterising suppliers, their products, and supply processes in previous periods. Under these conditions, the solution of the problem of multi-criteria selection of traditional suppliers is carried out by optimising purchase amounts of different product types in accordance with the needs of the consumer company based on many criteria. The main selection criteria are supply reliability and logistics costs of the purchase and product delivery. The generalised criterion for the assessment of supply reliability reflects the results of the interaction with suppliers in previous periods and includes assessment of completeness, package contents, timeliness of supply, and quality of supplied products. The logistics costs criterion shows the rejection of product prices offered by traditional suppliers and delivery costs from the minimum values of these indicators in the markets at the time of making procurement decisions. The paper contains the developed linear programming model, which allows optimising the procurement of different types of products from several traditional suppliers under the objective function, combining the evaluation criteria of supply reliability and logistics costs. The list of suppliers for each type of product is determined by the optimisation results. The method for selection of traditional suppliers is based on the proposed mathematical model and has a numerical example illustrating its application.

Keywords: traditional supplier; multi-criteria selection; supply reliability; logistics costs; linear programming model; procurement optimization

JEL Classification: C61; M21

Introduction

The efficient and regular functioning of supply chains depends on the organisation of supply of the necessary materials or goods to their member companies, which requires competent management of their procurement and supply. Against the backdrop of a growing number of suppliers of identical products, with different opportunities, parameters of the offered products, and the organisation of the supply process, one of the most important procurement tasks is to choose the most profitable suppliers, from the point of view of the consumer company.

The formed supply chains create a stable range of traditional suppliers, which leads to certain peculiarities of solving the problem of their choice. When selecting suppliers with whom one has already established business relationships and interacted, one typically uses quantitative criteria characterising the suppliers and processes of the previous supplies. Based on the business objectives of companies in the field of supply, the main criteria for the selection of traditional suppliers include their production capacities, supply reliability, quality of service and products supplied, costs of the purchase and product supply, which determines the multi-criteria tasks for the selection of suppliers (Aguzzoul 2012, Ávila *et al.* 2015, Cheraghi *et al.* 2004, Ha and Krishnan 2008). The number of suppliers, with whom the company or the consumer is cooperating at the same time, is important in supply management (Ford 1993, Lysons and Farrington 2006). Interaction with a single supplier makes the consumer or the company more vulnerable and dependent on the performance of supplier's work. Therefore, many companies have multiple sources

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of product supply, which reduces the probability of failures in their work with suppliers, increases the flexibility of supply by varying orders in case of emerging issues or changing demands.

Given the multivariance of solving the problem of selecting traditional suppliers under various criteria, the most attractive option is its optimisation arrangement that allows not only to select the best suppliers, but also to determine the best quantity of the product orders for each of them. However, in the context of diversity of purchased products, different dimensions, and interconnectedness of indicators characterising suppliers and the supply process, the rigorous solution to this issue is a complex problem that requires the development of optimisation models of procurement from multiple suppliers, based on the joint use of different economic and mathematical methods.

Conclusions

Efficient management of supply chains is based on mutually beneficial and long-term cooperation in each pair "supplier – consumer". In the context of market economy, most companies have several suppliers of the same product to ensure reliable supply, to use their competition for reduce prices of products supplied, and to more easily meet the changing demand of the range of products. Interaction with several traditional (permanent) suppliers does not remove from the agenda the task of selecting the best of them from the standpoint of the consumer company with each new procurement. In this case, the task is formulated as a task of optimal allocation of orders among suppliers based on many factors characterising suppliers, their products and supply processes in previous time periods. Supply reliability and logistics costs of product purchase and delivery are offered as the main criteria for selecting traditional suppliers. The generalised criterion for the assessment of supply reliability reflects the results of the interaction with suppliers in previous periods and presented in the form of multiplicative convolution of local indicators assessing the completeness, package contents, and timeliness of supply, as well as the quality of products supplied, taking into account their weighting coefficients that are defined by methods of expert evaluation. The logistics costs criterion shows the rejection of product prices offered by suppliers and delivery costs from the minimum values of these indicators in the markets at the time of making procurement decisions.

The developed linear programming model allows optimising the procurement of different types of products from several traditional suppliers under the objective function, combining the evaluation criteria of supply reliability and logistics costs, given the weighting coefficients of product types. The model contains a rational combination between the elements of retrospective and marketing analysis, optimisation with expert reviews, which provides the optimal solution when selecting traditional suppliers. We proposed indicator assessing procurement efficiency. The developed method of multi-criteria selection of traditional suppliers is based on the proposed mathematical model.

The article shows the numerical example, illustrating the application of the developed model and method that confirms their efficiency as tools of justifying decisions made by the management of the consumer company in the context of a different procurement options from several traditional suppliers and limited financial resources.

An important task in further research is the development of a model for simultaneous selection of both traditional and new suppliers.

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