

Research Paper

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Designing a supplier rating model and allocating the optimal purchase amount

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Abstract

In today's global competition, choosing suppliers, increasing relationships with suppliers, and developing collaborative and sustainable relationships with them to reduce costs and increase flexibility against market changes is necessary and difficult. The present study aims to design a model for ranking suppliers and allocating the optimal number of purchases of sugar beet from the suppliers. The statistical population of the research is experts and specialists in the field of supplier selection at Torbat-e Heydarieh Sugar Company whose number is about 10 people based on proficiency, authority, and skills. The research method of this study is quantitative based on nature, and applicable based on purpose. In this research, to identify the basic criteria for the selection of suppliers, theoretical literature and experts' opinions have been used, and the method of the Analytic Hierarchy Process has been used to rank suppliers. In addition, to allocate the optimal order amount to each of the suppliers, the integration of the Goal Programming model with the Analytic Hierarchy Process has been used. The results of this research show that how Torbat-e Heydarieh Sugar Company can allocate optimal order amount to any of the suppliers by prioritizing them and also by examining the different parameters, according to the capacity of suppliers, and determine how the studied companies purchase their desired raw materials from suppliers to achieve the desired relative and strategic advantage.

Keywords:

optimal order allocation,
supply chain,
Analytic Hierarchy
Process,
Goal Programming,
supplier evaluation

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Extended Introduction

The issue of supplier evaluation and achieving sustainability in the supply chain is one of the important components of supply chain management because suppliers play an important role in creating sustainability in the supply chain, which means achieving social, environmental, and economic goals and ultimately the success of the company. As much as the selection of suitable suppliers is effective in reducing costs and increasing the competitiveness of companies, the selection of inappropriate suppliers can also degrade the financial and operational position of companies (Baroto et al., 2022; Soheilifar and Falah Lajimi, 2019). The process of selecting suppliers is the most important factor in the effective management of the modern supply chain network because it helps in achieving high-quality products and customer satisfaction. Also, the performance of the supplier plays a key role in price, quality, delivery, and service in achieving the goals of the chain (Mohammed et al., 2021; Tavakolian et al., 2020).

Currently, the way to supply raw materials and evaluate suppliers in the supply chain is one of the challenges that organizations face for more profitability. Because of the ever-increasing number of suppliers due to the creation of competitive conditions, organizations need to develop a suitable methodology for evaluating and selecting suppliers as well as evaluating their performance to successfully reduce costs and increase the quality of services and products (Rashidi Komijan and Masoudifar, 2021).

On the other hand; if the supplier cannot deliver the orders on time and with the required quality and reliability, issues and problems will arise in meeting the demand of the seller's customers and ultimately lead to customer dissatisfaction (Ha & Krishnan, 2008). A supplier that fails to deliver a guaranteed and sufficient product to the seller on time will result in customer loss (Gupta & Barua, 2017). Therefore, choosing a supplier is of considerable importance. During the process of choosing a supplier, especially in a competitive environment, it is very important to buy from a supplier who can meet the most criteria such as material quality, on-time delivery, etc. The current research aims to provide a multi-stage and consistent approach for selecting and ranking effective factors and providing a model for the best purchasing situation using the Goal Programming method, which initially identifies the effective criteria for the evaluation and selection of suppliers and the desired criteria using the hierarchical analysis method, then the important suppliers of Tarbat-e Haidarieh Sugar Company have been ranked and finally, the optimal amount of purchase from suppliers has been allocated using the AHP-GP mixed model.

Theoretical framework

Rashidi Komijan and Masoudifar (2021) in a research titled "Mathematical model for evaluating suppliers and purchasing spare parts" showed that determining the group for each part according to the two dimensions of supply risk and criticality of the part is a suitable management tool for equipment supply management, and the use of the zero and one planning model is a suitable method for allocating orders in the field of spare parts, and the structure and components of the objective function and restrictions can be changed according to the type of organization.

Firouzi & Jadidi (2021), in research entitled "Multi-objective model for supplier selection and order allocation problem through fuzzy parameters", presented a fuzzy multi-objective model for the supplier selection problem and have created a weight additive function to convert the fuzzy multi-objective model into a single objective fuzzy model that can effectively consider the preferences of decision-makers. Then, a separation method was used to solve the single-objective model with fuzzy parameters (Firouzi & Jadidi, 2021).

Naqvi & Hassanzadeh Amin (2021) have written an article titled "Supplier selection and order allocation: a literature review." In this research, the articles conducted in the field of supplier selection have been reviewed, and the scope of the problem has been examined in three subcategories, including literature models, deterministic optimization models, and uncertain optimization models.

Methodology

This research is applied based on the purpose, and descriptive-survey based on the nature and method of research. Data collection has been done through interviews and distribution of questionnaires among senior and middle managers and experts involved in the purchase of beet sugar of Torbat-Haidarieh sugar factory. Also, through library studies and the use of references and sources related to the topic, the materials and topics related to the discussion have been extracted and used in the present research. The aim of this study is to provide a multi-stage and consistent approach to select the effective factors, rank them, and then provide a model for the best purchase situation using the Goal Programming method. This methodology can be divided into two main phases: the first phase includes the determination of quantitative and qualitative criteria and the use of an Analytic Hierarchy Process to weigh the criteria and options, and the second phase includes the identification of goal and systemic limitations and combining the results of the first phase with the Goal Programming method to allocate the optimal order amount to each supplier. The softwares used in this research were Expert Choice and Lindo 6.01.

Discussion and Results

The purpose of this research is to provide a framework for the analysis and selection of suppliers of raw materials for Torbat-Haidaryeh Sugar Joint Stock Company. Therefore, this research provides a framework that determines the optimal combination of suppliers according to multiple quantitative and qualitative goals and takes into account system limitations so that the maximum possible value is achieved according to the opinions of experts and specialists of the company. One of the features of this research and the combined model is the possibility of considering the weight of decision-makers. This is important because the decision-making committee may include different members, each of whom has different positions in the organization. By accepting the assumption that different positions are the result of knowledge, experience, work records, etc., the executive director as the person in charge of the decision-making committee can compare the members of the committee in pairs, and finally, the weight of the decision-makers is obtained by calculating the special vector of the matrix. Then the next calculations will be influenced by the weight of the decision-makers. In this study, the factors influencing the selection of suppliers were first identified using literature and experts' opinions. Then these criteria and sub-criteria were prioritized using the AHP method. After that, each of the suppliers was rated for each criterion and also for all sub-criteria. In the next step, using the Goal Programming method, the optimal amount of order allocation to each supplier was determined, and according to the results of the research, the largest amount of purchase allocation should be made from Razavi Agricultural Company; Islamabad and Khezri Agricultural Company in the second place, and Marghzar Farmers' Cooperative Company were ranked third according to the number of orders. Among the other advantages of this model, it can be mentioned that this model includes multiple criteria (quantitative and qualitative) such as grade, quality, timely delivery, etc. in the evaluation and selection of suppliers so that the optimal value according to the Goal limitations is allocated to selected suppliers.

Conclusion

According to the results of this research, at first, the effective components on the evaluation of suppliers were extracted based on the opinion of experts and theoretical foundations. After that, these components were prioritized. After prioritizing these components, all suppliers were evaluated based on these components. Finally, after prioritizing the suppliers based on these components, the optimal allocation of orders from suppliers was determined for each supplier. Among the evaluation components, shipping cost is one of the factors influencing the order (Gergin et al., 2021; Jiang et al., 2018; Adalı & Işık, 2017) and most companies are formed near raw materials to bear the least excess cost. (Khan et al., 2016).

Also, companies are generally looking for suppliers who can be more compatible with these companies in terms of conditions (Hadian et al., 2020; Gergin et al., 2021), but in some situations, such as the lack of primary goods and the presence of strong competitors, the supplier gets a higher bargaining power and in this situation, the company has to adapt reluctantly to the supplier's conditions (Mohammed et al., 2021). In this situation, companies may have financial requests in the implementation of the contract (Öztürk & Paksoy, 2020). The more financially powerful the suppliers are and the more they can supply, the more they can change the conditions in their favor. On the other hand, the fewer competing companies in the market, the more companies can choose their suppliers with better conditions (Taherdoost and Brard, 2019). Governments can push companies to buy more products from suppliers by giving subsidies. However, companies tend to buy from suppliers with higher quality products (Rezaei et al., 2014; Adalı & Işık, 2017).

The higher the quality of the products, the more companies look for the products of these suppliers (Fei et al., 2019). On the other hand, one of the most important factors for sugar beet companies is the grade of this product, and the companies have understood very well that products with higher grades lead to more profit for these companies; therefore, they are looking for buying quality products with suitable quality. Reassuring factors are among the factors that are of great importance in the process of supplier evaluation and selection. Suppliers whose delivery is fast and on time are more important for companies (Jain et al., 2018; Arabsheybani et al., 2018); because if the delivery time is inappropriate, it may cause problems for the company's production. In addition, suppliers who have stable delivery guarantee the future of the company's production (Hadian et al., 2020), and these suppliers are considered strategic partners of the company and are generally much easier adapt with the Companies' conditions to conclude a contract (Szmelter-Jarosz, 2020).

The company should support its loyal suppliers and not leave them alone in critical situations, and the contract between the two should be designed in such a way that the risk is shared between the supplier and the company to create confidence on both sides of the transaction (kabgani & shahbandarzadeh, 2019; Junior et al., 2014).

Due to the fact that in this research, the mentioned cases have been investigated, therefore, this research is in accordance with the research conducted in terms of using the mentioned variables. In this section, according to the results of the research and in line with expanding the scope of the dynamic problem of supplier selection and order amount allocation, it is suggested that from now on, using the results of this research, the selection of suppliers in this company to be done every year by systematically and scientifically collecting the information required by the models, and establish a marketing strategy related to the suppliers who have obtained high ranks in this research.

Also, considering that the conclusion of the initial contract is the responsibility of the company's inspectors; a list of factors affecting the selection of suppliers based on the set priorities has been provided to each of the inspectors to identify the suppliers based on it and proceed to the final negotiations. After the ranking, it was found that the sugar beet quality

criterion has a very important priority among the factors. Therefore, it is suggested that sugar production companies use the quality determination device (Betalyzer) to determine the quality of beet sugar.