Abstracts of Papers in English

OPTIMIZATION OF BILATERAL TRADE UNDER SANCTIONS

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Abstract
The issue of international trade and economic sanctions has been one of the most important topics for every country, especially developing nations and those under sanctions. Countries establish economic relationships to meet their needs through international trade and some nations impose sanctions on others to achieve their political and monopolistic goals. Studying these sanctions and mitigating their effects is crucial for countries facing boycotts. Additionally, we recognize that exchange rate fluctuations are one of the main challenges that export and import agents encounter in sanction settings, including both public and private entities. Therefore, addressing the exchange rate debate and its volatility in the business sector is vital. Although numerous studies have been conducted in this field, few have utilized mathematical modeling. In this paper, we aim to present a mathematical model for optimizing Iran's trade exchange with its key partners during periods of trade sanctions. Two objective functions are employed: one to accurately represent the impact of trade sanctions and the other to minimize the standard deviation of the logarithm of the exchange rate difference between two consecutive years. This approach is designed to achieve a robust solution. Consequently, to formulate the problem, a mixed-integer non-linear programming model is used to select corresponding countries and determine the quantity of goods exchanged. To evaluate the performance of the proposed model, the solution is compared with real-world data in the range of 1395 to 1398. The results demonstrate an

improved trade balance due to changes in the country of origin of goods or the destination of exports, as well as the utilization of conversion industries to enhance export profit margin. The solution derived from the model to mitigate the effects of commercial sanctions is available. The results indicate that the impact of sanctions can be reduced if an appropriate program is implemented in accordance with exchange rate fluctuations.

Key Words: Mixed integer nonlinear programming, international trade, sanctions, exchange rate fluctuation, uncertainty.

DEVELOPING A HIERARCHICAL HUB LOCATION MODEL FOR SUSTAINABLE SUPPLY CHAIN NETWORK

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Abstract

Identifying the optimal location for facilities is a key strategic objective for companies striving to enhance their competitiveness. Managers carefully select facility locations to ensure they effectively meet demand and align with organizational goals. Given the impracticality of establishing direct communication between all points in a network, utilizing hub points within networks can result in significant cost savings. Hub location problems are one of the new and remarkable topics in industrial engineering and one of the most important branches of transportation which is widely used in strategic areas such as transportation systems, postal systems, and communication networks. The use of hubs in the distribution network reduces the costs of current transmission in the network and thus increases system efficiency. In summary, hubs are used in different places of the supply chain such as transferring from point to point, sorting, and switching. The problem of location-allocation of hub is one important problem that is common in many transportation systems. One of the important branches of hub area is hierarchical hub that has been considered by many researchers. In this research, a two-objective model for the hierarchical hub location problem is presented. Given the importance of real-world environmental problems and concerns about increasing destructive environmental pollution, in this study, in addition to reviewing and trying to improve and reduce costs, environmental problems and their improvement have been studied. The proposed model also examines multi-mode transport and creates several types of transport systems in one hub. In the following, smaller problems are solved by GAMS software and large-scale problems are solved by genetic, strong Pareto and gray wolf metaheuristic algorithms and the results are compared. The results of solving problems with different dimensions show the good performance of the proposed algorithm, so that by using this method in an acceptable time, a suitable quality answer can be obtained.

Key Words: Location, hierarchical hub, sustainability, supply chain, metaheuristic algorithm.

THE COORDINATION OF BIOFUEL SUPPLY CHAIN MEMBERS CONSIDERING FARMERS' TECHNOLOGY LEVEL AND AGRICULTURAL SUPPORT SERVICES COMPANY

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Abstract

Due to the significant growth in the world population in the last decade, there have been many challenges, including an increasing demand for energy and fossil fuels and rising oil prices. According to the mentioned problems, renewable energy would be more cost-effective, efficient, less polluting, and more sustainable. Among renewable energies, bioenergy is the third largest renewable source of electricity and the most significant renewable heat source, having more than 95% of the supply. In recent years, due to increased fossil fuel consumption and greenhouse gas emissions, the use of renewable energy, including biological energy, has been of significant importance. Therefore, the bioenergy supply chain is one of the most important and challenging issues due to its environmental impact. Moreover, coordination models among members to reduce costs and increase chain profit are inevitable in the bioenergy supply chain. Therefore, this research has a three-level bioenergy supply chain, consisting of two competing farmers 'A' and 'B', an Agricultural Support Services Company (ASSC) and a biorefinery. Considering the importance of technology in different stages of the agricultural process, farmer sales, besides the price, farmers decide on the technology level used in biomass agriculture. The company and biorefinery decide on the basic order quantity and biofuel price respectively. In order to analyze the model, the results obtained from the non-cooperation mode were compared with the cooperation mode, in which three separate infrastructure cost-sharing, operational cost-sharing, and revenue-sharing contracts are used. The results indicate that cooperation with the agricultural company leads to an increase in the technology level and profit of farmer A. While the biomass price of farmer 'B' decreased, accepting part of the operational costs by the company increases the farmer's final profit. In addition, sharing the refinery's income with the company leads to an increase in the price of biofuel. Therefore, this research shows that using collaboration contracts between members of this supply chain and also the intervention of the agricultural company in upgrading the technology level can be effective in improving the members' profit and technology level.

Key Words: Biomass supply chain, coordination contracts, game theory, agricultural support services company.

DEVIATION MONITORING MODEL OF CONSTRUCTION PROJECTS, CASE STUDY: A CONTRACTING COMPANY

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Abstract

Project management is always looking for ways to complete the project on time, quality, and cost according to the project contract. Due to the existence of various risks and increased uncertainty in business environments, a high percentage of the projects have deviations when compared with the base plan. The purpose of this research is to continuously monitor the deviation of the project by evaluating the deviation of cost, time, and quality simultaneously under the conditions of uncertainty. By conducting a pairwise comparison between cost, time, and quality factors and interviewing experts of a contractor company, the relative importance of these factors has been determined. The most important risks of the project have been identified by interviewing experts in the contractor company. The risk assessment has been carried out with the failure mode and effect analysis and fuzzy logic method. By using the approach of fuzzy inference system and Bayesian networks, project deviation is predicted. In the fuzzy inference system, project risks are considered as input variables in the form of triangle fuzzy number and project deviation is obtained as the output variable of the cohesive fuzzy inference system in the Matlab software. In the Bayesian network approach, the initial and conditional probabilities of the nodes have been obtained by using the experts' opinion and the project deviation has been investigated using the network between risks in AgenaRisk software. To estimate the validity of the results of the models, the mean square error criterion was used. By comparing the actual deviation percentage of projects implemented in the mentioned company with the estimated deviation percentage of the models, the mean squared error in the fuzzy inference method is less compared to the Bayesian network method, and the fuzzy inference method with the mean squared error equal to 0.0011 is more efficient than the Bayesian network method.

Key Words: Project management, deviation, failure mode and effect analysis, fuzzy inference system, bayesian network.

EVALUATION OF THE RELATIONSHIP BETWEEN THE GOVERNMENT AND CONTRACTORS IN THE FIELD OF FINANCIAL RESOURCES OF MINING PROJECTS USING THE NASH BARGAINING METHOD

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Abstract

The complex relationship between governments and contractors in the mining industry requires intelligent management, especially in cases of financial constraints. Effective decision making by both parties is very important to achieve optimal results and maintain the economic share of the industry. Engagement and strategic management of government-contractor relationships is essential to address challenges and ensure mutually beneficial outcomes. The use of tools such as game theory and Nash bargaining provides suitable methods for conflict resolution and efficiency optimization. By understanding the dynamics of this relationship, stakeholders can work towards promoting sustainable and successful mining practices. This paper pursues two main goals: First, it aims to develop a comprehensive model of government-contractor dynamics using game theory principles. It explores strategic interactions to elucidate the underlying drivers of decision making in the mining sector. Second, it seeks to evaluate Nash bargaining as a mechanism for resolving conflicts and achieving optimal outcomes. This evaluation entails carefully examining how Nash bargaining principles can be applied in the context of government-contractor relations and provides insights into its potential effectiveness. An analysis of mining contractors' extraction strategies from a government perspective reveals significant government influence attributed to its significant capital investments. This dominance gives government institutions more bargaining power and shapes the dynamics of policy formulation and implementation. By quantifying the respective benefits for each participant, it becomes clear that government policies related to sustainable and maximal production have a significant contribution, which emphasizes the central role of government intervention. On the contrary, mining contractors follow these policies with a relatively smaller share, which indicates an inherent power imbalance in this relationship. This dominance translates into enhanced bargaining power for government entities. After calculating the respective payoffs for each participant, it becomes evident that the government's stake in sustainable and maximum production policies amounts to 838,866 billion rials and 838,264 billion rials, respectively. In contrast, mining contractors' shares in these policies stand at 65,642 billion rials and 64,126 billion rials, respectively.

Key Words: Government and contractor cooperation, game theory, nash bargaining, complete information game, cooperative game.

PROPOSING A SUPERVISED MACHINE LEARNING APPROACH FOR DATA-DRIVEN SIMULATION IN SUPPLIER SELECTION PROBLEM

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Abstract

Supplier selection is a crucial aspect of supply chain management. Traditionally, multi-criteria decision-making methods and experts' experience have been the go-to approaches for this process. However, in today's highly competitive business environment, making decisions quickly and accurately has become paramount. Consequently, innovative data-driven technologies and machine learning methods have gained significant importance. Surprisingly, the combination of simulation and

machine learning has received limited attention in research endeavors. This study evaluates supplier performance based on specific characteristics utilizing a combination of simulation and machine learning techniques. The research investigates its applications in data-driven decision support for supplier selection. We tackled the supplier selection challenge by simulating the problem using Arena software. The dataset generated from the simulation served as input for our machine learning model. We employed different algorithms, namely Decision Tree (DT), K-Nearest Neighbor (KNN), and Logistic Regression (LR), to analyze the data. Our research demonstrates the remarkable effectiveness of machine learning algorithms in supplier selection. Based on the results, the DT algorithm with 99% accuracy, the LR algorithm with 98% accuracy, and the KNN algorithm with 96% accuracy assign orders to suppliers with the highest probability of delivering them on time. Our approach proves invaluable in analyzing the supplier base and identifying critical suppliers or combinations thereof, minimizing disruptions caused by adverse supplier performance. These findings underscore the potential of integrating advanced computational methods to significantly enhance decision-making processes within supplier selection in supply chain management. Our analysis highlights the pivotal role of combining simulation and machine learning techniques, offering a robust framework for improving supplier selection methods in the fast-paced and competitive landscape of modern industries. This approach not only improves existing methods but also promises a new era in supply chain management. The synergy of simulation and machine learning can revolutionize how businesses choose strategic suppliers and ensure speed and accuracy in decision-making processes.

Key Words: Simulation, machine learning, supplier selection, data-driven supply chain.

DETERMINING THE PRODUCT MIX IN ENVIRONMENTS WITH MULTIPLE CONSTRAINTS, CONSIDERING THE PRIORITY OF CONSTRAINTS

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Abstract

One of the problems in the production line is determining the product mix while paying attention to resources and customer demands. The theory of constraints is a philosophy that is decisive in determining the product mix according to the constraints of the system and the productivity of the system. This theory gives an optimal solution in environments with one constraint, but in systems with more constraints, the solution may become impossible. The present research examines the problem of determining the product mix in environments with more than one constraint. It is necessary to pay attention to the opinions of the decision maker regarding the priority of the bottlenecks in the environments with more constraints.

Three states for the theory of constraints method are envisioned according to the number and type of bottlenecks: the first is the state where the system has only one bottleneck and the solution of the theory of constraints is identical to the optimal method of linear programming. The second is the case where the system has more than one bottleneck and the theory of constraints maintains its efficiency and produces an optimal solution. The third is the case where the system has more than one bottleneck and the theory of constraints produces an impossible solution. It is worth noting that in all the three cases considered for the theory of constraints, the opinions of the decision makers have been ignored, which is considered in the proposed method. To prove the efficiency of the proposed model, various examples have been solved with the help of goal programming and WinQSB software. The computation results and the processing time show the efficiency of the proposed model in reaching the optimal solution in environments with multiple constraints by considering the opinions of the decision maker.

Key Words: Theory of constraints, product mix, constraints, decision maker ideas.

A GAME-THEORETIC APPROACH FOR PRICING IN A SUSTAINABLE SUPPLY CHAIN CONSIDERING GOVERNMENTAL INTERVENTION AND WATER REBOUND EFFECT: A CASE STUDY OF IRANIAN FOOD PRODUCTS

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Abstract

Escalating freshwater depletion and contamination driven by anthropogenic activities significantly threaten global water accessibility, jeopardizing food security, environmental integrity, and economic prosperity. The dearth of water resources worldwide and the significance of the adverse effects of wastewater pollution on the environment have promoted the discussion of water and wastewater treatment in the supply chain in this research. A subsidy has been proposed to encourage producers to treat wastewater to create a sustainable supply chain. The government will determine the subsidy. Wastewater generated during the production process undergoes treatment and is subsequently marketed for reuse within the supply chain. Wastewater treatment coupled with the reuse of treated wastewater in the supply chain effectively reduces freshwater consumption. Subsequently, the green manufacturer determines the selling price of each green product unit by considering the cost of wastewater treatment, the rise in fresh water consumption due to the rebound effect, and the impact of the amount of government subsidy for wastewater treatment. Given the concurrent roles of the government and the green producer within this domain and the impact of their decisions on each other, the game theory approach has been employed for the first time for pricing the green product under the mentioned conditions. This holistic approach offers a more realistic appraisal of freshwater consumption in production and paves the way for formulating effective water management strategies towards sustainable production. In this study, the designed game has been solved under two structures, namely Nash and Stackelberg. A parametric analysis of the parameters of the problem is conducted. A real-life case study from the food industry of Iran is solved. The analysis of the results revealed that wastewater treatment for both the government and the green producer as players in both structures generally yield higher profits than not treating wastewater.

Key Words: Sustainable supply chain, water rebound effect, pricing, game theory.

STATISTICAL METHODS FOR IMAGE DATA MONITORING: A SYSTEMATIC OVERVIEW

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Abstract

Nowadays, one of the biggest challenges in the field of statistical process control (SPC) is how to effectively handle the abundance of big data to evaluate the quality of processes and products. Image data, which is increasingly utilized in the manufacturing and service industries, poses a significant component of this big data. Images offer a cost-effective means of swiftly generating a large volume of data within just a few seconds. Machine vision systems (MVSS) are extensively employed across various industries for obtaining information pertaining to dimensions, geometric features, surface defects, surface finish, as well as the differentiation between conforming and nonconforming products. Consequently, researchers are placing greater emphasis on utilizing statistical process control methods for analyzing image data to detect process variations and defective products, among other goals. This research contribution is highly attractive to practitioners seeking to leverage digital tools for quality management due to its diverse range of potential applications in addressing real-world issues (e.g., Quality 4).

Notably, the research effectively integrates machine learning, traditional statistical methods, and image processing within the framework of image-based statistical process monitoring. Choosing appropriate types of images should consider their respective strengths and weaknesses. Binary images are well-suited for monitoring geometric features, grayscale images are suitable for assessing

product surfaces, and multi-spectral images prove useful when color represents a critical quality characteristic. This paper presents a systematic overview accompanied by a conceptual classification scheme based on content analysis methodology. The objective is to analyze and categorize prior research that has explored various aspects of statistical process monitoring applied to image data across different industries. The focus is specifically on reliable scientific sources, without any constraints on time limitations. Moreover, drawing from 64 relevant papers in this field, the paper highlights research gaps and provides directions to inspire future studies.

Key Words: Statistical Process control (SPC), statistical monitoring of image data, machine learning, image processing.

DEVELOPING A ROBUST PORTFOLIO REBALANCING MODEL BY CONSIDERING FUNDAMENTAL FACTORS

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Abstract

Portfolio rebalancing is one of the most important parts of investment management. After forming a portfolio by an investor, due to changing prices in the market, the portfolio value deviates from its initial amount. Therefore, the investor must rebalance the investment portfolio to achieve their goal. On the other hand, the fundamental factors of companies do not remain constant over time due to reasons such as changes in the country's economic situation and changes in policies related to the purchase, production, and sale of the company's products. Furthermore, to select the best stocks that are prone to grow, it is essential to pay attention to the fundamental factors of companies by examining important financial ratios, including net profit ratio, return on assets (ROA), return on equity ratio (ROE), debt ratio (DR) and other ratios. In this research, a multi-objective model for the portfolio rebalancing problem is developed to consider the fundamental factors of stocks. To include the fundamental factors to the model, the TOPSIS technique is applied. In addition, due to considering several goals in the model, multi-choice fuzzy ideal programming is used to solve the model. Also, due to the variety of investors' expectations and the uncertainty of some parameters, including the ratio P/E and expected stock return, the uncertainty in the parameters of the model has been taken into account and the model is formulated using Bertsimas and Sim's approach from robust optimization approaches. In addition, by adopting Constant Proportion Portfolio Insurance strategy (CPPI) and maintaining the stop loss in specific time periods such as three months, the developed model is solved using the real data of the Tehran Stock Exchange and its results have been analyzed. In summary, the results show that the return and the Sharp ratio of the proposed portfolio are better than the traditional models.

Key Words: Portfolio management, fundamental analysis, weighted-additive fuzzy multi choice goal programming, robust optimization.