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Identifying and investigating the effectiveness of supply chain risk indicators of online business activities in the food industry using machine learning methods using the unit support vector algorithm

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Abstract

The aim of the present study is to identify and investigate the effectiveness of supply chain risk indicators of online business activities in the food industry through machine learning method using single support vector algorithm. The research method is applicable in terms of its purpose, and mixed (qualitative-quantitative) in terms of implementation method. In the qualitative part, interviews with experts active in the food industry with complete information and sufficient experience in the supply chain of this industry have been used until theoretical saturation, which were 10 people of relevant experts in large companies in this field. In the quantitative part, the field method and questionnaire were used to collect data with statistical methods, and this number was also 114 people selected as a sample from the statistical population. Considering the data conditions and the application of machine learning in the supply chain, the support vector machine algorithm, one of the most powerful algorithms in the field of artificial intelligence, was used. The results showed that customer satisfaction has a negative effect in the research model. Supply chain coordination has a positive effect in the research model. Factors affecting costs have a positive effect, but its amount is moderate. Economic and market conditions have a positive effect in the model. Internet infrastructure has limited importance in the model. Environmental risks have a positive effect. Product quality has a negative effect in the model.

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Extended Abstract

Introduction

Today, risk management is one of the effective factors in every industry and business activity in economic enterprises around the world. Therefore, for this purpose, it is first necessary to identify the relevant risks (Rajendran & Ravindran, 2019). Companies are always looking for ways to deal with work uncertainties. In this regard, risk management has been introduced as an efficient tool for organizational managers. Risk identification and management is a new approach used to strengthen and improve the effectiveness of organizations (Ghaderi & Tariverdi, 2020).

Risk management is a logical and systematic method for analyzing, assessing, and dealing with risk related to any type of activity that enables organizations to minimize losses while taking advantage of opportunities. (Rahnamaye Rudposhti & Soleimani, 2021). Increasing costs and complexities in organizations, along with increasing uncertainty and risk, have led managers to use risk management to reduce risk-taking and deviation from goals (Jalali & Moghadamnia, 2022). Identifying supply chain risks based on minimizing and managing these risks has always been an important challenge for industries and organizations. Supply chain risks increase the likelihood of unexpected events occurring in this chain that may cause significant losses to the organization (Mehrmanesh & Safavi Mirmahalleh, 2020). In this article, we decided to identify these factors in order to determine these risks in general and specifically in our country's market and in the food industry. On the other hand, by analyzing data in artificial intelligence methods such as machine learning, human error can be significantly reduced. Accordingly, the present study seeks to answer the question: What is the effectiveness of supply chain risk indicators in online business activities in the food industry through machine learning methods using the unit support vector algorithm?

Theoretical framework

Supply chain

A supply chain is defined as a set of functional activities (transportation, inventory control, etc.) that are repeated many times along the flow channel and by which raw materials are converted into final products and value and reach the consumer. Since globalization has opened new markets and intensified competition, organizations have been able to reduce production costs by developing more complex supply chains to compete in the global market (Kamalahmad & Mrllat-Parast, 2016).

Risk Management

In the conventional sense, risk management means compensating for known risks by managing them. In the past, risk or danger was seen as a result of natural causes that could not be predicted. However, in a modern, managed thinking based on current science in the field of risk management, a view has been presented that risk can be measured and controlled provided that there are effective and efficient systems (Sepahvand & Vaghfi, 2021).

Ahmadi et al., (2023) studied the design of a distribution channel selection system in the oil industry supply chain using a combination of adaptive neural-fuzzy network and metaheuristic algorithms (case study: National Petroleum Distribution Company of the West Azerbaijan Dual Regions). In order to analyze the data, confirmatory factor analysis, adaptive neural-fuzzy network in the basic mode, and adaptive neural-fuzzy network combined with genetic and particle swarm optimization algorithms were used. In this study, a hybrid distribution channel selection system was first designed and then evaluated based on the input scores using the system designed based on the least error, traditional distribution channel, and fuel station branding design. The results show that the best system for distribution channel

selection was the adaptive neural-fuzzy network combined with the particle swarm algorithm. By comparing the performance of the branding plan and the traditional method, it was determined that the branding plan performed better and was a suitable distribution channel for the National Oil Products Distribution Company of the West Azerbaijan Dual Regions.
Brusset et al., (2023) addressed this issue in a study as a dynamic method for the effects of re-understanding the supply chain during the pandemic. In this study, they created and used the dynamic method in which they redrawn the dynamic model using the optimal control model. Their model is a combination of optimal control and a pandemic model (such as Corona); and in fact, their model was a combination of these two models, which are older and more time-consuming than machine learning methods.

Research Methodology

The research method is applicable in terms of its purpose, and mixed (qualitative-quantitative) in terms of implementation method. In the qualitative part, interviews with experts active in the food industry with complete information and sufficient experience in the supply chain of this industry have been used until theoretical saturation, which were 10 people of relevant experts in large companies in this field. In the quantitative part, the field method and questionnaire were used to collect data with statistical methods, and this number was also 114 people selected as a sample from the statistical population.

Research findings

Due to the data conditions and the application of the field of machine learning in the supply chain, the support vector machine algorithm; which is one of the very strong algorithms in the field of artificial intelligence, was used. The results showed that customer satisfaction has a negative effect in the research model. Supply chain coordination has a positive effect in the research model. Factors affecting costs have a positive effect, but its amount is moderate. Economic and market conditions have a positive effect in the model. Internet infrastructure has limited importance in the model. Environmental risks have a positive effect. Product quality has a negative effect in the model.

Conclusion

The present study aimed to identify and investigate the effectiveness of supply chain risk indicators of online commerce activities in the food industry through machine learning method using the single support vector algorithm. The results of this study are consistent with the results of Ahmadi et al., (2023), Samiei et al., (2023), SpieskeAlexander et al., (2023), Akkerman et al., (2023), Brusset et al., (2023), Burgess et al., (2023), Ozdemir et al., (2022), Khorram Ruz., (2022), Sheydaei (2022), Pellegrino et al., (2022), and Zeng et al., (2019). Ozdemir et al., (2022) examined the effects of the pandemic on the supply chain of store goods, and finally examined and evaluated their presented model using covariance. The results indicated that in the field of supply chain vibration control, innovation can be greatly affected, so they used statistical methods for their research method.
Considering the research topic, it is suggested that researchers use other machine learning algorithms, such as random forest and decision tree, and estimate the necessary evaluations. In addition, in each of these models, the accuracy of the models can be compared, and the effectiveness of each indicator in other models can also be examined. These algorithms and evaluations can also be used in industries other than the food industry.