# Supplier Evaluation in Supply Chain Environment Based on Radial Basis Function Neural Network

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## ABSTRACT

The comprehensive evaluation and selection of suppliers under the environment of supply chain management has become a key factor affecting the success of supply chain. How to select suppliers and the strategic partnership between suppliers under the environment of supply chain management has become an important challenge. To solve this problem, this paper takes the supplier evaluation and selection of Guangzhou Automobile Toyota Company as the research object, constructs the index system of supplier comprehensive evaluation and selection, uses the RBF neural network algorithm to establish the supplier evaluation and selection model, and makes an experimental study. The results show that radial basis function neural network is a local approximation network, which has a unique and definite solution to the problem, and there is no local minimum problem in BP network. It is a method that enables enterprises and suppliers to have a clear understanding and seek further promotion together. The research provides theoretical data support for enterprise managers to make decisions.

## KEYWORDS

Analytic Hierarchy Process, Neural Network, Supplier Evaluation, Supply Chain

With the intensification of globalization and market competition, supply chain has become an important research hotspot in the business community (Luo & Ierapetritou, 2023). The comprehensive evaluation and selection of suppliers in the supply chain management environment has become a key factor affecting the success of the supply chain (Roozkhosh et al., 2023). How to select suppliers and establish strategic partnerships between suppliers in the supply chain management environment has become an important challenge. This article takes the supplier evaluation and selection of GAC Toyota as the research object. Based on an actual investigation of GAC Toyota, a comprehensive evaluation and selection index system for suppliers was constructed according to the standards of supplier evaluation and selection. Meanwhile, the authors established a supplier evaluation and selection model using a radial basis function neural network algorithm and conducted experimental research. This article provides theoretical data support for the decision-making of enterprise managers, helping them to

better evaluate and select suppliers, optimize the supply chain structure, and thereby improve the efficiency and effectiveness of supply chain management.

## LITERATURE REVIEW

Supply chain refers to an open system composed of suppliers, manufacturers, sellers, and customers that connects all parties in the supply chain through feed-forward information flow, feedback material flow, and information flow, thus forming a whole supply chain management mode (Zhang et al., 2023). With the economic globalization and the rapid development of modern information technology, customers' expectations of products are too high, and the competitive environment of enterprise market has changed from the traditional seller's market to the buyer's market (Ghalandari et al., 2023). Customers are pursuing high standard requirements such as better quality, more choices, higher value, and lower price. Faced with this situation, in order to maintain the core competitiveness, enterprises constantly improve their competitiveness by shortening product development time, improving product quality, reducing production costs, and shortening the delivery cycle (Konstantakis et al., 2023). As the source of the whole supply chain, the evaluation and selection of suppliers is the foundation of supply chain formation (Zaare Tajabadi & Daneshvar, 2023). The supplier's delivery efficiency, product quality, inventory level, design advantage, and other aspects directly affect the manufacturer's income (Delgoshaei et al., 2023). At the same time, the supplier's product price and quality also determine the final customer satisfaction, product market competitiveness, possession, and viability and also have a certain impact on the core competitiveness of each component of the supply chain (Jo et al., 2023). With the development of economic globalization, enterprises devote themselves to their core business, and a large number of spare parts are purchased externally, which makes them more dependent on suppliers (Q.Wang et al., 2023). It has become the key for manufacturing enterprises to improve their competitive advantage by actively developing supplier partnerships and establishing a win-win situation (Sangwa et al., 2023). Market competition is the competition between supply chain and other supply chains, and a weak link will destroy the competitiveness of the whole chain (Esmaeili et al., 2023). Therefore, it is of great practical significance to study supplier selection and evaluation based on supply chain environment (Mohammadnazari et al., 2023).

The theoretical and practical research on supplier selection in supply chain environment at home and abroad has made rich achievements, mainly studying the index system adopted by purchasing enterprises when selecting suppliers, reasonably processing and quantifying the index values, and establishing supplier evaluation and selection models. Some researchers suggest that manufacturers should consider not only basic factors such as cost, quality, and delivery time but also soft indicators such as management compatibility and target consistency when selecting suppliers (Celent et al., 2023). Some researchers put forward three evaluation criteria: risk factors, enterprise demand factors, and measurable cost factors. Through the investigation of Ford Motor Co., Ltd. and its 20 auto parts suppliers, they put forward that the supplier evaluation should be based on product quality, delivery date, price, trade-off among various factors, etc. and not just on price. Some researchers divide the supplier evaluation index system into quality system, enterprise performance, business structure, production capacity, and enterprise environment, mainly aiming at the supplier evaluation system of different product types with retailers as the core (Singh et al., 2023).

With the rapid development of artificial neural network technology, neural network has been widely used in supplier evaluation system (Yu & Lou, 2023). Some researchers put forward the radial basis function method to solve the multivariate interpolation problem and introduced it into the neural network, forming the radial basis function network, which mainly solves the problem of function approximation and pattern classification (Sihotang et al., 2023). Compared with the BP neural network, the radial basis function network is a local approximation neural network, and its optimization process can be regarded as surface fitting in high-dimensional space and its training process is to constantly find the best surface fitted by training data. Some researchers believe that the

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