Sciforce

International Journal of Cloud Computing and Supply Chain Management

Journal homepage: www.sciforce.org

ISSN : 3067-0535

Open Access Review Article

Optimizing Supply Chain Management Using Multi Criteria Decision Making Approaches

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Abstract

Introduction: This study examines the existing body of literature on vaccine supply chains in humanitarian aid settings, focusing on key publications related to supply chain management and logistics, procurement. The findings highlight the paucity of research on vaccine logistics in these contexts. The review discusses Strategic sourcing's effects, outsourcing decisions, chain of supply dynamics decisions. Management on improving efficiency within humanitarian aid networks.

Research significance: This study emphasizes the key supply chain management's significance distribution of vaccines in humanitarian settings, particularly within complex global networks. By reviewing the existing literature, it identifies gaps in research related to vaccine logistics. The study highlights the Significance of Strategic Sourcing, outsourcing decisions, and integration of global supply chain management to improve efficiency and adaptability.

Research methodology: Alternatives; Inventory management policy, Lot-for-lot (as-is), Fixed period, EOQ, W-W. Evaluation in parameters; Quantity (m3), Average inventory (m3), Min-Max inventory (m3), Number of orders released (units), Purchasing.

Result: The results show that EOQ has the highest ranking and W-W has the lowest ranking. In conclusion, EOQ has the highest value for the global supply chain, based on this VIKOR method.

Key words: Vaccine supply chains, strategic sourcing, multi-criteria decision making (MCDM), global supply chain, VIKOR method.

Introduction

[1] A comprehensive literature review was conducted following a research analysis in vaccine distribution networks within humanitarian aid organizations. This review included an in-depth study of three major journals in supply chain management, logistics, and procurement: The Relevant information was identified by reviewing the Supply Chain Management: An International Journal, Journal of Purchasing and Supply Management, and Journal of Supply Chain Management research this topic. The findings summarized in indicate a lack of studies that specifically address humanitarian aid systems, with very few studies focusing in the vaccine distribution networks within these systems. [2] In the context of contemporary management practices that prioritize focusing on core competencies while outsourcing other functions to improve competitiveness within supply chains, in-source/outsource decisions have become increasingly important to a company's overall performance, particularly within supply chains.

A survey of 369 professionals identified outsourcing as one of eight key future trends in procurement and supply chain management. Similarly, a recent survey of procurement and supply chain professionals predicted that external reliance on process and product technologies would reach 55% and 50%, respectively, by the year 2000. [3] Environmental analysis is an important part of a strategic sourcing plan. It assesses current conditions within the organization, its key customers, its supply chain, and the broader market or industry. This analysis provides the context for developing the plan and ensures that the objectives are consistent with the existing business environment. Major changes in these conditions may require revision of the plan. In addition, the analysis should take into account factors throughout the supply chain that may affect the supply strategy. For example, a semiconductor manufacturer may need to forecast customer demand for advanced technology and align its development timeline with customers' plans and technology roadmaps. [4] In recent years, supply chains have become increasingly global and complex due to efforts to control costs. The shift to supply ecosystems can help address this issue by promoting structural simplification through strategic sourcing. This simplification is critical to creating interconnected and integrated systems. Regionally-based supply ecosystems are expected to become more common, gradually replacing some global supply chains. [5] The findings of this research are significant insights for managers in two key areas. First, investing in strategic sourcing (SS) can improve the ability to successfully implement a chosen supply chain strategy, whether it is lean or agile.

The results emphasize that SS is critical to the success of supply chain strategies, as it helps build strong supplier relationships and ensures efficient supply network management. Therefore, managers should acknowledge the positive impact of SS and incorporate it as a key component of their organization's operations. [6] (SCM) involves the integrated planning, management, and oversight of all processes and operations within a supply chain, with the aim of delivering exceptional value to consumers at the lowest possible cost while meeting the expectations of various stakeholders. SCM continues to evolve in response to strategic organizational changes, technological advances, competitive dynamics,

Received date: August 09, 2025 **Accepted date:** August 15, 2025; **Published date:** August 21, 2025

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Citation: PK Kanumarlapudi. "Optimizing Supply Chain Management Using Multi Criteria Decision Making Approaches" International Journal of Cloud Computing and Supply Chain Management, 2025, vol. 1, no. 2, pp. 1–7. doi: https://dx.doi.org/10.55124/ijccscm.v1i2.242

supplier relationships, and changing customer demands. Modern supply chains are becoming more strategic, adaptive, and customer-centric. Strategic supply chain management enhances a company's ability to build achieve competitiveness in ever-changing market key areas of strategic planning, sourcing, manufacturing, and distribution collectively make SCM a complex, enterprise-wide, and interactive business framework. [7] The idea of supply chain management has been thoroughly explored, encompassing the transportation and storage of raw materials and finished goods, along with factors such as inventory, labor, interconnected networks, and cost management. It is clear that every The phase From purchasing raw materials to the supply chain the delivery of completed goods to consumers, introduces various risk elements that lead to uncertainty in costs estimates. [8] These processes often depend on specific resources, either tangible or intangible, that a company wants to protect from being copied by competitors.

Therefore, outsourcing to domestic or international vendors is generally avoided. Companies may also be wary of "knowledge hunting", where vendors may use knowledge gained from the outsourcing relationship to benefit other customers. As a result, even when a strategic process is mature, companies may choose to keep it in-house to retain control. For example, Dell's supply chain process is a mature example of where a company might decide to keep it in-house.[9] While sourcing raw materials near the field may offer potential benefits, there is limited research on the benefits it can bring to the supply chain (SC). In contrast, sourcing raw materials globally requires the creation of supply chain configurations that meet transportation and lead-time requirements. Reducing geographic distance to suppliers often requires significant changes to business processes. As a result, many companies have begun to explore sourcing raw materials near the field, especially in industries such as furniture, apparel, footwear, and steel, where rising oil prices are already driving up high transportation costs. [10] Another important take away from this study is the empirical evidence supporting the Emerging conceptual structures represent the structure of a learning organization and the organizational learning process strengthen competitive advantage and increase efficiency in strategic sourcing. Although the broad focus of the study limits the results to some extent, it provides compelling evidence for the practical benefits of organizational learning beyond theoretical considerations. The study also underscores the potential for synergistic effects when organizational learning principles are applied to foster integration within supply chain management relationships.[11] This is especially true in the IT industry, where FM is often associated with outsourced services.

However, while FM is generally understood as management of physical assets and support functions linked to In-house services, outsourcing, is one of the various approaches to Do you offer FM services? The new ISO standard for FM terminology describes it this way: "An organizational function that integrates people, place and process within the built environment to improve the quality of life of individuals and the productivity of the core business." [12] Partnerships provide additional benefits such as increased capital, effective Strategic planning, innovation and technology advancement. As a result, more benefits arise from the implementation of the roles of different Partners in joint ventures between suppliers and buyers. As a result, the literature review highlights strategic sourcing decisions, including elements such as collaboration and partnerships in the development and evaluation of multiple suppliers, as well as the involvement of various stake holders decision-making mediation tools and the value co-creation process. [13] However, this approach requires managing a large supply base. Flexibility in information systems is crucial as companies have to deal with a variety of contract types, terms, and languages. This underscores the importance of thoughtfully structuring the global capital process, which includes stages such as scouting, qualification, negotiation, and selection. It also highlights that organizational Successful global capital strategies depend on structures, processes, business expertise, proficiency in international languages, and strong commitment from top management. [14] Strategic planning and decision-making occur in a variety of contexts and are often complex. Supply chain decisions, in particular, are more complex as they involve additional dimensions, stakeholders, and functions. Restructuring is a significant supply chain decision, and it may require the use of advanced tools. However, managers still prefer decisions that are intuitive and supported by strong business logic and reasoning. [15] The business landscape in which today's companies operate is very different from previous decades. Advances in computing power and the rise of the Internet have reduced integration costs, making it easier to connect diverse companies worldwide into an integrated supply chain. As outsourcing has gained importance, the emphasis on supply chain integration has shifted from managing internal business units to global management. Networks of customers and suppliers. The responsibility to oversee these complex global networks now lays with a company's supply chain management teams. An essential component in managing these networks is resource decisions, which define a company's global supply chain. While procurement traditionally handles operational functions such as while it once focused on contracts, pricing, scheduling, and payments, it is now a strategic role in influencing the direction of the company through careful supplier selection, which significantly affects the composition, characteristics, and arrangement of the global supply chain.

Materials and Methods

[16] VIKOR technique was created to make decisions based on multiple criteria approach aimed at tackling unique decision-making challenges involving conflicting and incompatible criteria. Its objective is to determine Reconcile solutions to issues with formulating contradictory standards and assisting decision-makers in coming to a conclusion choice by ranking and Choosing from various options. A compromise solution is the being very close to the optimal solution, where compromise involves mutual compromises. Another perspective approach, TOPSIS, seeks a solution that is distant very close to the ideal answer and away from the negative-perfect solution. VIKOR method serves as a valuable tool in decision-making based on a variety of factors, particularly when decision-makers are unable to declare their preferences clearly at the outset of the computer design process. [17] Once the material selection criteria have been established and a once a once a list of materials for a specific engineering application has been compiled, the optimal material may be as follows: ranked and selected using the recommended extended version of VIKOR. Originally developed to optimize multiple criteria in complex systems, the VIKOR method has gained widely recognized. It emphasizes ranking and selecting options with conflicting criteria that have various units. The compromise ranking in the VIKOR approach is determined by evaluating how close each alternative is to the best one, with "compromise" referring to a solution reached through mutual concessions. [18]The central concept of the VIKOR method involves identifying focus on ranking Ideal points in the solution space that are both positive and negative when choosing from a list of limited options, considering the contradiction and incompatible criteria (attributes with varying units).

This method calculates multi-criteria ranking structure, proximity to the 'best' solution. By evaluating each alternative against each criterion, a compromise ranking is established by assessing the relative proximity to the most advantageous option. The compromise solution that emerged the most practical option, both the positive and negative ideal solutions are the ones that it is most similar to. In this situation, a compromise refers to an agreement reached through mutual concessions between alternatives.

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In addition to the traditional VIKOR method, there are many variations these include detailed VIKOR, vague VIKOR, regret theory-based VIKOR, and modified VIKOR. and gap VIKOR developed to address various challenges in decision-making and meet the unique needs of decision-makers. [19] The VIKOR This approach is predicated on the notion that determining optimum locations, both positive and negative within a solution space. It emphasizes ranking and selecting from a limited set of alternatives, taking into account conflicting and incompatible criteria (attributes with different units). The method calculates a rating index with multiple criteria that is based on "closeness" to the optimal solution. By evaluating each alternative against each criterion, a compromise ranking is determined by Comparing the relative distances to the ideal alternative. The resulting compromise solution is a viable option that is closest to the positive ideal solution and farthest from the negative ideal solution. In this case, compromise refers to a compromise made between alternatives through mutual concessions. Beyond the standard VIKOR method, several variations have been developed to address various addressing the challenges in decision-making and the specific needs of decision-makers. [20] Initially, we provided a brief overview of the basic concepts of INNs.

This approach combines evaluation information from all individual decision makers using the INNWA The operator then uses the traditional VIKOR method, which is suitable for MAGDM issues in combining INNs. The effectiveness and stability of this approach are verified through examples and comparative analyses, which demonstrated its advantages over existing methods. In the future, it will be necessary to further explore MAGDM, risk analysis, and other INN methods for various uncertain and ambiguous environments. [21]Despite considerable efforts to apply the VIKOR method, published results regarding its effectiveness as a decision-making tool medical and healthcare sectors fields are inconclusive. A comprehensive literature review has been conducted to classify, Examine and explain current studies on developments and applications of VIKOR. However, there is only a small amount of research specifically dedicated to the development application of the VIKOR method in medicine and health management. [22] Promoting sustainable economic development and environmental management protection, an increasing number of companies are implementing (GSC) practices for their products. Implementing these practices impacts the operational efficiency of businesses.

As a result, companies must fully assess their performance when incorporating GSC initiatives. Evaluating these initiatives it is a multifaceted process that requires consideration of various factors, for example inventory levels, supply reliability in procurement, and technological and innovation capabilities in production. This research introduces a new Probabilistic linguistics to support VIKOR method these assessments. Initially, to effectively identify probabilistic linguistic positive and negative ideal solutions, A new comparative approach to probabilistic linguistic term sets (PLTSs) introduced. [23] By using the Using the DEMATEL method, cause-and-effect relationships and correlations between different cotton fiber properties identified, which helps to accurately identify the most influential property (criterion) and its significant impact on other properties. A digraph is created to visualize the influence network in the cotton fiber selection and evaluation process. Additionally, the VIKOR method, a compromise ranking technique, evaluates and ranks 17 cotton fiber alternatives from best to worst. This comprehensive multi-criteria approach enables experts in the spinning industry to evaluate various cotton fiber properties based on their influence, while also providing a ranking of available cotton fibers.[24] Pareto optimality was used to solve this problem.

The VIKOR method, a multi-criteria analysis technique widely used in scientific research, is based on the principle of optimality. Due to its high flexibility compared to other methods and its ability to provide a compromise solution to conflicting data, This study used the VIKOR method to evaluate the water quality monitoring system, focusing on the evaluation of the current system at TWRD, can point out areas that need attention more extensive monitoring. Monitoring stations in these areas should be properly maintained, and if none exist, new stations should be established. [25] Decision-making plays a vital role in daily life, especially in fields such as business, home management, employment, education, marketing, healthcare, engineering, social sciences, and economics.

Therefore, making the right decisions is essential to maintain a comfortable and balanced lifestyle. Decision-making involves finding solutions to challenges by evaluating multiple options based on conflicting criteria. To address these key issues, this research presents a new technique based on the VIKOR method. In the proposed approach, the assigned jury and criteria is first evaluated using complex Fermatian fuzzy NSF ranked standards, which determine the normalized weights. Then, the individual perspectives of decision-makers are taken into account, and the collective complexity Fermatian fuzzy N-smooth weighted average operator is used to construct a combined complex Fermatian fuzzy N-smooth decision matrix. The inputs in this matrix are converted into clear data by a scoring function. After evaluating the best and worst values, the ranking measures are determined. Finally, the alternatives are ranked in ascending order, and the optimal option is selected by testing both conditions. [26] Although some studies have attempted to select or rank performance appraisal methods (PAMs), none have specifically focused on evaluating PAMs based on rating errors or used the fuzzy VIKOR method, as this study does. While various factors contribute to the decline in the effectiveness of performance appraisals, this research focuses on rating errors made by raters and aims to rank PAMs based on their perceived effectiveness in reducing these errors.

The study begins by reviewing the importance of employees' perceptions of fairness regarding PAMs and errors. It then describes the research methodology, including a brief description of the fuzzy VIKOR method, followed by a presentation of the findings and a discussion of managerial and educational implications. [27] In decision-making, it is necessary to understand how to integrate both decision weights and attribute weights within the VIKOR method. To overcome these challenges,this paper introduces a modified VIKOR method, in which both the weights and attributes of decision makers are completely unknown, and the attribute values are expressed as trapezoidal fuzzy numbers.[28] The improved VIKOR method provides faster analysis, requires less memory, and provides more accurate results compared to other methods. It effectively addresses complex multi-criteria problems with unmeasured and conflicting Criteria. Furthermore, the coefficient of the decision-making mechanism can be adjusted based on the personal preferences of the decision-makers and the specific importance of the research. This flexibility allows for both group and individual benefits to be considered in balance, improving the operational flexibility and consistency Data obtained from the VIKOR method are used to develop a barrier size model for detecting WRCC, which provides a detailed analysis of the key factors affecting WRCC in the weighing city.[29]Gap Quantitative values and ambiguous language are frequently used in real-world situations. The modified VIKOR method is commonly used to accurately and reasonably estimate uncertainty factors for MADM problems. Despite the many advantages of the VIKOR method, it does not fully solve all real-world challenges. In such situations, the modified VIKOR method is used. Its main strength lies in its ability to process this involves not just exact values, but also ambiguous language and ambiguous numbers.

The proposed qualitative approach is used to address this assessment code; the gap numbers and fuzzy language are managed using triangular fuzzy theory. After determining the importance of each code for the modified VIKOR method, is established, the entropy method is combined

with the AHP to calculate the weights. This method combines expert knowledge, minimizing the effect of both subjective and objective elements in the weighting process. However, when selecting from a large set of land reclamation projects, many experts rely on techniques Methods such as extreme conditions approach, coding techniques, fuzzy mathematical models, artificial intelligence neural networks, extension methods, expert system design based on CLIPS language, and immune clone algorithm. [30] This method ranks alternatives from best to worst, taking into account a set of conflicting criteria, categorized into benefit and cost factors, which are used to prioritize alternatives in the VIKOR method. The aim of VIKOR is to increase using benefit attributes while reducing cost attributes. Typically, organizations seek to improve benefit factors and reduce cost factors. For example, factors such as quality, scope, and profitability should be increased as benefit factors, while factors such as risk, cost, and time should be reduced should be reduced as cost factors.

Analysis and Dissection

Table 1: The table 1 summarizes the inventory management policies in a global supply chain analyzed using the VIKOR method

Inventory management policy	Quantity (m3)	Average inventory (m3)	Min-Max inventory (m3)	Number of orders released (units)	Purchasing
Lot-for-lot (as-is)	2552	208	539	18	1914000
Fixed period	3008	570	573	18	2256000
EOQ	2618	292	631	24	1963500
W-W	2552	208	539	18	191400
Best	3008	570	631	24	2256000
worst	2552	208	539	18	191400

The table 1 summarizes the inventory management policies in a global supply chain analyzed using the VIKOR method. These include metrics such as volume (m^3), average inventory, min-max inventory levels, number of orders placed, and purchasing costs. The main policies compared are lot-to-lot (as is), fixed duration, EOQ (economic order quantity), and W-W. The fixed duration policy shows the highest average inventory (570 m^3) and purchasing cost (2,256,000), while the EOQ shows a balance between high order frequency (24 units) and moderate costs (1,963,500). The best-performing scenario is aligned with fixed duration, while the worst reflects lot-to-lot. These results guide inventory management decisions.

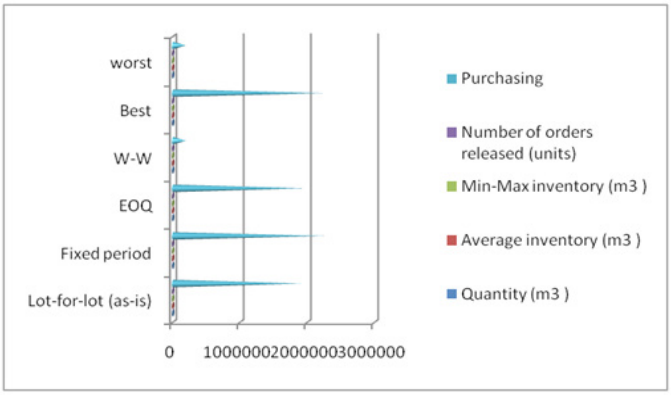

Figure 1: Global Supply Chain

The figure 1 compares inventory policies in a global supply chain using the VIKOR method. Fixed Period has the highest average inventory (570 m^3) and purchasing cost (2,256,000), while EOQ balances higher order frequency (24) with moderate costs (1,963,500). Fixed Period is the best-performing, and Lot-for-Lot represents the worst scenario.

Table 2: evaluates inventory management policies in a global supply chain using the VIKOR method

Inventory management policy	Sj	Rj
Lot-for-lot (as-is)	0.695663	0.167
Fixed period	0.272283	0.167
EOQ	0.294737	0.142829
W-W	0.835	0.167

Table 2 evaluates inventory management policies in a global supply chain using the VIKOR method, which considers a compromise ranking approach to evaluating decision making under conflicting criteria. Two metrics, Sj and Rj, are used to rank the policies. Sj represents the weighted sum of deviations from the best solution, where smaller values indicate better overall performance. Rj indicates maximum group utilization or the largest deviation from the best solution, with lower values being preferable. The results show that the fixed-term policy has the lowest Sj value (0.272283), indicating its best overall performance among the evaluated criteria. This ties with the other policies in Rj at 0.167, indicating consistent utilization. The EOQ policy follows closely, with anSj of 0.294737 and the lowest Rj value (0.142829), making it the efficient choice with the least deviation. The lot-for-lot policy has the highest Sj value (0.695663), reflecting poor overall performance, although its Rj is in line with most of the others at 0.167. The W-W policy performs the worst, with the highest Sj (0.835), showing the least alignment with optimal supply chain goals. The analysis highlights fixed lead time and EOQ as the optimal policies for inventory management.

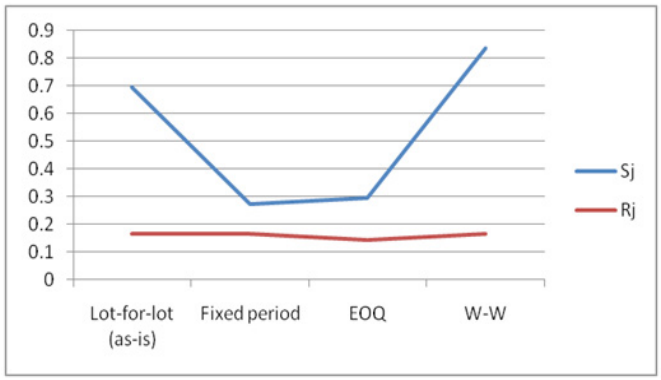

Figure 2: Sj and Rj

Figure 2 analyzes global supply chain inventory policies using the VIKOR method, focusing on compromise solutions. The Sj metric (sum of estimated deviations) shows that the fixed-term policy (0.272283) performs best overall, closely followed by EOQ (0.294737). The Rj metric (maximum group utilization deviation) favors EOQ (0.142829) for its minimum deviation, while the other policies are at 0.167. The lot-for-lot policy and the W-W policy exhibit higher Sj values (0.695663 and 0.835, respectively), reflecting poorer performance. The results suggest that the fixed-term and EOQ are the optimal choices, with EOQ being the best at minimizing deviation from the best solutions.

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Table 3: Evaluates inventory management policies in a global supply chain using the VIKOR method	
Inventory management policy	Qj
Lot-for-lot (as-is)	0.123807
Fixed period	0.5
EOQ	0.730048
W-W	0

Table 3 evaluates inventory management policies in a global supply chain using the VIKOR method, focusing specifically on the Qj measure, which represents the compromise ranking value. This measure combines the weighted criteria of group utility (Sj) and individual regret (Rj), which determine the relative closeness of each policy to the best solution. Lower Qj values indicate better performance. The results reveal that the W-W policy achieves the lowest Qj value (0), which is most aligned with the best solution. This indicates that W-W effectively balances overall performance and minimizes the deviation between the criteria. The lot-for-lot policy performs relatively well with a Qj of 0.123807, which indicates moderate alignment with the ideal. It outperforms both fixed duration and EOQ in the compromise ranking. The fixed duration policy has a Qj of 0.5, which indicates a medium level of performance that balances group utility and individual regret. The EOQ policy, despite its efficiency on some metrics, has the highest Qj value (0.730048), which reflects a greater deviation from the ideal compared to the other policies. Overall, the results show that the W-W policy is the optimal choice, while fixed duration and lot-for-lot are viable alternatives under certain conditions.

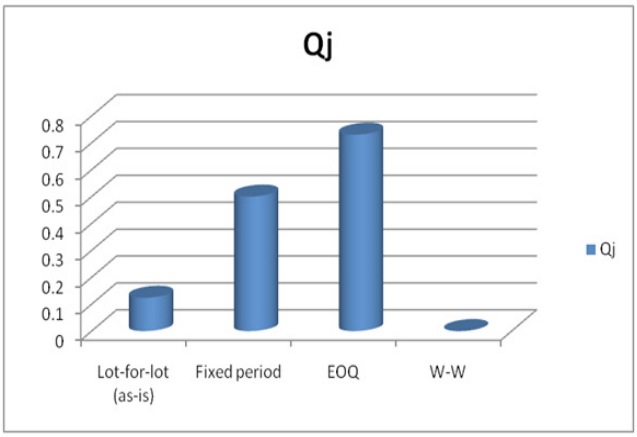

Figure 3: Qj

Figure 3 evaluates inventory management policies in a global supply chain using the VIKOR method, focusing on the Qj measure, which ranks policies based on their proximity to the optimal solution. The W-W policy achieves the best performance with a Qj value of 0, indicating perfect alignment with the ideal. The lot-for-lot policy follows with a relatively low Qj (0.123807), indicating good alignment. The constant-time policy has a moderate Qj value of 0.5, while the EOQ shows the weakest performance with a very high Qj (0.730048), reflecting a high deviation from the optimal solution. The W-W is the preferred policy.

Table 4: Ranks inventory management policies in the global supply chain	
Inventory management policy	Rank
Lot-for-lot (as-is)	3
Fixed period	2
	1
W-W	4

Table 4 ranks inventory management policies in the global supply chain, assessing their proximity to the optimal solution by balancing trade-offs between conflicting criteria. The rankings range from 1 (best) to 4 (worst), providing a clear hierarchy for decision-making. The EOQ policy takes first place with a ranking of 1, reflecting its overall best performance in balancing key factors such as inventory levels, order frequency, and purchasing costs. Its ability to minimize deviations from the ideal values makes it the most effective policy. The fixed-term policy is ranked 2, indicating strong performance but slightly less alignment with the optimal solution compared to EOQ. Its higher average inventory and costs may contribute to its low ranking. The lot-for-lot policy, ranked 3, performs moderately well. However, its higher purchasing costs and limitations in balancing inventory measurements affect its overall performance. The W-W policy, ranked 4th, is the least efficient, showing significant deviations from the best performance on several metrics. While performing well on specific metrics, its overall compromise solution remains less favorable. This ranking highlights EOQ and fixed duration as the most suitable choices, with EOQ standing out as the preferred policy for improving supply chain efficiency.

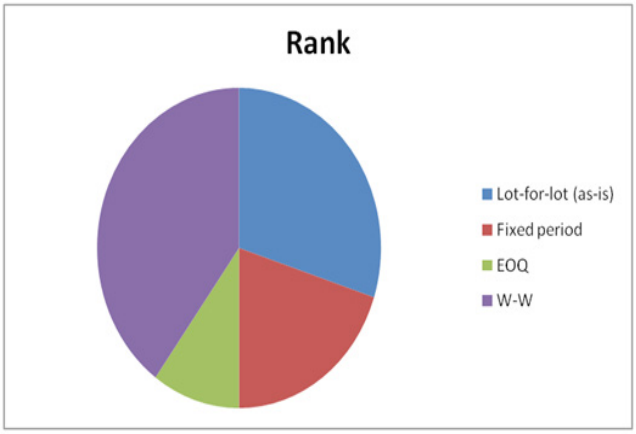

Figure 4: Rank

Figure 4 presents a ranking of inventory management policies in the global supply chain using the VIKOR method, assessing their alignment with the best solution. The EOQ policy is ranked highest (1), reflecting a high balance of inventory metrics and purchasing efficiency. The fixed-term policy is ranked 2nd, indicating strong but slightly less optimal performance. The lot-for-lot policy is ranked 3rd, showing moderate performance but high costs and limitations in the equilibrium criteria. The W-W policy, ranked 4th, shows weak performance, with significant deviations from ideal metrics. EOQ is identified as the best policy for inventory management.

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Conclusion

A comprehensive review of the current literature on supply chains for vaccines in networks of humanitarian assistance and subsequent research analysis reveals significant challenges in effectively managing these supply chains. Review important journals related to supply chain management, procurement and logistics shows a paucity of research in this area, particularly in humanitarian settings. The findings underscore the growing need to incorporate sourcing decisions, outsourcing strategies and environmental assessments when developing robust supply chain strategies. Modern supply chains are increasingly complex and global, influenced by technological advances and competitive pressures. Adopting strategic sourcing (SS) and supply ecosystems can improve efficiency and sustainability, particularly by fostering strong supplier relationships and aligning organizational goals with market needs. The VIKOR algorithm has proven valuable in addressing multi-criteria decision-making challenges within supply chains, providing a compromise ranking of optimal solutions to help decision makers manage conflicting criteria.

This research emphasizes important role of strategic supply chain management in achieving competitive advantages and operational excellence. The importance of balancing global sourcing strategies with regionally based supply ecosystems is emphasized to reduce risks such as lead time variability and supply disruptions. In addition, integrating organizational learning and collaborative partnerships into supply chain processes can improve efficiency and drive innovation. In humanitarian settings, effective use of the VIKOR method and other decision-making frameworks can improve vaccine supply chains by overcoming challenges such as resource scarcity, geographic limitations, and urgent supply needs. By using these tools, supply chain managers can improve decision-making and ensure timely distribution of key resources in critical situations. These insights are valuable to both practitioners and researchers, highlighting the need for adaptive, collaborative, and use data to inform decisions in the rapidly evolving sector of global supply chain management. Future research ought to concentrate on explore innovative approaches and frameworks such as modified VIKOR and dealing with collective decision-making that involves multiple criteria models new challenges and advance the field. The results indicated that EOQ achieved the highest quality and W-W achieved the lowest quality.

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Citation: PK Kanumarlapudi. “Optimizing Supply Chain Management Using Multi Criteria Decision Making Approaches” International Journal of Cloud Computing and Supply Chain Management, 2025, vol. 1, no. 2, pp. 1–7. doi: https://dx.doi.org/10.55124/ijccscm.v1i2.242

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