



Computer Science, Engineering and Technology

Vol: 3(4), December 2025

REST Publisher; ISSN: 2583-9179

Website: <https://restpublisher.com/journals/cset/>

DOI: <https://doi.org/10.46632/cset/3/4/2>



A software package for analysis in experimental statistics and quantitative genetics by using VIKOR Method

*Sathiyaraj Chinnasamy, Ramya Sharma, M. Ramachandran, Poonkodi Sathiyamoorthy

REST Labs, Kaveripattinam, Krishnagiri, Tamil Nadu, India.

*Corresponding Author Email: sathiyaraj@restlabs.in

Abstract: Software package selection is a critical yet complex process with significant implications for organizational performance and efficiency. This study employs the VIKOR multi-criteria decision-making method to systematically evaluate and compare different software acquisition strategies. The research explores five primary approaches: Commercial Off-The-Shelf (COTS), Open Source Solutions, Custom Development, Software as a Service, and solutions with potential security risks. The methodology involves a comprehensive assessment across four key dimensions: functional requirements, technical considerations, cost analysis, and support and documentation. By utilizing the VIKOR method, the study provides a structured framework for quantitatively ranking these software approaches based on their comprehensive performance. Key findings reveal that Commercial Off-The-Shelf solutions emerge as the most favorable option, ranking first with the highest Q_j value of 1. This suggests that pre-developed, standardized software packages offer significant advantages in terms of implementation speed, cost-effectiveness, and proven functionality. However, the research also highlights the nuanced nature of software selection, emphasizing that no single approach is universally optimal. The study contributes to the field by providing a rigorous, data-driven approach to software package selection. It demonstrates the value of multi-criteria decision-making techniques in navigating the complex landscape of software acquisition. Organizations can leverage this methodology to make more informed decisions, balancing technical, financial, and operational considerations when selecting software solutions. The research underscores the importance of a holistic, systematic approach to software package evaluation in an increasingly digital and technology-dependent business environment.

Keywords: Commercial Off-The-Shelf, Open Source Solutions, Custom Development, Software as a Service and Potential security risks. Functional Requirements, Technical Considerations, Cost Analysis and Support & Documentation

1. INTRODUCTION

Selecting software that aligns with an organization's needs is a challenging task, and the process of evaluating and choosing software packages is complex. Incorrect software selection can be costly and negatively impact business processes. The goal of this thesis is to assess the evaluation process and provide a foundation for improving software package selection. This paper reviews systematic studies from journals and conference proceedings, offering guidelines for software package selection, evaluation techniques, evaluation criteria, and decision support systems. Additionally, the review explores how software producers approach the evaluation of software packages [1]. Dynamite's primary use is for precise measurements, particularly in the fields of physics, chemistry, or biology. It is designed to investigate the mechanisms behind various processes. Most biochemists rely on kinetic models, and Dyna Fit allows them to account for the systematic uncertainty in parameter estimates. These uncertainties are viewed as errors, as is the case with other popular software packages that handle nonlinear data. Similar to linear least squares regression, the reported standard errors in Dyna Fit reflect the uncertainties in nonlinear parameters,

typically presented as plus or minus values alongside the best-fit estimates [2]. The ABINIT software program was first launched in 1997 with the goal of providing a free software package for the preliminary study of material properties, primarily designed to run on Linux. A key factor in its success was the active involvement of the materials science community, who recognized the value of such a tool. The first publicly available version was released in December 2000. Since then, the developer community has grown from a small group of early enthusiasts to about fifty contributors, while the user base, approximately ten times larger, has expanded at a similar pace [3]. The implementation plan is straightforward and adaptable. It not only handles data processing but also integrates seamlessly with other software packages, promoting easy collaboration. The collection includes an open-source codebase, allowing access to various tasks and details related to the implementation of the algorithms. While the current implementation enables users to quickly execute the previously mentioned tasks, certain features still require improvement, and some implementation aspects may need to be revised [4]. A quantitative description of the aforementioned processes, along with a fundamental requirement for analysis, is an understanding of solvent molecules and their behavior in aqueous environments. This involves recognizing the significance of the interrelationships between molecules. Solvent-solvent interactions are typically categorized into polar and non-polar types. While this classification is commonly used, it is somewhat arbitrary and open to various interpretations. Warnings are associated with these classifications, as there is an inherent connection between the two types of interactions. This work primarily focuses on the polar-type interactions between solvent molecules [5]. The development of software in the field of plant genetics and breeding is crucial for the scientific community due to the lack of available resources. These tools are essential for managing the vast amounts of data, accommodating the growing number of users in research institutions, and meeting the increasing demand for statistical analysis and efficient data processing. This is vital for the accurate estimation of biological parameters. In plant genetics, particularly with the intensive breeding of many species, the complexity of key traits requires the use of increasingly precise selection criteria [6]. In image processing, various local sub patterns such as brightness, color scale, hardness, movement, and unevenness can be perceived, revealing characteristics like smoothness or granularity. These features are often used to describe human tissue or the internal structure of organs in medical imaging. As a result, analyzing texture in images plays a crucial role in image interpretation and understanding. While humans can easily recognize textures qualitatively, there is no precise definition of texture in image processing. However, quantitative texture analysis is frequently needed, especially in systems like those used for clinical diagnosis [7]. Frustration arises from outdated legacy systems that no longer align with current business needs, as well as the IS department's struggles with system integration, handling the Y2K issue, and adapting to new European currencies. The growing trend of consolidation has led to increased demand for comprehensive solutions like Enterprise Resource Planning (ERP) software packages. ERP systems bring value to businesses by supporting various processes throughout the supply chain. For example, SAP R/3 offers financial and logistics management with over 1,000 predefined procedures, stored in its "Business Engineer" repository, which includes human resources best practices [8]. With the advancement of techniques like microarray, mass spectrometry, and large-scale high-throughput testing, there is a growing need for automatic annotation of gene sets and identification of associated pathways. While various multi-pathway analysis tools have been developed, there is still a demand for new tools that can provide more flexible or advanced analytical capabilities. In response to this need, we have developed an R-based software package called Sub pathway Miner, designed for flexible pathway annotation [9]. In EPR spectroscopy, including techniques like ENDOR and pulse EPR, the extraction of structural and kinetic information from experimental data heavily relies on data processing. While there is a range of software available and well-established mechanisms for general EPR spectroscopy, a flexible simulation environment is still lacking, despite the critical role of computerized data processing, numerical simulation, and iterative parameter fitting [10]. In addition to molecular data analyses, morph metric analyses are becoming more common. This integration of data includes applications such as mapping shape data onto inferred phylogenies based on DNA sequences. By utilizing information from molecular markers and quantitative genetics, researchers can evaluate the effects of hybridization on form and analyze asymmetry. Consequently, there is a need for flexible tools in morph metric analysis to support the expanding community of users within ecology and evolutionary biology [11]. The entire procedure involves configuring RDC data refinement, potentially leading to an optimal structure. This is achieved through manual iterations until convergence is reached. However, there are often various practical and theoretical limitations tied to the RDC data when optimizing macromolecular structures. Converting file formats within these constraints and between different analytical software systems is challenging but essential. Additionally, a significant challenge in studying RDCs involves determining the most effective purification mechanism based on the configuration using

RDC constraints [12]. Software packages are not interchangeable; in fact, different procedures are often used for many of the same data-processing tasks. The choice of software can also influence subsequent analyses. Additionally, no single package covers all needs, as some laboratories have created their own software solutions. This custom approach has both benefits and drawbacks. When comparing results across different laboratories, the variety of software used to analyze the same data can lead to inconsistencies in the literature. Furthermore, individual datasets may contain errors because thorough debugging can only be achieved after extensive use. Due to these complexities, it can be challenging for a researcher to fully grasp a specific software package without assistance from someone who has expertise in it [13]. Different force fields for defining atom types utilize various strategies. As a result, molecular mechanics (MM) calculations are performed based on specified parameters to identify atomic types. Some MM software packages have fixed atomic types defined by their core engine, which cannot be easily altered by users. In contrast, other MM packages allow for flexibility and user-defined atomic types, relying on algorithms that can automatically recognize these types, which can be beneficial [14]. Such packages will be managed by administrators. Software packages consist of extensive software ecosystems that establish systems. The packaging process is environmentally oriented, with numerous package releases in various settings. Additionally, there are other collections that receive regular updates. Publications have numerous dependencies, creating a complex packaging environment. While these systems are beneficial to their respective developer communities, they encounter challenges related to their size, complexity, and rapid evolution. Common issues include outdated or incompatible package updates and reliance on transitional, obsolete, or malfunctioning packages [15].

2. MATERIALS AND METHOD

Commercial Off-The-Shelf: COTS, or Commercial-Off-the-Shelf, refer to products that are available in their pre-made, standard form. These hardware or software products are ready-made and sourced from commercial suppliers. They are designed for quick installation and integration, allowing them to seamlessly work with existing system components.

Open Source Solutions: Open source software is publicly available and consists of openly shared code, allowing anyone to view, modify, and distribute it. This type of software is built collaboratively, relying on peer review, social contributions, and decentralized development.

Custom Development: Custom application development involves creating, building, and implementing software applications tailored to meet the unique needs of specific users or situations. For instance, companies may design custom HR portals to accommodate employees and freelancers with unique features. This type of software, also called bespoke or tailor-made software, is developed either for an individual company or a distinct group of users, offering functionalities not available in off-the-shelf solutions.

Software as a Service: Software as a Service, describes applications that are accessed online without requiring downloads. Users subscribe to software that is hosted remotely and accessible through web browsers, removing the need for direct maintenance. These subscription-based services are managed by external vendors via the Internet. Popular examples of SaaS include Drop box, Google Workspace, and Sales force.

Potential security risks: A security risk is a category of risk that affects a company's assets due to harmful actions. This includes potential losses or damage to data and reputation. Security risks may arise from external threats such as hackers, malware, and viruses or from internal issues like employee negligence or malicious insider activities.

Functional Requirements: Operational safety requirements refer to the safety services that a system under examination needs to provide to ensure secure operation. These may include features such as authentication, backups, and server clustering. Often, best practices for these requirements are derived from established policies and regulations. Functional requirements, on the other hand, specify what the system or its components must accomplish. They define the essential features and activities, describing "what" the system must do. These requirements outline the system's expected actions and outputs in response to given inputs.

Technical Considerations: In technical analysis, it is believed that past price patterns of stocks tend to recur over time. As a result, these trends are regarded as important predictors of future stock price movements. Traders examine these price trends and volume data to forecast the future direction of stock prices.

Cost Analysis: Cost analysis, or cost-benefit analysis, involves calculating the expected revenue from a project or situation and subtracting the total costs required to complete it. This process helps predict the potential profit from the project and compares its costs to the anticipated financial benefits.

Support & Documentation: Company profiles and registration certificates, along with lists, samples, and documents verifying the qualifications and identification of company owners, are included. Supporting documents refer to all public records, regardless of format, medium, or source, provided to members of the legislative body for review of agenda items for a specific meeting, as well as all information submitted in a timely manner for that meeting.

VIKOR Method: Performance ratings for various criteria are assessed using different units, yet the comparison matrix must consist of dimensionless elements. This is particularly relevant for cost-benefit analysis. To address this, normalization methods have been created to help align results with target values. It is important to consider engineering design contexts, including the limitations of current methods. This paper introduces a new version of the VIKOR method that encompasses all types of criteria and emphasizes the importance of finding a compromise solution. The proposed comprehensive version enhances the traditional VIKOR approach, providing a straightforward solution to a significant error. This recommended method can improve the accuracy of material selection across various applications, especially in biomedical contexts, where materials need to possess properties similar to those of human tissue [16]. The VIKOR method is effective for addressing complex decision-making challenges. Besides its successful application, there are various types, including detailed VIKOR, vague VIKOR, regret theory-based VIKOR, modified VIKOR, and interval VIKOR. The choice of method depends on the specific decision problem and the preferences of the decision maker. These variations are suited for different decision scenarios and come with their own mathematical formulas. The five versions of the VIKOR method provide a robust framework for ranking performance across categories based on their original values, allowing for effective comparisons. The primary focus of this thesis is to demonstrate all six types of VIKOR through examples to compare their ranking performances, utilizing Spearman's rank correlation coefficient to assess which VIKOR method yields the best results [17]. In decision-making, it is essential to consider various conflicting objectives due to the growing complexity of social, economic, technological, and environmental factors. Traditional single-criteria decision-making approaches are no longer adequate to address these challenges. The VIKOR method, recognized for providing a compromise ranking, identifies the "best" solution based on a specific metric known as "closeness." This method introduces a scale ranking index. In this paper, we apply this methodology to the selection of renewable energy projects, initiated by the Spanish government [18]. Engineers occasionally face challenges with optimization, leading to unsatisfactory outcomes. Additionally, numerous solutions have been created to enhance this process. These solutions often rely on intricate statistical models, which may be difficult for engineers lacking a strong mathematical foundation to utilize effectively. As a result, this study introduces VIKOR as a method for multi-criteria decision-making (MCDM). This new approach aims to address the optimization issues in multi-response processes. The MCDM process typically involves conflicting and trade-off criteria, which can help identify the best solution among various alternatives [19]. The VIKOR method evaluates alternatives and identifies the optimal solution through a process of compromise and closeness. This technique is a multi-criteria decision-making approach that features a straightforward calculation method, allowing for the simultaneous evaluation of both ideal and anti-ideal alternatives. Previous studies indicate that numerous authors have applied the VIKOR method in their research. In this paper, we utilize this method to address the selection problem for RESs (Renewable Energy Sources), with a case study conducted on the BHU campus [20]. As a result, conventional methods cannot be used to select from a range of alternatives. Consequently, this study introduces a revised VIKOR method tailored for addressing lean tool selection challenges in manufacturing systems. A model was developed to assist practitioners in enhancing their problem-solving capabilities by evaluating potential solutions based on their specific criteria. In fact, the modified VIKOR method allows for the ranking of alternatives in three scenarios: those with shared criteria, those with distinct criteria, and those that encompass both shared and distinct criteria [21]. The objective of this thesis is to address the gap in value related to multi-attribute grouping within an intuitive fuzzy environment. It aims to enhance the VIKOR method for decision-making processes by incorporating all alternatives provided by decision-makers. The information presented is characterized by ambiguity and is represented as decision matrices, utilizing interval-valued intuitionist fuzzy numbers. Additionally, the information is categorized based on attribute weights. There is limited existing knowledge in this area, making it a significant focus within the fields of decision science and operations research [22]. Reservoirs in Taiwan occupy significant land areas, which is under pressure due to the country's high population density and ongoing development. This development has led to various

environmental impacts, necessitating land use restrictions, especially for subdivisions around watersheds. To effectively manage these areas, prioritizing land use controls is essential. Given the many factors involved in evaluating environmental impacts from subdivisions, this study employed a multi-criteria analysis approach. Using selected criteria related to geography and weather, the VIKOR method was applied to find the best solution. The aim of this study is to establish a priority ranking for land use controls around the Cheng- Went Reservoir in southern Taiwan [23]. The final results reveal that disposal has minimal negative impact on the environment, making it the most favorable recovery option. However, reselling, while financially beneficial, is less ideal. Recovery was treated as optional in this study, but the research opens up new avenues for future investigation. From a managerial perspective, the proposed model makes it interesting to study standard reverse logistics (RL). While this study focused only on the environmental aspects of RL, it would be even more precise if economic and social factors were considered as well. Furthermore, it's essential to incorporate technical feedback from all stakeholders, reflecting their concerns and redemption goals. We recommend using Fuzzy-MADM methods for group decision-making across RL processes to design a comprehensive model [24]. In a competitive environment, there is an increasing demand for miniaturization and diversity in manufacturing, particularly for applications requiring enhanced mechanical properties. The demand for high-quality products is rising, driving the need for precise and miniaturized manufacturing. Industries like aerospace, space exploration, nuclear physics, and missile technology are seeking more sophisticated solutions. Researchers are focusing on developing new materials to meet these advanced requirements. However, traditional machining processes often struggle with handling such materials. As a result, modern manufacturing trends are shifting toward using unconventional energy sources such as light, sound, chemical, mechanical, electrical, and ions. Electrical Discharge Machining (EDM) is one of these unconventional processes. It uses thermal and electrical energy to remove material from the work piece and is capable of machining various types of conductive materials. This makes EDM highly popular among manufacturers, although it requires significant electrical power to operate [25]. This work is kept limited in scope for simplicity. While various alternatives were considered, this model can serve as an estimation tool. Moreover, it is not confined to evaluating personnel in research institutions; it can also be applied to selecting diverse outcomes relevant to the field of study. The remainder of the paper is structured as follows: the next section provides a brief overview of the problem at hand, followed by a detailed explanation of the VIKOR method, including practical steps, its application, and the final results [26]. The GDM approach considers the perspectives of each participant, aiming to reach a reflective consensus. To address ambiguous, contradictory, and immeasurable criteria, a Multi-Criteria Decision Making (MCDM) method, incorporating VIKOR, was developed. This approach seeks near-optimal solutions based on predefined criteria. By integrating the GDM method with Fuzzy VIKOR, this inclusive technique effectively generates compromise solutions [27]. The proposed method, SMAA-VIKOR, is a combination of SMAA-2 and VIKOR, designed to handle imprecise and uncertain data. One question raised is whether VIKOR can be used to manipulate data. The objective of this study was to explore the application of SMAA-VIKOR. This method has been previously applied in the literature, particularly in the context of medicinal purposes and risk analysis. To demonstrate the method, an inverse logistic case study was selected to evaluate the problem. The findings showed that SMAA-VIKOR is capable of handling uncertain and arbitrarily distributed values for weights and scale measurements [28]. Understanding the water quality conditions of a river system is essential for effective water resource management. In this study, the VIKOR method was applied to assess various criteria. A widely used approach for this type of evaluation is multi-criteria analysis. In the context of the Taipei Water Resources Domain (TWRD), this method was employed to assess the design of the water quality monitoring network. Five key criteria were selected for analysis: non-point source pollution, green cover ratio, land area ratio, over-utilized hilly area ratio, and the density of water quality monitoring stations [29]. This research introduces a novel VIKOR-based approach to address the problem. The proposed method involves evaluating intervals of projects or features and controlling the process to better understand and achieve the desired goals. By identifying significant gaps in materials, it helps decision-makers prioritize areas for improvement. The concept is rooted in compromise solutions, particularly utilizing the VIKOR method. Additionally, the study presents an example of enhancing information security risk management to demonstrate the method's applicability. The results indicate the effectiveness of this new approach [30].

3. ANALYSIS AND DISCUSSION

TABLE 1. Determination of best and worst value of Software package using VIKOR method

	Functional Requirements	Technical Considerations	Cost Analysis	Support & Documentation
Commercial Off-The-Shelf	11	21	10	95
Open Source Solutions	55	31	80	55
Custom Development	77	41	70	45
Software as a Service	66	51	90	35
Potential security risks	99	61	100	85
Best	11	61	100	35
Worst	99	21	10	95

Table 1 provides an assessment of various software packages based on the VIKOR method, which considers a number of factors, such as functional requirements, technical considerations, cost analysis, and support/documentation. The analysis identifies the best and worst values for each category. For example, the “commercial off-the-shelf” solution ranks best with a score of 11 for functional requirements, while “potential security risks” ranks worst based on cost analysis, scoring 99. The VIKOR method facilitates comparison and prioritization of options by providing a clear view of their performance across these important criteria.

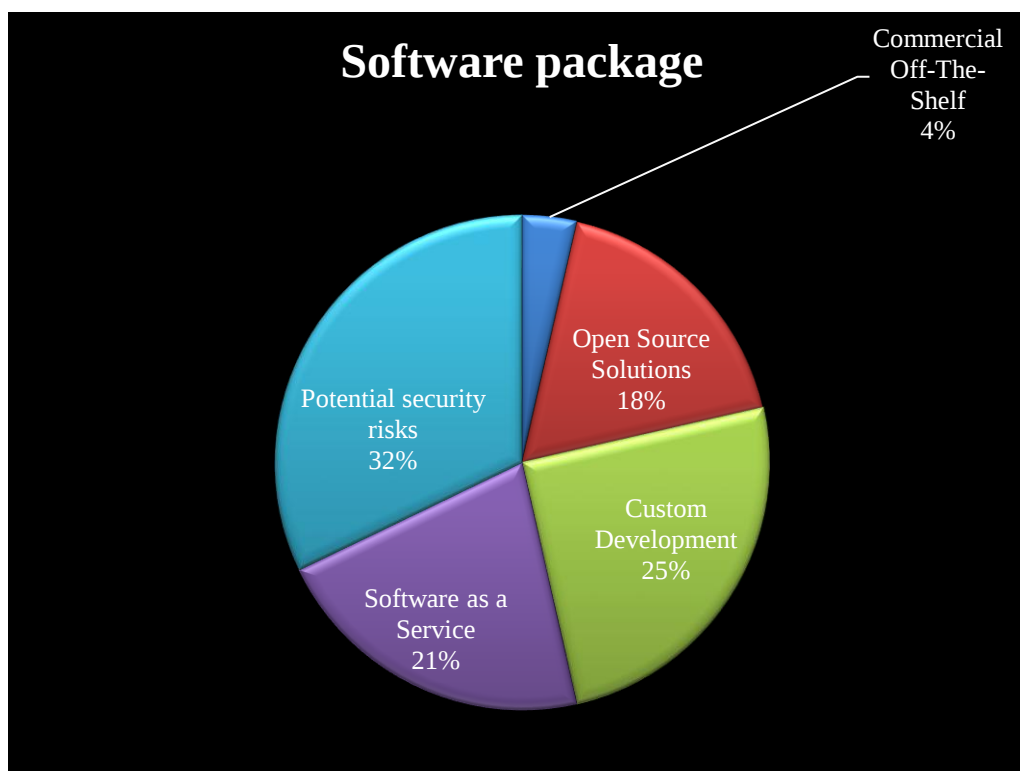


FIGURE 1. Determination of best and worst value of Software package

Figure 1 illustrates the evaluation of polymer composites using the VIKOR method, assessing functional requirements, technical considerations, cost analysis, and support/documentation. The “commercial off-the-shelf” option achieves the best score in functional requirements (11), while the “potential safety risks” option ranks the worst in cost analysis (99), highlighting the varying performance across the criteria.

TABLE 2. Calculation Sj and Rj

	Performance Assessment	Environmental Impact	Cost-Benefit Analysis	Safety and Regulatory Compliance	Sj	Rj
Commercial Off-The-Shelf	0	0.25	0.25	0.25	0.75	0.25
Open Source Solutions	0.125	0.1875	0.055556	0.083333	0.451389	0.1875
Custom Development	0.1875	0.125	0.083333	0.041667	0.4375	0.1875
Software as a Service	0.15625	0.0625	0.027778	0	0.246528	0.15625
Potential security risks	0.25	0	0	0.208333	0.458333	0.25

Table 2 presents the Sj and Rj calculations using the VIKOR method, which evaluates various software options based on performance assessment, environmental impact, cost-benefit analysis, and security/regulatory compliance. The Sj values represent the overall score for each option, with “Commercial Off-The-Shelf” having the highest score of 0.75, while “Software as a Service” has the lowest score of 0.246528. The Rj values “Open Source Solutions” and “Custom Development” both show an Rj value of 0.1875, indicating their close performance. “Potential Security Risks” ranks high in environmental impact, but low in security and compliance.

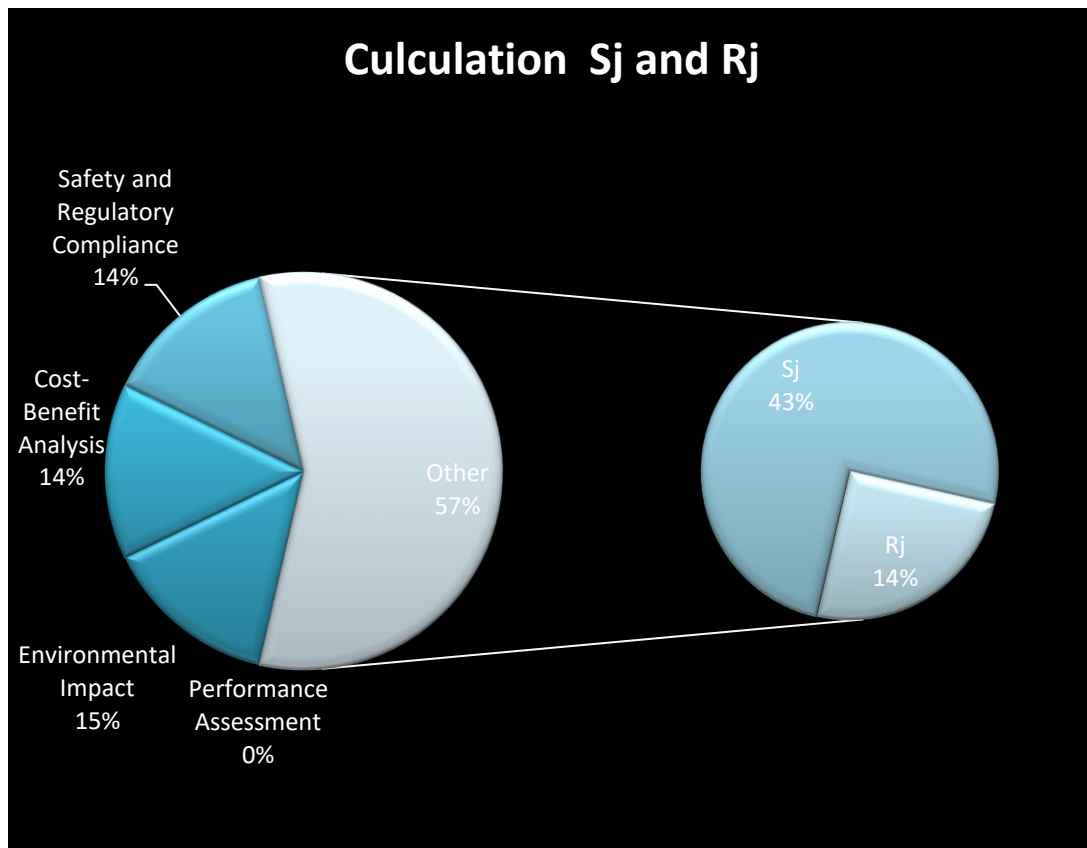
**FIGURE 2.** Calculation Sj, Rj

Figure 2 shows the calculation of Sj and Rj values using the VIKOR method, evaluating software options for performance, environmental impact, cost-benefit analysis, and security/compliance. “Commercial off-the-shelf” has the highest Sj value of 0.75, while “Software as a Service” ranks the lowest. “Open source solutions” and “Custom development” have similar rankings.

TABLE 3. Final Result of Calculation Qj

	Sj	Rj	Qj	Rank
Commercial Off-The-Shelf	1.25	0.75	1	1
Open Source Solutions	0.722222	0.451389	0.391973	3
Custom Development	0.666667	0.4375	0.345393	4
Software as a Service	0.402778	0.246528	0	5
Potential security risks	0.916667	0.458333	0.513624	2

Table 3 presents the final calculation of Qj using the VIKOR method, which determines the ranking of software options based on Sj and Rj values. “Commercial off-the-shelf” ranks highest with a Qj value of 1, indicating the most favorable option. “Potential security risks” is a close second with a Qj value of 0.513624. “Open source solutions” and “custom development” are third and fourth with Qj values of 0.391973 and 0.345393, respectively. “Software as a service” ranks lowest with a Qj value of 0, indicating the least favorable performance.

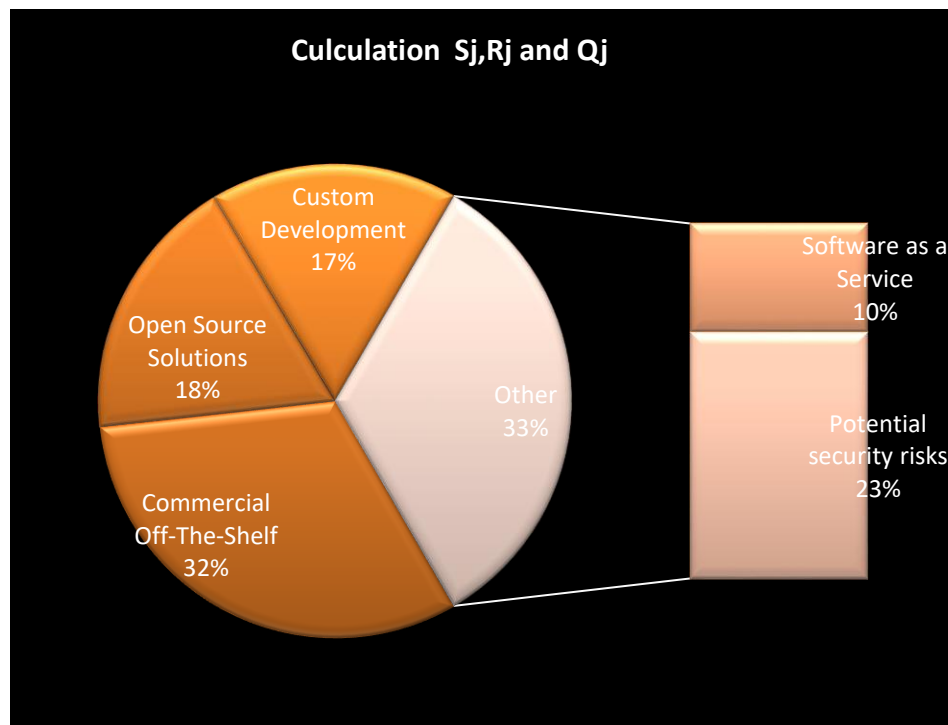
**FIGURE 3.** Calculation Sj, Rj and Qj

Figure 3 shows the final Qj calculations using the VIKOR method, showing the rankings of the software options. “Commercial Off-the-Shelf” ranks first with the highest Qj value of 1, while “Potential Security Risks” ranks second. “Open Source Solutions” and “Custom Development” rank third and fourth, respectively, with “Software as a Service” in last place.

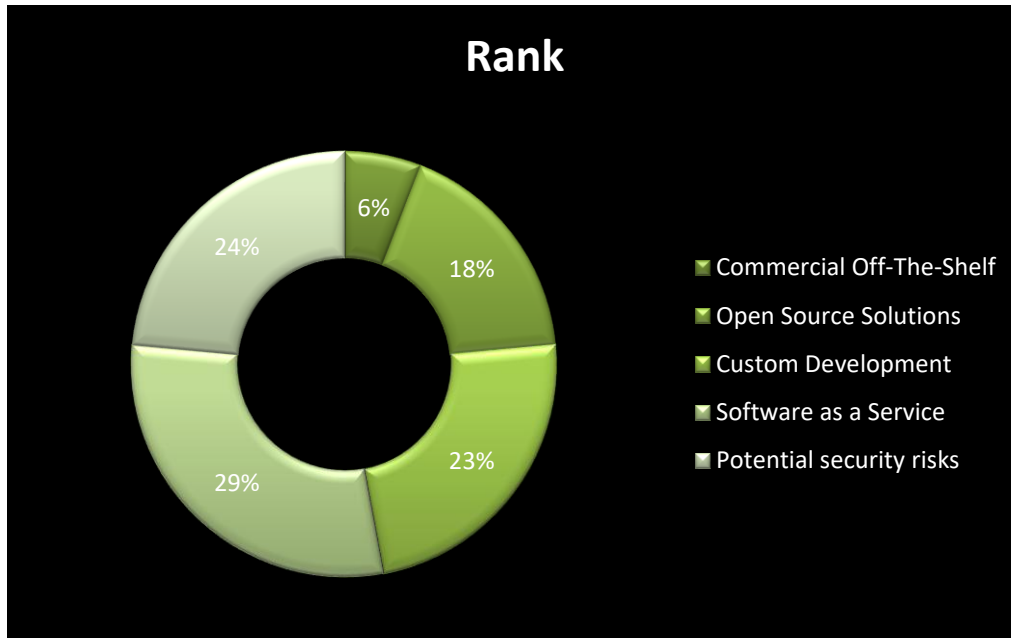


FIGURE 4.Shown the Rank

Figure 4 illustrates the final rankings based on the VIKOR methodology. “Commercial off-the-shelf” ranks first, while “Open Source Solutions” ranks third. “Custom Development” and “Potential Security Risks” both rank fourth, and “Software as a Service” ranks fifth, reflecting the overall performance across the criteria assessed.

4. CONCLUSION

The research demonstrates the effectiveness of the VIKOR method in systematically evaluating and comparing various software package selection approaches. Through a comprehensive multi-criteria decision-making analysis, the study reveals important insights into the strengths and limitations of various software development and acquisition strategies. The analysis highlights that “commercial off-the-shelf” (COTS) solutions emerge as the most favorable option, ranking first with the highest Q_j value of 1. This finding underscores the benefits of pre-developed, standardized software packages that are quickly implemented, reduced development costs, and proven functionality in multiple enterprise environments. However, the research also emphasizes the complexity of software selection, which cannot be reduced to a single metric. Each software approach—commercial off-the-shelf, open source solutions, custom development, software as a service, and those with potential security risks—offers unique characteristics that organizations should carefully consider.

REFERENCES

- [1]. Jadhav, Anil S., and Rajendra M. Sonar. "Evaluating and selecting software packages: A review." *Information and software technology* 51, no. 3 (2009): 555-563.
- [2]. Taylor, Erin L., Preethi M. Kesavan, Abigail E. Wolfe, and Patrick J. O'Brien. "Distinguishing specific and nonspecific complexes of alkyladenine DNA glycosylase." *Biochemistry* 57, no. 30 (2018): 4440-4454.
- [3]. Gonze, Xavier. "A brief introduction to the ABINIT software package." *Zeitschrift für Kristallographie-Crystalline Materials* 220, no. 5-6 (2005): 558-562.
- [4]. Pál, András. "FITSH—a software package for image processing." *Monthly Notices of the Royal Astronomical Society* 421, no. 3 (2012): 1825-1837.
- [5]. Peram, S. R. "Advanced Network Traffic Visualization and Anomaly Detection Using PCA-MDS Integration and Histogram Gradient Boosting Regression." *Journal of Artificial Intelligence and Machine Learning* 1, no. 3 (2023): 281.

- [6]. Chen, Duan, Zhan Chen, Changjun Chen, Weihua Geng, and Guo-Wei Wei. "MIBPB: a software package for electrostatic analysis." *Journal of computational chemistry* 32, no. 4 (2011): 756-770.
- [7]. Cruz, Cosme Damião. "Genes: a software package for analysis in experimental statistics and quantitative genetics." *Acta Scientiarum. Agronomy* 35 (2013): 271-276.
- [8]. Szczypiński, Piotr M., Michał Strzelecki, Andrzej Materka, and Artur Klepaczek. "MaZda—a software package for image texture analysis." *Computer methods and programs in biomedicine* 94, no. 1 (2009): 66-76.
- [9]. Scott, Judy E., and Lisa Kaindl. "Enhancing functionality in an enterprise software package." *Information & management* 37, no. 3 (2000): 111-122.
- [10]. Li, Chunquan, Xia Li, Yingbo Miao, Qianghu Wang, Wei Jiang, Chun Xu, Jing Li et al. "SubpathwayMiner: a software package for flexible identification of pathways." *Nucleic acids research* 37, no. 19 (2009): e131-e131.
- [11]. Stoll, Stefan, and Arthur Schweiger. "EasySpin, a comprehensive software package for spectral simulation and analysis in EPR." *Journal of magnetic resonance* 178, no. 1 (2006): 42-55.
- [12]. Klingenberg, Christian Peter. "MorphoJ: an integrated software package for geometric morphometrics." *Molecular ecology resources* 11, no. 2 (2011): 353-357.
- [13]. Kucab, Jill. "Targeting Akt signaling in breast cancer: expression of phosphorylated Akt in breast tumors and the efficacy of celecoxib analogues as potential inhibitors of Akt activation." PhD diss., University of British Columbia, 2004.
- [14]. Gold, Sherri, Brad Christian, Stephan Arndt, Gene Zeien, Ted Cizadlo, Debra L. Johnson, Michael Flaum, and Nancy C. Andreasen. "Functional MRI statistical software packages: a comparative analysis." *Human brain mapping* 6, no. 2 (1998): 73-84.
- [15]. Peram, S. R. "Automated Label Detection and Recommendation System Using Deep Convolution Neural Networks and SPSS-Based Evaluation." *International Journal of Computer Science and Data Engineering* 1, no. 2 (2024): 258.
- [16]. Kakulavaram, S. R. "Strategic Insights into Healthcare Waste Management through the DEMATEL Approach." *Journal of Business Intelligence and Data Analytics* 1, no. 3 (2024): 255.
- [17]. Thota, Sandeep Kumar, Kumari Gubbala, Ashok Polavarapu, Vikram Narayandas, Hari Suresh Babu Gummadi, Narendra Chennupati, Sreedhar Babu Seshagani, Shivakrishna Deepak Veeravalli, and Manisha Guduri. "Adversarial Training with Attention-Guided DCGAN for Robust Lung Segmentation in Medical Imaging." In *2025 IEEE Region 10 Symposium (TENSYP)*, pp. 1-6. IEEE, 2025.
- [18]. Vidhya Prasanth, M Ramachandran, Ramya sharma, Chinnasami Sivaji, Solving the Conveyor Selection Problems in a Manufacturing Industry with the Grey Relational Analysis (GRA) Technique" *Aeronautical and Aerospace Engineering*, 1(4), December 2023, 32-38.
- [19]. Kanumarlupudi, P. K. "Improving Data Market Implementation Using Gray Relational Analysis in Decentralized Environments." *Journal of Artificial intelligence and Machine Learning* 2, no. 1 (2024): 1-7.
- [20]. Wang, Junmei, Wei Wang, Peter A. Kollman, and David A. Case. "Antechamber: an accessory software package for molecular mechanical calculations." *J. Am. Chem. Soc* 222, no. 1 (2001): 2001.
- [21]. Decan, Alexandre, Tom Mens, and Philippe Grosjean. "An empirical comparison of dependency network evolution in seven software packaging ecosystems." *Empirical Software Engineering* 24, no. 1 (2019): 381-416.
- [22]. Jahan, Ali, Faizal Mustapha, Md Yusof Ismail, S. M. Sapuan, and Marjan Bahraminasab. "A comprehensive VIKOR method for material selection." *Materials & Design* 32, no. 3 (2011): 1215-1221.
- [23]. Chatterjee, Prasenjit, and Shankar Chakraborty. "A comparative analysis of VIKOR method and its variants." *Decision Science Letters* 5, no. 4 (2016): 469-486.
- [24]. Kakulavaram, S. R. "Performance Measurement of Test Management Roles in 'A' Group through the TOPSIS Strategy." *International Journal of Artificial intelligence and Machine Learning* 1, no. 3 (2023): 276.
- [25]. San Cristóbal, José Ramón. "Multi-criteria decision-making in the selection of a renewable energy project in Spain: The VIKOR method." *Renewable energy* 36, no. 2 (2011): 498-502.
- [26]. Tong, Lee-Ing, Chi-Chan Chen, and Chung-Ho Wang. "Optimization of multi-response processes using the VIKOR method." *The International Journal of Advanced Manufacturing Technology* 31 (2007): 1049-1057.
- [27]. Kumar, Manish, and Cherian Samuel. "Selection of best renewable energy source by using VIKOR method." *Technology and Economics of Smart Grids and Sustainable Energy* 2 (2017): 1-10.
- [28]. Anvari, Alireza, Norzima Zulkifli, and Omid Arghish. "Application of a modified VIKOR method for decision-making problems in lean tool selection." *The international journal of advanced manufacturing technology* 71 (2014): 829-841.
- [29]. Park, Jin Han, Hyun Ju Cho, and Young Chel Kwun. "Extension of the VIKOR method for group decision making with interval-valued intuitionistic fuzzy information." *Fuzzy Optimization and Decision Making* 10 (2011): 233-253.
- [30]. Chang, Chia-Ling, and Chung-Hsin Hsu. "Multi-criteria analysis via the VIKOR method for prioritizing land-use restraint strategies in the Tseng-Wen reservoir watershed." *Journal of Environmental Management* 90, no. 11 (2009): 3226-3230.
- [31]. Vimala Saravanan, M. Ramachandran, Ramya sharma, Chinnasami Sivaji, "An Assessment of material selection Problem for piston in Automotive Engines Using the weighted sum model (WSM)", *Journal on Materials and its Characterization* 2(4), December 2023, 29-35.

- [32].Kakulavaram, S. R. "Strategic Insights into Healthcare Waste Management through the DEMATEL Approach." *Journal of Business Intelligence and Data Analytics* 1, no. 3 (2024): 255.
- [33].Nayeemuddina Umme Salma, Green Fabrication of Nio Nano Particles Doped PS-PVDF Nanocomposite Films: Structural, Morphology and Electrical Studies, *Journal of Information Systems Engineering and Management*, 10(23), 2025, 794-800.
- [34].Kakulavaram, Sridhar Reddy, Praveen Kumar Kanumarlupudi, and Sudhakara Reddy Peram. "Performance Metrics and Defect Rate Prediction Using Gaussian Process Regression and Multilayer Perceptron." *Information Technology and Management* 15, no. 1 (2024): 37-53.
- [35].Vahabzadeh, Ali Haji, Arash Asiaei, and Suhaiza Zailani. "Green decision-making model in reverse logistics using FUZZY-VIKOR method." *Resources, Conservation and Recycling* 103 (2015): 125-138.
- [36].Gangil, Manish, and M. K. Pradhan. "Optimization the machining parameters by using VIKOR Method during EDM process of Titanium alloy." *Materials Today: Proceedings* 5, no. 2 (2018): 7486-7495.
- [37].Radhika, Sajda, D. Sameer Kumar, and D. Swapna. "VIKOR method for multi criteria decision making in academic staff selection." *Journal of Production research and Management* 3, no. 2 (2013): 30-35.
- [38].Lee, G., K. S. Jun, and E-S. Chung. "Group decision-making approach for flood vulnerability identification using the fuzzy VIKOR method." *Natural Hazards and Earth System Sciences* 15, no. 4 (2015): 863-874.
- [39].Aydogan, Emel Kizilkaya, and Mihrimah Ozmen. "The stochastic vikor method and its use in reverse logistic option selection problem." *RAIRO-Operations Research-Recherche Opérationnelle* 51, no. 2 (2017): 375-389.
- [40].Chang, C-L., and Y-T. Lin. "Using the VIKOR method to evaluate the design of a water quality monitoring network in a watershed." *International Journal of Environmental Science and Technology* 11 (2014): 303-310.
- [41].Ou Yang, Yu-Ping, How-Ming Shieh, Jun-Der Leu, and Gwo-Hshiung Tzeng. "A VIKOR-based multiple criteria decision method for improving information security risk." *International Journal of Information Technology & Decision Making* 8, no. 02 (2009): 267-287.
- [42].Abhinav, E. Meher, Sai Naveen Kavuri, Thota Sandeep Kumar, Maragani Thirupathi, M. Chandra Mohan, and A. Suresh Reddy. "Analysis of molecular single-electron transistors using silicene, graphene and germanene." In *Proceedings of the Second International Conference on Computer and Communication Technologies: IC3T 2015, Volume 1*, pp. 77-84. New Delhi: Springer India, 2015.
- [43].Nayeemuddin, . and Salma, Umme, Analysis of a Drilling Hybrid Aluminum Metal Matrix Composites by Using SPSS (May 7, 2023). *Int. J. Adv. Res.* 11(01), 82-91, 2023, Available at SSRN: <https://ssrn.com/abstract=4440349>
- [44]. Kanumarlupudi, Praveen Kumar, and S. Ballamudi. "Enhancing Generative AI Shopping Assistants through Advanced Multi-Attribute Decision Making Technique." *Journal of Artificial Intelligence and Machine Learning* 3, no. 2 (2025): 1-7.