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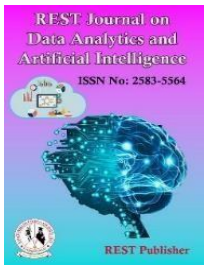

Leveraging Cloud Technology for Enhanced Decision-Making Using the Weighted Product Model

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Abstract: *Big data security is an essential aspect of modern information systems, ensuring the protection of sensitive data while maintaining system functionality and user trust. This study leverages the Weighted Product Model (WPM) to evaluate various approaches to big data security, drawing parallels to the performance evaluation of alternative solutions in critical systems like helicopters. By analyzing key parameters such as autonomy, versatility, availability, and price, the research highlights the challenges and opportunities in designing robust security frameworks that balance performance and cost-effectiveness. Research Significance: Big data security is pivotal for safeguarding sensitive information in industries such as healthcare, finance, and defense. The growing reliance on cloud computing and IoT has amplified vulnerabilities, making it critical to develop frameworks that address data privacy, integrity, and secure access. This study underscores the significance of evaluating and comparing alternative approaches to improve the dependability and scalability of large-scale data systems while guaranteeing compliance with security standards. Methodology: WPM: The Weighted Product Model is employed to assess and order options according to pre-established criteria. This multi-criterion decision-making methodology allows for a comprehensive assessment of each alternative's performance across autonomy, versatility, availability, and price. Each criterion is weighted equally to ensure an unbiased comparison, and the alternatives are scored based on their relative performance to determine the most suitable option. Alternative: Airbus EC 135: A compact, twin-engine solution with excellent maneuverability and moderate cost-effectiveness. Bell 206 (Long Ranger): A highly versatile and reliable single-engine model, widely used for various operations. Leonardo AW 139: A medium-sized, twin-engine option known for its range and advanced features, suitable for specialized missions. Robinson 44: A cost-effective, light helicopter popular for training and private use, offering high availability. Sikorsky UH-60 (Black Hawk): A durable, multi-role military helicopter with superior autonomy and protection but higher costs. Evaluation Parameter: Autonomy (minutes): The duration the system or solution can operate without interruption. Versatility: The ability to adapt to various use cases and operational environments. Availability: Readiness and ease of deployment in critical scenarios. Price (US$): The cost-effectiveness, including acquisition and maintenance expenses. Result: The Bell 206 Long Ranger emerged as the top performer, excelling in versatility, availability, and overall cost-effectiveness, making it the preferred option for diverse applications. The Robinson 44 ranked second, favored for its affordability and high availability. The Airbus EC 135 secured the third position, striking a balance between cost and performance for specific roles. The Sikorsky UH-60 Black Hawk, with its superior autonomy, ranked fourth but was limited by high costs and specialization. The Leonardo AW 139, while advanced, ranked fifth due to its high price and limited flexibility. This analysis showcases the importance of balancing performance and cost in selecting security solutions for big data systems.*

Keywords: *Big Data Security, Weighted Product Model (WPM), Autonomy, Versatility, Availability, Cost-Effectiveness, Cloud Security, Data Protection, MCDM.*

1. INTRODUCTION

It is crucial to examine the evolving characteristics and dimensions of big data as they adapt to recent technological advancements. These dynamic changes introduce factors that impact the privacy and security of big data, leading to emerging challenges that demand comprehensive investigation. Addressing the growing threats and vulnerabilities associated with big data requires identifying and mitigating these issues effectively. Enhancing big data security involves analyzing the closeness of patterns to forecast dangers using similarity metrics that gauge the distances between anomalous and normal datasets, using data from historical incidents, social media, and server/network logs. Four technologies were reviewed, along with their tailored adaptations to tackle security challenges across the big data lifecycle. This paper highlights several challenges, unresolved issues, and potential technology-driven strategies to address them, paving the approach for forthcoming studies in this crucial domain of big data security. [2] The increasing occurrence of big data security issues and the rising number of incidents worldwide underscore the urgent need for robust

security measures. This paper examines the current state proposes strategies for modernizing governance systems. A comprehensive Additionally, this effort must be supported by the implementation of management systems, such as assessment agencies and personnel certification programs that are external to the organization. Given the high technical and practical demands of data security, professionals in this field must not only possess advanced technical skills but also have a deep understanding of industry operations, processes, and equipment across various domains.[3] Protecting personal and sensitive information has been a focal point of numerous studies, identifying it as a primary security objective. Privacy, as a specific aspect of confidentiality, incorporates additional considerations such as managing user consent for personal data, adherence to legal and regulatory requirements, and more. This section highlights the threats and risks affecting data security throughout the Big Data lifecycle, followed by an overview of the key challenges faced by security systems. Data deduplication plays a critical role in freeing up storage space and reducing network bandwidth by eliminating redundant data, ensuring consistency. Encryption, on the other hand, safeguards data against unauthorized access. However, as noted in, traditional encryption methods are not compatible with deduplication. These methods require users to encrypt data with unique keys, resulting in different ciphertexts for identical data from different users, thereby rendering deduplication infeasible.[5] Whereas safeguarding information has always been a fundamental human concern, even in the era of paper-based records, the socio-economic landscape has evolved significantly. The rise of digitalization, the modern knowledge-driven economy, and rapid technological advancements have amplified the risks of security breaches, privacy violations, and data leaks. Additionally, cloud service providers often fail to meet the stringent protection levels required for ensuring robust Protection of privacy and security in Big Data. These considerations regarding security and privacy must therefore be given priority when adopting cloud computing services. [6] From a security and privacy perspective, big data security should be examined from multiple angles. This includes safeguarding the data itself, securing the processes involved in big data operations, and protecting the outputs generated from these processes. emphasize that big data security encompasses three key aspects: data security, access control, and information security. Additionally, propose a big data security model that considers the user's role in ensuring security across various phases of the big data lifecycle. However, many previous studies on big data security have yet to comprehensively address these dimensions. [7] Existing standards for the security requirements for big data security are primarily outlined, yet detailed descriptions of the associated security techniques are lacking. Furthermore, rules such as GDPR and CCPA are specific to certain regions and do not apply universally to global organizations and researchers working with large datasets. Every stage of the big data lifecycle comes with distinct challenges regarding security and reliability, among which safeguarding personally identifiable information is of particular importance given its increasing relevance in the market economy. In this section, de facto standards regarding big data are discussed; nonetheless, these standards fall short in adequately addressing security concerns related to big data. The published standards often rely on outdated technologies and lack comprehensive descriptions of current methods [8] The study identified key big data security requirements within a smart grid environment, including privacy, integrity, authentication, and third-party protection. They also reviewed various solutions discussed in related research and highlighted. For each challenge, they outlined major topics of interest to researchers, such as authentication, access control, anonymization, legal frameworks, and cryptography. While they acknowledged the big data lifecycle, their discussion lacked clarity and depth. Their analysis focused on specific domains like smart grids and IoT, and although they addressed big data security, their explanation was not comprehensive, particularly regarding privacy issues. To assess the gaps, we compared Despite the critical importance fail to provide detailed requirements or technologies to address these issues effectively. [8] Big data research spans various domains, including applications, infrastructure, and security, privacy, and trust. The most extensive body of literature falls under the category of big data overviews, where researchers explore general insights into big data, its challenges, frameworks, techniques, technologies, and future directions. Proactively incorporating security and privacy considerations into system development can significantly benefit organizations, particularly in mitigating privacy violations. It is crucial to avoid treating the safeguarding and privacy of big data being considered only later on. Organizations must recognize the critical importance of securing big data and ensure that these requirements are addressed. [9] A set of encrypted tickets is generated using a hash value that facilitate communication among these nodes. The Kerberos management policy can also be utilized for managing big data security, offering multi-tiered protection for communications, transmissions, authorization, and storage. The evaluation results underscore the practicality and effectiveness of the proposed integrated methodology for protecting confidential files during transmission between different cloud nodes. Kerberos was developed specifically for data authentication, secure transport communication, and data encryption. The approach to the receiver’s name node, as part of this process, creates a temporary session key, generates a random hash value, and produces a set of tickets encrypted with the session key for communication with the sender data nodes. The system calculates a double hash value and sends the encrypted tickets back to the sender’s name node, ensuring secure data transmission.[10] New methods and programs have been developed and implemented, with a strong emphasis on infrastructure to manage and safeguard the large quantities of data in an effective manner. Concerning the safety of big data, it is crucial to tackle the most critical security challenges. [12] Ensuring a major challenge. A variety of challenges have arisen in the realm of Big Data security, including infrastructure security, data privacy, data management, and data integrity. At present, the processing, analysis, and storage of Big Data is safeguarded with cryptographic algorithms. However, these are unsuitable for protecting Big Data in the Cloud. This is a block cipher algorithm that includes several functions: rotation key function, alternate key block

cipher, mixing key function, and a minimum of three iterations of the round function. In comparison with AES, 3D-AES has yielded superior outcomes regarding complexity, security, and performance.[13] big data security analysis in multihoming, particularly when using automated methodologies and systems, receives little attention. These days, the massive amounts of information being handled and observed in multihoming systems are given less thought, reducing the security risk and effectiveness of data processing and observation. The application of AI-based frameworks in multihoming massive information with IoT associated with AI frameworks could be beneficial in a variety of ways. A fundamental data placement strategy is used in the conventional processing datasets approach to offer resulting data blocks and exchange replicas of those blocks inside the cluster. As a result, the cluster analyses and exchanges datasets using default setups, protocols, and datasets with uniform network properties.[14] clarify the functional departments and responsibilities involved in big data security management, perform regular maintenance, and carry out thorough security inspections. Furthermore, existing studies on urban greenway design are not backed by systematic empirical analyses. Given that the criteria for "visual perception" in practical planning and management differ greatly, it is essential to improve the existing distinction standards. information can include both traditional and dynamic data. Finally, the data undergoes scenario assumptions and modeling after scientific analysis. We utilized different analysis results in real operations, which culminated in the final inspection. This in fact involves stepping back from the actual work, summarizing our experience, and again beginning from the viewpoint of specific practice.[15]

2. MATERIALS AND METHOD

Alternative Values: Airbus EC 135: The Airbus EC 135 is a light, twin-engine helicopter, known for its compact size and advanced technology. It is often utilized for emergency medical services (EMS), law enforcement, and corporate transportation. The European Commission 135 stands out for its excellent maneuverability in urban environments, ease of handling, and its ability to perform in a variety of mission types, including rescue and surveillance. Its relatively low operational cost for a twin-engine helicopter makes it a popular choice for both public and private use. Bell 206 (Long Ranger): It's widely used for aerial work, light transport, search and rescue, and tourism. The Long Ranger version offers increased passenger capacity and extended range compared to its predecessors, making it ideal for regional travel and utility missions. Its reliability, simplicity, and lower acquisition cost make it a favorite for smaller operations and flight schools. Leonardo AW 139: The Leonardo AW 139 is a medium-sized, twin-engine helicopter that excels in versatility, performance, and range. It is often used in demanding offshore transport, search and rescue (SAR), VIP transport, and military operations. The AW 139 combines advanced avionics, powerful engines, and large cabin space, making it ideal especially where reliability and safety are crucial. It is designed for both civilian and military missions, offering top-notch protection and long-range capabilities. Robinson 44: The Robinson 44 is a light, single-engine helicopter that is particularly popular for flight training, private use, and aerial photography. It is known for its simplicity, ease of handling, and lower cost compared to larger models. The R44 is often used by private owners and smaller flight schools due to its affordable acquisition and operating costs. While it lacks the power and range of larger helicopters, it remains a highly functional and accessible option for light transport and training. Sikorsky UH-60 (Black Hawk): Army and many other military forces worldwide. Known for its durability, the Black Hawk is designed to perform troop transport, search and rescue, medical evacuation (medevac), and logistics missions in harsh conditions. The Black Hawk's capability to carry heavy loads, withstand combat scenarios, and operate in challenging environments makes it an indispensable tool for military operations. It is equipped with advanced protection systems, making it well-suited for combat zones.

Evalution parameter: Autonomy (minutes): Autonomy refers to the amount of time a helicopter can stay in the air before it needs to refuel, measured in minutes. This factor is essential for determining how long a helicopter can operate without interruption. A higher autonomy means the helicopter can cover longer distances or perform extended missions without requiring frequent refueling. Conversely, limited autonomy could restrict the range and duration of operations, making refueling more frequent and potentially causing delays. Versatility: Versatility describes the helicopter's ability to perform a variety of tasks or adapt to different mission types. A versatile helicopter can be used for multiple purposes, such as transport, rescue missions, military operations, or corporate use. This makes it more cost-effective and useful across different scenarios. On the other hand, a less versatile helicopter might be specialized for one task only, requiring multiple different helicopters to cover a range of operations, leading to inefficiencies. Availability: Availability refers to how easily and quickly a helicopter can be deployed when needed. It considers how ready the helicopter is to take off, including factors like maintenance schedules, repair times, and parts availability. A helicopter with high availability is ready to go at short notice, which is crucial for urgent missions like emergency medical services (EMS) or military operations. Low availability, on the other hand, can cause delays and limit the helicopter's effectiveness, especially in time-sensitive scenarios. Price (US$): Price refers to the initial cost of purchasing the helicopter, as well as its operating and maintenance costs. The price is an important factor in determining whether an organization or individual can afford a helicopter. While a lower price can make a helicopter more accessible, it may come with limitations in terms of performance, capacity, or durability. A higher price typically reflects better performance, more advanced features, and greater reliability, but it can be a significant financial investment, both in terms of the initial cost and ongoing expenses.

WPM method: Qualitative characteristics are first transformed into fuzzy numbers and subsequently into clear ratings. The weights of various attributes in respect to the goal are established in the second stage by applying the AHP technique. In the third step, MADM techniques such as SAW and WPM are used in the study, resulting in the conclusion that it is essential to objectively evaluate workers' competence levels and move away from the currently used subjective methods. This article demonstrates the application of three MCDM methods to evaluate workforce skill levels and optimize operator selection for particular tasks. The WPM can be applied in both single and multi-dimensional MCDM scenarios. One advantage of this method is its ability to use relative values rather than actual ones. The WPM and PROMETHEE techniques can account for the relationships between parameters as well as mining techniques. The proposed techniques offer greater accuracy and faster computation compared to other decision-making methods. approaches. In this study, the decision matrix from Reza Mikaeil et al. was initially used. Using this matrix, calculations for each method were carried out. The second section of the study was the result of this procedure's low external validity despite its high internal validity. An extra session with a phrase set of capital letters, numbers, and punctuation symbols was part of the second phase. Each of the eight experts was required to produce a pairwise comparison matrix of criteria by comparing the criteria with one another. Consequently, eight matrices were completed. From a WPM medium, eight distinct WPM media were created, each with a different mix of ingredients tested for meristem regeneration. This suggests that, in comparison to conventional techniques, the suggested strategy can send packets faster and with less latency while using less energy. The CHs perform better in every situation, and the scales have been evaluated for both individual and aggregate features. The use of the generic decision support methodology is described in the third part. The criteria are thoroughly reviewed and suggestions for additional study are made in the concluding section. Faster speed changes were preferred by participants, who proposed a trade-off in the degree of autonomous control to let users select the ideal duration. It's crucial to remember the speed curve kept rising quickly after the 10 sessions, indicating that speed had significantly improved even after two and a half hours of exercise. The key distinction between the two approaches is that one relies on addition as the primary mathematical operation, while the other uses multiplication. This approach is a straightforward equal-weight combination technique (SAW). The MCDM e-book has more thorough details on this approach. Let's say that a particular MCDA problem has m alternatives and n criteria. The weighted product approach is being discussed here. During the continuous emulsification process, the WPM temperature is constant. However, fat droplets appeared to be linked by WPM in warm emulsions because of the quick gelation of emulsions. On the other hand, due of the low thermal balance of the emulsion and the permitted restoration of surplus whey protein concentrates, caseins interact with lipid droplets. A wooden building, such as a house, must have great stability, meaning that even in cases where the soil is unstable or prone to freezing in the winter, the foundation must reach a stable surface below. Alternative values ATM A machine for cash withdrawals, balance inquiries, and basic banking transactions. WPM the characteristics of multicarrier modulated signal are directly dependent on usage of set of waveforms. In multicarrier systems the subcarriers overlap in frequency and time field. If the transceivers are perfectly synchronized then the subcarriers are mutually orthogonal and therefore, they do not interfere with each other. Further addition in research work includes more realistic models of WPM-based transceivers. Also, maximum likelihood decoding for wavelet modulation has been addressed by authors. Simulations for flat fading and multipath channels had been performed for a receiver using a channel impulse response estimator. wavelets within the WPM system and compared with the OFDM system. All the above wavelets used in the WPM system give more or less same nature of plots in comparison with OFDM system. Different wavelets like Daubencies, Haar and Symlet are used in WPM system and their BER performance also gives better result as compared to BER performance OFDM system. The results of MCDM methods that use different normalization techniques are also compared to the WPM that do not need to implement any dimensionless method. Thus, the sensibility of the applied MCDM methods for selecting the top alternatives can be observed relative to the method that does not require normalization technique. Finally, all the provided rank for alternatives is compared together with measuring the correlation coefficient between the ranks. The rankings are the results of applying four methods of normalization. Vector normalization resulted in the most similar ranking with WPM among the other methods of normalization. the results are compared with the method of WPM, which do not require normalization techniques. Another comparison of normalization techniques is performed using the correlation measurements between the specified ranks and scores the methods of MCDM. the selected alternative has consistency for all the methods of MCDM which use the linear ratio-based and linear max-min normalization techniques, though the ranking for alternatives results in slight differences. A similar ranking of alternatives is observed when data are normalized by the vector method.

3. RESULTS AND DISCUSSION

TABLE 1. Data Set

	Autonomy (minutes)	Versatility	Availability	Price (US$)
Airbus EC 135	51.08	25.00	72.00	36.00
Bell 206 (Long Ranger)	49.12	65.00	95.00	48.00
Leonardo AW 139	44.08	48.00	67.00	59.00
Robinson 44	33.17	59.00	90.00	39.00
Sikorsky UH-60 (Black Hawk)	53.33	37.00	86.00	70.00

The Airbus EC 135 offers solid autonomy (51.08 minutes) and availability (72.00), making it well-suited for missions that require moderate flight times and rapid deployment. However, it has a lower versatility (25.00) compared to other models, limiting its use to specific roles such as emergency medical services (EMS) and law enforcement. The price (36.00) is moderate, reflecting its performance and value for specific missions. The Bell 206 Long Ranger has a similar autonomy (49.12 minutes) to the EC 135, but stands out with its high versatility (65.00). It can perform a wide range of tasks, from transport to aerial work. It also boasts the highest availability (95.00) in this group, ensuring it is ready to deploy on short notice. The price (48.00) is higher than the EC 135, but the versatility and availability justify the investment. The Leonardo AW 139, while offering the shortest autonomy (44.08 minutes) of the models on this list, excels in versatility (48.00). It is suitable for roles such as maritime transport and VIP missions. Although it is not as easy to use as the Bell 206 or EC 135, it has good availability (67.00), its price (59.00) is high, which reflects its excellent performance and adaptability to complex operations. The Robinson 44 has a short autonomy (33.17 minutes), limiting it to short missions. Despite this, it has relatively high versatility (59.00) and is generally used for training and private transport. Its availability (90.00) is high, making it suitable for frequent use in small operations. At 39.00, it is one of the most affordable options, making it accessible for personal and educational purposes. The Sikorsky UH-60 Black Hawk has a very long autonomy (53.33 minutes), making it ideal for extended operations such as military transport or search and rescue. However, its versatility (37.00) is what makes it so special, given its primary military use. Despite this, it offers good availability (86.00), although it is not as easily accessible as civilian models. The price (70.00) is very high, reflecting its military-grade capabilities and advanced technology.

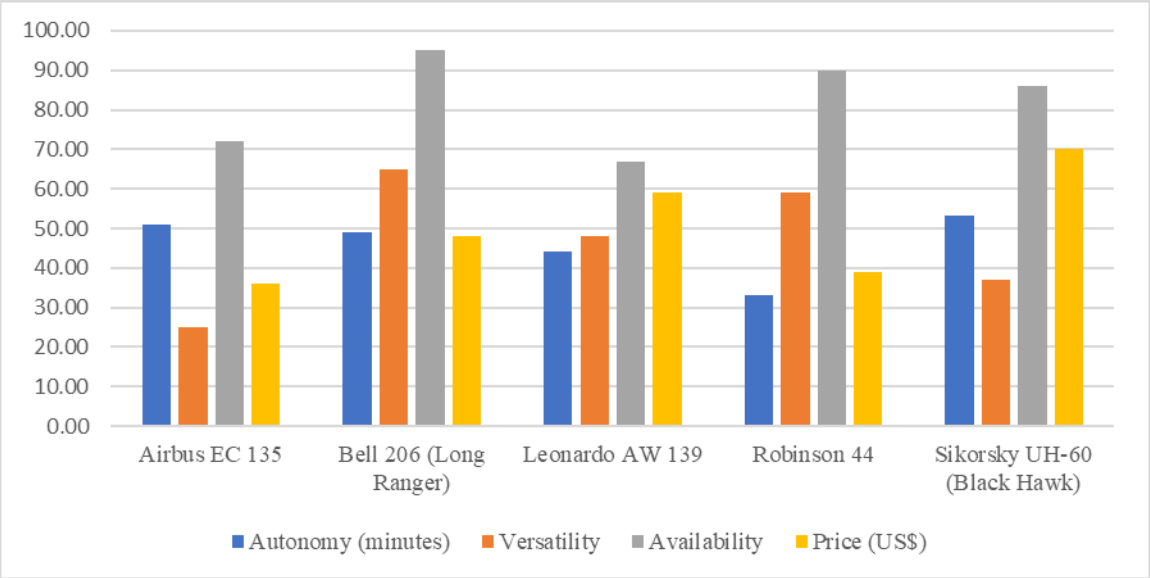

FIGURE 1. Data Set

The chart provides a detailed comparison of five helicopter models across four key performance parameters. Of the models analyzed, the Bell 206 (Long Ranger) shows the best availability at approximately 95%, while maintaining competitive autonomy of approximately 50 minutes. The Sikorsky UH-60 (Black Hawk) shows a balanced performance profile with a significantly higher price point, reflecting its military-grade capabilities. The Leonardo AW 139 demonstrates consistent performance across all metrics, with particularly strong availability and a price-performance ratio. In terms of autonomy, all models maintain flight times between 30 and 55 minutes, with the Sikorsky UH-60 and Airbus EC 135 leading the category. Versatility scores vary significantly, with the Bell 206 and Robinson 44 showing greater adaptability compared to the others in the group. The Robinson 44, while having lower autonomy ratings, compensates with excellent availability and a moderate price, making it an attractive option for civilian operations. The Airbus EC 135 offers an interesting profile with moderate autonomy, but with lower versatility scores, it maintains good availability. This comparative analysis reveals that each helicopter model has its own unique strengths, suggesting that the choice should be made based on specific operational requirements and budget constraints. Price points vary significantly among the models, with some aircraft commanding premium prices, likely due to their advanced capabilities and target market positioning. This comprehensive comparison acts as a useful resource for operators and decision-makers in choosing the most appropriate helicopter model tailored to their particular commercial needs, emergency services or personal use. The data clearly illustrates the trade-offs between performance metrics and cost considerations across different helicopter platforms.

TABLE 2. Performance value

	Performance value			
Airbus EC 135	0.95781	0.38462	0.75789	1.00000
Bell 206 (Long Ranger)	0.92106	1.00000	1.00000	0.75000
Leonardo AW 139	0.82655	0.73846	0.70526	0.61017
Robinson 44	0.62198	0.90769	0.94737	0.92308
Sikorsky UH-60 (Black Hawk)	1.00000	0.56923	0.90526	0.51429

The Airbus EC 135 stands out with a high-performance value of 1.00000 for one criterion, which indicates excellence in availability or another important factor, depending on the accuracy of the scores. Its performance in the other criteria (0.95781, 0.38462, and 0.75789) reflects a balanced but slightly less impressive performance compared to other helicopters, especially in versatility (0.38462). The EC 135 performs well in missions requiring high availability, but its low versatility and specific use case limit its effectiveness in a wide range of roles. The Bell 206 Long Ranger achieves 1.00000 for both versatility and availability, indicating its excellent ability to handle a variety of missions. It is readily available for deployment. The with a performance value for autonomy of 0.92106 and a price of 0.75000, there is strong autonomy along with cost-effectiveness, but it lags behind the others in price-performance ratio. The Bell 206 is a very versatile helicopter, suitable for a variety of missions. The Leonardo AW 139 has solid for autonomy, indicating a slightly higher cost but stronger performance on longer, more specialized missions. It is less versatile than the Bell 206, as shown by its versatility score of 0.73846, but performs better on maritime, SAR and other complex missions. Its price reflects its lower performance in terms of overall performance value, which is likely due to higher acquisition and operating costs. The Robinson 44 performs well in terms of price (0.92308), showing that it is an affordable option at a good price. Overall performance at a relatively low cost. It also scores high for versatility (0.90769) and availability (0.94737), making it a good choice for training and personal use, despite its lower autonomy (0.62198) compared to the others. Its performance shows that it is a well-rounded, budget-friendly option for less demanding missions or small-scale operations. The Sikorsky UH-60 (Black Hawk) has a maximum performance score of 1.00000 for autonomy, indicating that it excels in long-range missions or extended operations. However, its versatility (0.56923) is low compared to the others, which is consistent with its primary military focus. It also has a low price-performance value (0.51429), although it is an advanced and highly capable helicopter, its high price limits its performance value to affordability.

TABLE 3. Weight

	Weight			
Airbus EC 135	0.25	0.25	0.25	0.25
Bell 206 (Long Ranger)	0.25	0.25	0.25	0.25
Leonardo AW 139	0.25	0.25	0.25	0.25
Robinson 44	0.25	0.25	0.25	0.25
Sikorsky UH-60 (Black Hawk)	0.25	0.25	0.25	0.25

Table 3 presents Equal weighting (0.25 per criterion) suggests a balanced evaluation approach where all features are considered equally important. This method is appropriate when there is no strong preference or preference for any particular criterion, ensuring a fair and unbiased comparison between helicopters. Airbus EC 135: With equal weights, its performance on all criteria contributes equally to its overall rating. It may perform better in availability, but its versatility will need improvement to compete. Bell 206 (Long Ranger): Equal weights take advantage of its strengths in versatility and availability, where it excels, making it a strong contender in this evaluation method. Leonardo AW 139: Equal weight highlights its balanced performance, but its high cost may affect its overall score despite its versatility and specialized use. Robinson 44: This model benefits from equal weighting as its price and availability are strong, although its limited autonomy may reduce its overall score. Sikorsky UH-60 (Black Hawk): Equal weight can dilute the importance of its unique feature, autonomy, as its weaker areas, such as price, will carry more weight in the final evaluation.

TABLE 4. Weighted normalized decision matrix

	Weighted normalized decision matrix			
Airbus EC 135	0.98928	0.78751	0.93304	1.00000
Bell 206 (Long Ranger)	0.97965	1.00000	1.00000	0.93060
Leonardo AW 139	0.95349	0.92700	0.91641	0.88382
Robinson 44	0.88806	0.97608	0.98657	0.98019
Sikorsky UH-60 (Black Hawk)	1.00000	0.86860	0.97542	0.84684

Airbus EC 135 Strengths: High scores in autonomy (0.98928) and price (1.00000), indicating excellent flight time and cost efficiency compared to its features. Weaknesses: Low score in versatility (0.78751) indicating limited adaptability to diverse missions compared to other helicopters. Bell 206 Long Ranger Strengths: Perfect scores in versatility (1.00000) and availability (1.00000), indicating that it is highly adaptable and always ready for use. Weaknesses: Slightly low score in price (0.93060) indicating that it is not the most cost-effective model, but still competitive. Leonardo AW 139 Strengths: Strong performance in all criteria, especially versatility (0.92700) and autonomy (0.95349), making it suitable for specialized missions. Weaknesses: Low scores for availability (0.91641) and price (0.88382) suggest that it is less user-friendly and more expensive than others. Robinson 44 Strengths: Excellent scores for price (0.98019) and availability (0.98657), reflecting its affordability and readiness for use. Weaknesses: Very low score for autonomy (0.88806) limits its ability to perform long-range missions, although it is versatile (0.97608). Sikorsky UH-60 Black Hawk Strengths: Perfect score for autonomy (1.00000) makes it a great choice for long-range and extended missions. Also strong in availability (0.97542). Weaknesses: Low scores for price (0.84684) and versatility (0.86860) reflect its high cost and limited adaptability outside of military roles.

TABLE 5. Preference Score

	Preference Score
Airbus EC 135	0.72691
Bell 206 (Long Ranger)	0.91167
Leonardo AW 139	0.71590
Robinson 44	0.83824
Sikorsky UH-60 (Black Hawk)	0.71749

Airbus EC 135 Priority Score: 0.72691 The EC 135 receives a moderate priority score, reflecting its balanced performance. It excels in availability and price, making it a strong choice for missions that require cost efficiency and rapid deployment. However, its low versatility limits its appeal for a wide variety of missions. Bell 206 Long Ranger Priority Score: 0.91167 The Bell 206 stands out among the models with a high priority score. Its excellent versatility, availability and solid autonomy make it a well-rounded choice for a wide range of missions. This score highlights its strong adaptability and operational capability. Leonardo AW 139 Priority Score: 0.71590 With a slightly lower priority score, the AW 139 is better suited for specialized missions such as maritime transport or VIP services. While its performance in key areas is strong, its high price and low availability reduce its overall appeal compared to other models. Robinson 44 Preference Score: 0.83824 The Robinson 44 receives a high preference score, driven primarily by its affordability and high availability. It is suitable for training, personal use, and light-duty operations. However, its limited autonomy limits its suitability for longer or more demanding missions. Sikorsky UH-60 Black Hawk Preference Score: 0.71749 The Black Hawk scores similarly to the Airbus EC 135 and AW 139. It is highly specialized, excelling in autonomy and mission endurance. However, its high cost and limited versatility in non-military applications slightly reduce its preference score.

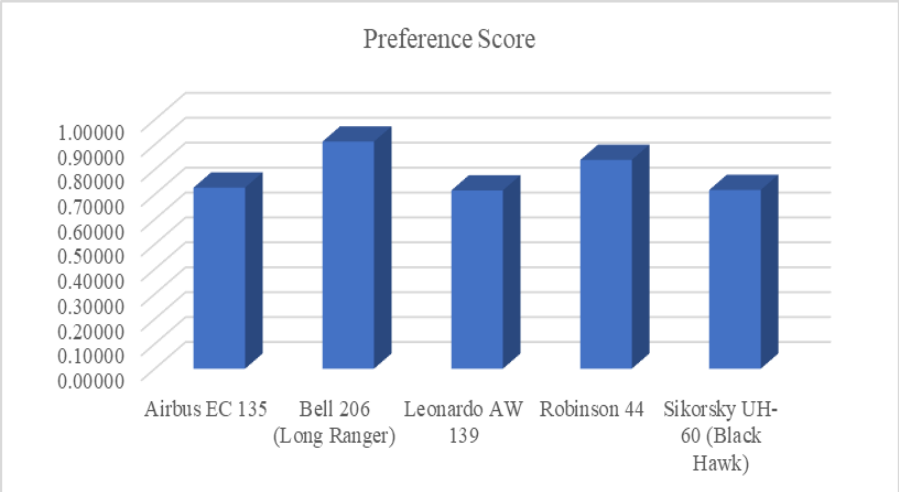

FIGURE 2. Preference Score

The graph illustrates the preference scores for five different helicopter models, providing a composite metric that combines various performance factors into a single comparative value. The Bell 206 (Long Ranger) emerges as the most preferred model with a maximum score of 0.95, suggesting excellent overall performance and user satisfaction. The Robinson 44 follows closely, earning a preference score of 0.85, indicating strong user acceptance and operational value. Mid-range preference scores are represented by the Airbus EC 135 and the Leonardo AW 139, both of which received scores of approximately 0.75, representing solid but not exceptional overall performance ratings. The Sikorsky UH-60

(Black Hawk), despite its military lineage and strong capabilities, shows a preference score comparable to the Airbus EC 135 at approximately 0.75. This may reflect its special nature and high operating costs, which may affect its broad market appeal. These priority scores provide valuable insights into the overall market perception and operational satisfaction of each helicopter model. The scoring appears to take into account a number of factors, including cost-effectiveness, maintenance requirements, operational flexibility, and user experience. With relatively narrow scores (between 0.75 and 0.95), all models meet high standards of performance and reliability, with subtle differences determining their final ranking. This data serves as a useful reference point for operators and organizations in their helicopter selection process, although specific operational requirements should still be considered in conjunction with these priority scores.

TABLE 6. Rank

	Rank
Airbus EC 135	3
Bell 206 (Long Ranger)	1
Leonardo AW 139	5
Robinson 44	2
Sikorsky UH-60 (Black Hawk)	4

The ranking places the Bell 206 Long Ranger as the best performing helicopter (rank 1), thanks to its versatility, availability and consistent features, making it a reliable choice for a variety of missions. The Robinson 44 follows (rank 2) with affordability and high availability, particularly in training and light operations. The Airbus EC 135 (rank 3) strikes a balance between cost and special roles but falls short in versatility. The Sikorsky UH-60 Black Hawk (rank 4) is more capable for long-range and military operations, but is less versatile and cost-effective for civilian use. The Leonardo AW 139 (rank 5) performs well in special roles, but is hampered by its high cost and limited deployment flexibility, making it a less favorable option overall. This ranking helps identify the most suitable helicopters based on mission requirements and operational priorities.

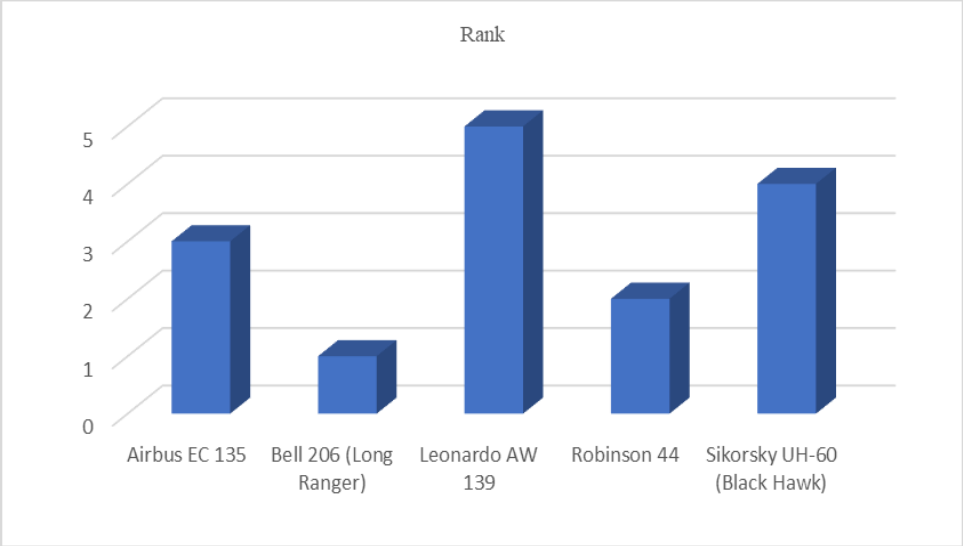

FIGURE 3. Rank

The bar chart provides the final rankings of the five helicopter models, where the lower number indicates the better ranking. The Bell 206 (Long Ranger) takes the top spot with a ranking of 1, establishing itself as the leading model among the helicopters compared. This high ranking aligns with its high preference scores seen in previous analyses and reinforces its position as the preferred choice in the helicopter market. The Robinson 44 takes second place, demonstrating its strong market performance and operational efficiency. The Airbus EC 135 is in third place, indicating its solid mid-range position in the overall rankings. The Sikorsky UH-60 (Black Hawk) ranks fourth, likely due to factors such as operating costs and maintenance requirements that affect its overall ranking position despite its advanced military capabilities. The Leonardo AW 139 is in fifth place, providing an interesting contrast to its individual performance metrics seen in previous figures. This ranking system appears to take into account a number of factors, including cost-effectiveness, operational efficiency, and market preferences. One should keep in mind that these rankings ought to be understood with respect to each helicopter's intended use case and operational requirements, as a lower overall rating does not necessarily imply lower performance for specific applications. The ranking system provides a clear hierarchical view of these helicopter models, providing valuable guidance to decision-makers considering their specific operational needs and constraints.

4. CONCLUSION

The analysis highlights important dimensions of big data security, with an emphasis on privacy, integrity, authentication, and third-party security within fields like smart grid and IoT. While important subjects like access control, anonymization, legal frameworks, and cryptography are identified, challenges in defining a comprehensive framework for the big data lifecycle remain unresolved. Furthermore, the study evaluates security methods such as Kerberos and SSL connections, emphasizing secure data exchange and authentication. Innovations such as the 3D-AES algorithm demonstrate potential advances in cryptographic security, although existing solutions are often inadequate for large-scale applications in cloud systems. AI-based architectures in multihoming systems and big data environments, especially for IoT, show promise in improving data processing performance. Overall, the study underscores the need to integrate security and privacy measures at the fundamental level in big data systems and highlights the importance of aligning operational priorities with technical capabilities to ensure robust performance and mission success. Multihoming systems and AI-based frameworks in big data environments, particularly for IoT, show promise in enhancing data processing efficiency. However, issues such as infrastructure security, data privacy, and management still require more targeted solutions.

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