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The TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) Method for Aircraft Type Selection

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Abstract: *Aircraft type Choice is flight A for companies Make important decisions process, in which Includes assessment various factors such as capacity, revenue potential, customer expectations, maintenance costs, and more. Technique for Priority Ranking by Similarity of Ideal Solution (TOPSIS) method provides a systematic approach to compare and rank different aircraft types based on multiple criteria. This abstract explores the application of the TOPSIS method in aircraft type selection, highlighting its benefits in considering diverse objectives and facilitating a more informed decision-making process. By assigning weights to criteria and comparing the alternatives to an ideal solution, the TOPSIS method helps airlines identify the most suitable aircraft type that aligns with their requirements and objectives. The abstract emphasizes the importance of accurate data and periodic reassessment due to evolving market conditions and technological advancements. Ultimately, the TOPSIS method assists airlines in making optimal decisions that optimize operational efficiency, customer satisfaction, and financial performance in aircraft type selection. Selecting the right type of aircraft is a crucial decision that involves a careful evaluation of various factors and considerations. Whether it's for commercial airlines, private aviation, military operations, or cargo transportation, choosing the appropriate aircraft type is essential to meet specific requirements, optimize performance, ensure safety, and achieve operational efficiency. The process of aircraft type selection involves a comprehensive analysis of multiple parameters, such as mission profile, range, payload capacity, operational costs, environmental considerations, regulatory requirements, and technological advancements. It requires a thorough understanding of the intended purpose, operational constraints, and long-term objectives. For commercial airlines, factors like passenger capacity, range capability, fuel efficiency, and passenger comfort play a vital role in selecting the right aircraft type. Airlines need to consider market demand, route network, and the ability to maximize revenue while minimizing operating expenses. The research on aircraft type selection holds significant importance in the aviation industry due to the following reasons: Operational Efficiency: The selection of the right aircraft type can significantly impact operational efficiency. By identifying the most suitable aircraft for a specific mission profile, airlines, private operators, and military organizations can optimize fuel consumption, reduce operating costs, and enhance overall performance. Research in this area helps to develop methodologies, models, and decision-support tools that enable informed and data-driven aircraft selection processes. Safety and Security: The safety and security of passengers, crew, and cargo are paramount in aviation. Choosing the appropriate aircraft type involves considering safety features, maintenance requirements, compliance with regulatory standards, and the ability to handle emergencies. Research in aircraft type selection contributes to the identification of aircraft that meet the highest safety standards, reducing the risk of accidents and ensuring the secure transportation of people and goods. Market Competitiveness: In the commercial aviation sector, staying competitive in a rapidly evolving market is crucial. Airlines need to select aircraft that align with market demand, passenger preferences, and route networks. Research in aircraft type selection aids in understanding market dynamics, forecasting future trends, and identifying aircraft that offer the best balance between capacity, range, fuel efficiency, and passenger comfort. It enables airlines to make informed decisions that enhance their competitiveness and profitability. We will be use TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) in this study, which is a research approach that gives TOPSIS research methods because it enables researchers to make informed and objective decisions in a multicriteria environment. Its quantitative and transparent approach, consideration of positive and negative aspects, simplicity, flexibility, and robustness make it a valuable tool for various research disciplines, facilitating systematic analysis and comparison of alternatives. Alternative Parameters taken as Boeing78C, Boeing79L, Airbus321, Airbus32C, Airbus320, Airbus319. Evaluation Parameters taken as Capacity, Revenue, Customer expectation, Maintenance Cost.*

RANK graph and the values making using the Analysis method in TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution). Alternative: Boeing78C, Boeing79L, Airbus321, Airbus32C, Airbus320, Airbus319. Evaluation preference: Capacity, Revenue, Customer expectation, Maintenance Cost. By the final rank graph, we can conclude that Airbus321 and Airbus 319 values are high. Training aircraft selection is a complex process that requires a thorough understanding of performance characteristics, training requirements, cost factors, technological advancements, and safety considerations. This research article provides a comprehensive analysis of these factors and offers insights into the methodologies and decision-making frameworks used in training aircraft selection. By considering the information presented in this article, flight training departments can make informed decisions that enhance the effectiveness and efficiency of their training programs, ensuring the development of skilled and competent pilots.

Keywords: *Boeing78C, Boeing79L, Airbus321, Airbus32C, Airbus320, Airbus319, Capacity, Revenue, Customer expectation, Maintenance Cost, aircraft, Maintenance Planning Document (MPD).*

1. INTRODUCTION

In recent years, economic crisis and fuel steady rise in prices as a result of the airline market is affected. Airlines are their market to maintain status or strengthen their service quality should be increased. From the traveler's perspective, higher frequencies, desired operating hours, attractive and comfortable flights based on the level of service is widespread can be defined. Attractive order under payment terms doable and at full capacity a viable minimum including operating costs the plane is an airline likes air travel to balance demand and capacity, an airline its reflect the policy for fleet planning process appropriate method to implement the approach want flight test the process is naval it is a component of planning. About literature flight selection discusses in various ways. Barda (2003) for flight test between passenger demand examines the relationship between trying to answer the question. In the areas under consideration based on passenger demand combination of air and navy can you choose? Passengers, distance and airport all of the core type in selecting the flight found to help. Listes and dekker (2005) travel as demand changes for determining fleet composition based on a visual integration present the technique. They are in a strategic position from handling the naval system. Harasani (2006, 2008) jetta (harasani, 2006) and madnia (harasani, 2008). Internal and with sites operates on international routes for saudi arabia airlines provides a flight test model. For a given route network flight range and payload in the study based on specific aircraft to evaluate types are selected. Flight performance and its in the net profit of the airline contributions are by the author as a result of the excel project are obtained, which is correct in selecting the flight helps planners. Wang and chang (2007) air force appropriate training for the academy in selecting the flight, primarily from the pilot's point of view since, systematic evaluation technique recommend. Evaluation importance of criteria there are many criteria to decide upon method they use, also trigonometrically ambiguous described with numbers linguistically possible performance evaluations of alternatives topsis is used to obtain ozdemir et al. (2011) turkish mid-range for airlines single-aisle aircraft analytical network to choose from use procedure (anp). They cost (purchasing, operating and spare, maintenance and salvage cost), time (delivery time and effective life) and physical characteristics and others (dimensions, security, reliability, etc.) And suitability for service quality). As main criteria (sub-criteria) consider . Dozic and kalić (2013a) a two-tier aircraft fleet propose a planning model. Passenger demand and distance are aircraft size (small or medium size) basis approximate fleet composition the inputs to the first stage are to get outputs are two sets of routes. By a set of small planes indicates closed routes and the other is by medium-sized aircraft indicates closed routes. A set of scheduled flights by dividing into subgroups, problem two is the independent fleet quantification becomes problematic. They choose the plane as a last step by (dozic and kalić, 2013b) expanding their research and a suitable fleet as equal as possible to choose from recommend a replacement system. The history of aviation begins in the 9th century abbas ibn firnas in the century built the first flying glider (lienhardt, 2019). Boo fu tao a chinese book in the 4th century there were rotary-wing aircraft is saying leonardo da vinci's glider design, survives to this day, it is a 15th century was by design only, but in the 15th century used items made in the 19th century. Hezarfen ahmet çelebi was born in 1638 from galata tower in 3 km to the anatolian region traveling and fascinated by birds with the wings he designed. By the montcollier brothers designed hot air a history of flight with the balloon the modern era had begun (kiliç, 2015). Modern aircraft history of transportation, alphonse the first structure of phenanthine uniform flight model, in history conducted by felix du temple first successful flight and orville and wilbur first of the wright brothers motorized development with aircraft continued. Second world in many cities during the war construction of airports have started. Second after world war ii, mobilization of pilots and airplanes used by soldiers introduced, but was surplus to the public, especially private in north america and commercial flights there was a huge increase in usage. Today, passenger transport, cargo transportation is dangerous various such as freight transport air transport modes of use by companies the rate of increase is rapid continues. In the coming years also, like air travel, services growth, increased safety and reliability space tourism with increase in usage found (webber, 2013).

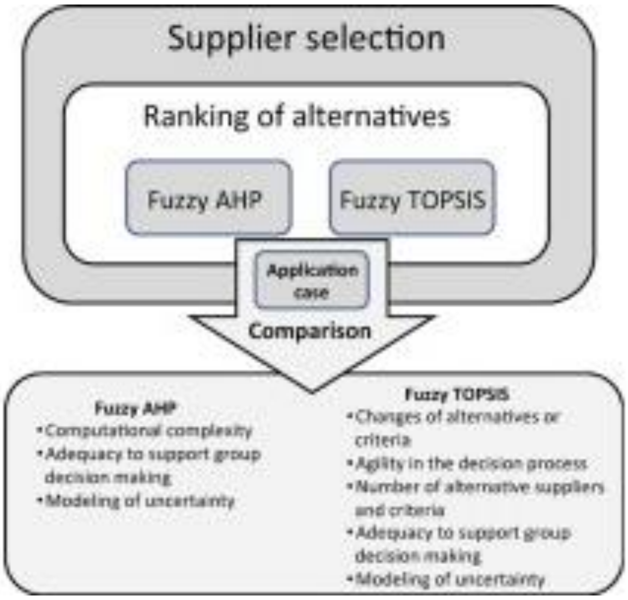

FIGURE 1. Supplier Selection

Regional aviation activities: rural and remote to communities in areas regional airlines are very important. This business model will work airlines are less population settlements with aviation hubs economic by combining and contribute to social development. For stakeholders in these areas they are an important lifeline represent. Important in aviation industry this business is important for some changes over time in the model subject to of these changes as a result, this airline business different definitions of model have been done. Previous in definitions, regional airline institutions are low seat capacity (up to 90) aircraft companies are defined as, but their seating capacity it has increased over time. Especially, aircraft like embraer manufacturers 120 seats with regional jets after starting to produce, regional the definition of flight has expanded. In this study, regional airlines seating capacity less than 120 short-range planned with are considered carriers. Airlines, on the other hand, have theirs have their own system. Aircraft operation and understanding structure, the world of aviation and its behavior with different aircraft designs one for better understanding important step, and a when to buy a flight selling or renting. Given for a given flight to examine the suitability of the aircraft important about the airline information should be known. This information is the capability of hangers and number etc should include, some of their maintenance if outsourced or some tasks or services of employees if outsourced number and their salary. The larger the given plane suitable for carrier but perfect for a small carrier there won't be. Any in flight maintenance, repair, inspection or for material handling, provided by the manufacturer maintenance planning document (mpd) deals with these issues. Mpd is for aircraft basic maintenance and line guidelines for maintenance its duration of operation and when to carry out want from maintenance operations, for machinery and aircraft maintenance labor rate needed. Base maintenance is usually in base to be carried out in the hangar all important to have it also includes tests, but line maintenance is every flight of the plane or will be done later in the day are tasks. In the aviation industry time of landing or return time is of the essence problem. Airplane, airplane, airport and airport traffic control communicate clearly this is the place. Ground for aviation sector because timing is important due to less ground time increased use of aircraft, these are direct operating costs reduce to airports ground time is also important. Low ground time flight reduces congestion at the station. Airports are more handling passengers.

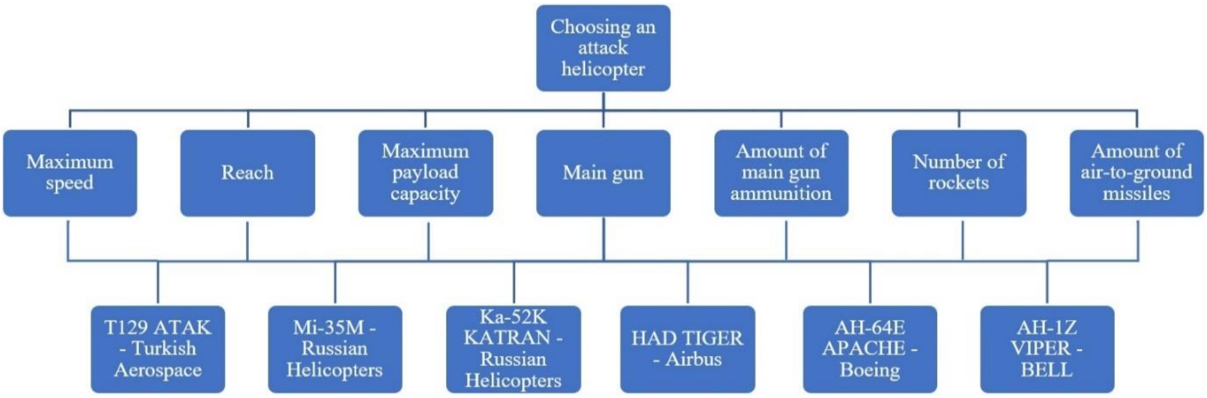

FIGURE 2. Choosing an Attack Helicopter

This research was carried out by the Navy Focuses on planning, Especially the flight test, which For an airline Most important long term In strategic decisions is one and of the company Significant in financial health Makes an impact. This Paper Indonesia's National Fleet planning of flag carrier Examines results, esp A variety of well-known high Frequency domestic route Airline for networks Exam results. of the market and airlines Satisfy the conditions Naval Planning Exam, Start a new path In selecting the flight Company performance Upgrades, it's more is cost efficient and May benefit from new route opening. Focus Group Discussion (FGD) and analysis hierarchy of Process (AHP). Better to use a combination Identify the aircraft type Six (six) criteria to view were used.

Basic Theory: Airlines or manufacturers market Whether there is competitiveness of civil aircraft to scale Economics is a decisive one plays a role. of the plane The model is continuously ventilated Eligibility, whereas, and economic benefits Only if received, esp Civil Aviation Steady market share in the sector can get. An airplane Civil to carry out the work The cost of the flight is usually fuel, salary of employees, Ownership cost, government taxes and charges, maintenance Includes expenses and more. Considered in this article The economy is mainly products or performance of flights represents the related cost, ie Air Force Maintenance Cost (AFMC). Taxes And unlike wages, It is with the performance of the product Relatedly, with test optimization There is no connection. AFMC In the conceptual design phase Related parameters Improving and evaluating to be considered by Choice of flight At component or product level There is, it is electronic equipment, Fitting and infrastructure Replaceable on line like component or maintainable. This class is usually tax replaceable unit (LRU) and Line Maintainable Area (LMP) is called They are To carry out maintenance work Smallest units. Historical Operational data, demand analysis and structural design are the foundation for it provide; This is a distortion Reliability index constraints And the key to choosing Design parameters, concept For failures in the design phase Mean Time Between (MTBF) allow. Design, manufacture, Sale, Use, Maintenance and scraping phases With thousands of products to enjoy (whether installed or backed up). large complex systems, At driven strategy and cost Facing huge challenges. A certain civil aircraft Recommended spare parts Catalog (RSPL) 757 species Tax convertible units and 789 types of tax maintainable Disposes up to parts.

2. MATERIALS AND METHODS

Boeing78C: B78X. In development, produced by Boeing Early production aircraft. A Boeing 787 Dreamliner Long range, medium range, Wide body, twin engine A jet plane. The B78X became On B787 series aircraft is a member. Technical data.

Airbus A321: Airbus A321 Airbus A320 short of family First medium distance, short body, Commercial passenger twin engine Jets, it's 185 First carrying 236 passengers is going It's a stretch consists of a body, This is the first of the basic A320 was derivative and About six years for the original A320 Then entered service in 1994. All other aircraft are Airbus Common with A320-family types Shares category assessment, Previous A320-family pilots aircraft without further training Allows to fly.

Airbus320: The Airbus A320 family Developed by Airbus Manufactured short body is the sequence of planes. The A320 was launched in March 1984, First on 22 February 1987 Flew, April 1988 Air Introduced by France. The first member of the family The longest continuous A321 (first issued in January 1994), Short A319 (April 1996) And the A318 even less (July 2003). Final assembly Takes place in Toulouse, France; Hamburg in Germany; Since 2009 Tianjin in China; April 2016 Alabama's first in America on mobile.

Airbus319: The Airbus A319 is the Airbus A320 Short first of the family Medium distance, short body, commercial Passenger twin engine jet Airplanes are manufactured by Airbus. The A319 seats 124 to 156 passengers carrying and max 3,700 nmi (6,900 km; 4,300 mi) has a limit. Final meeting of the flight Hamburg, Germany and Tianjin, China It takes place in places.

Capacity*:* In the context of aircraft type selection, capacity refers to the maximum number of passengers or the payload that an aircraft can carry. It is an important consideration when choosing an aircraft for a particular route or airline operation. The capacity of an aircraft is determined by its design, including factors such as the size of the cabin, seating configuration, and cargo space. It is typically measured in terms of the maximum number of passengers that can be accommodated in different seating arrangements, such as single class or multiple classes (economy, business, first).

Revenue: In the context of aircraft type selection, revenue refers to the income generated by an airline from operating a particular aircraft on a specific route or set of routes. It is a critical factor that airlines consider when deciding on the most suitable aircraft type for their operations. The revenue generated by an aircraft is primarily derived from ticket sales to passengers. The number of passengers that an aircraft can carry, along with factors such as ticket prices and load factors (percentage of seats filled on average), directly impact the revenue potential.

***Customer expectation**:* Customer expectations, in the context of aircraft type selection, refer to the desires, preferences, and requirements of the passengers who will be flying on a particular route or with a specific airline. Understanding and meeting customer expectations is a key factor that airlines consider when selecting an aircraft type. Passenger expectations can vary widely based on factors such as demographics, market segment, travel purpose business or leisure, and regional or cultural preferences. Airlines strive to provide a positive passenger experience and meet or exceed these expectations to attract and retain customers.

Maintenance Cost: Maintenance cost, in the context of aircraft type selection, refers to the expenses incurred by an airline to maintain and service an aircraft throughout its operational life. It is an important consideration when selecting an aircraft type because it directly impacts the overall operating costs and profitability of an airline.

TOPSIS method: TOPSIS method is better by matching the solution a for order option technique (hwang & yoon, 1981). Best solution (positive best solution also known as are the criteria/characteristics of goodness maximize and cost criteria/characteristics a solution that minimizes, whereas negative ideal solution (expect also called resistance solution) cost criteria/characteristics increases and decreases. Eligibility criteria/characteristics (chen, 2000). Eligibility criteria/ called attributes maximum, while cost criteria/attributes to reduce. Best alternative the best solution, this is for the best solution is very close and from the negative ideal solution far away (herrera, herrera-viedma, & verdegay, 1996; herrera & herrera-viedma, 2000). An MCDM problem is hashem alternatives (a1,a2, . . . ,am), and n result criteria/attributes (c1,c2, . . . ,cn) let's assume that. Every substitution n criteria/attributes evaluated accordingly. Every for alternatives depending on criteria all reserved values/estimates by x = (xij)m*n the resulting team will be marked create w= (w1,w2, . . . ,wn) bpe satisfies n j¼1wj ¼ 1 comparison of criteria weight vector. Then topsis the method can be summarized as follows let us say: result matrix x = (xij)m* normalized scale/attribute rij representing the value/rating by calculating n. Flight type examination topsis (ideal for an order of preference similar to the solution technique) method, a specific for the purpose or use of most suitable aircraft type evaluate and select several criteria are used it is a decision making technique. Topsis is a popular decision maker systematic, it's for decision makers based on several criteria evaluate and rank alternatives helps. Aircraft type selection topsis for how the method works here is a step-by-step explanation: define the decision criteria: to select the flight type critical decision criteria start by finding out. Depending on the specific application these criteria may vary, but they are generally limited, payload capacity, fuel efficiency, operating cost, passenger capacity, security features and factors like environmental impact includes. Objective assessment implementation criteria and well defined be scalable want determination of weights: its in the decision making process to indicate relative importance weights for each criterion set aside. Weights are the decision maker's reflect preferences and expert opinions, analysis hierarchical processes or studies with stakeholders and various including discussions can be determined by methods. Sum of all weights assessment should be equal establish matrix: each each type of flight against the decision criteria a comparative assessment matrix create. For each criterion data or expert opinions collect each aircraft type how much of that scale that works well matrix by evaluating is being constructed. Data size (eg, numerical values) or qualitatively (eg, rankings or ratings) may be. The team is usually in rows listed aircraft types and result listed in columns contains criteria. Normalizing a matrix: on scales different sizes used or potential caused by units evaluation matrix to eliminate bias normalize. All criteria comparable range for assessment normalization of having the process ensures. Common linear in normalization techniques scaling, min-max normalization or standard deviation including normalization by. Best and negative best determining solutions: each better and for scale negative best solutions identify. Best solution is for each criterion higher or more favorable means value, while negative ideal solution low or low indicates positive value. Max for each criterion by selecting the value the best solution is determined, at the same time negative the best solution is the minimum value determined by selection. Calculate euclidean distances: for each flight type, the best and negative best solutions euclidean distance between calculate. Euclidean distance is ideal or negative each of the ideal solutions unity of substitution or indicates closeness. This is alternative and ideal or of the negative ideal solution for each criterion of class differences between by the square root of the sum is calculated. Relative intimacy calculate: each flight closeness related to type, for negative ideal solution distance ideal and negative of distances to ideal solutions by dividing by the sum calculate. Relative intimacy is of each alternative indicates relative performance and between 0 and 1 will be higher values are better indicate performance. Sort the flight types: their types of aircraft of corresponding close values rank based on for the given decision criteria a very suitable flight the highest ranked alternative in the category considered. Sensitivity analysis: to assess the robustness of the results perform a sensitivity analysis and in scale weights changes or data how variations rank assessment of impact do it. This step is decisive stability of the process helps to understand and possible trade-offs provides insights into final result: rank and based on sensitivity analysis, given decision criteria very well complementing appropriate aircraft type final decision in choosing take it. Select flight type the topsis method is multi-criteria types of aircraft to consider to assess and select a structured and systematic provides an approach. Predefined for decision makers their against criteria alternatives based on performance objectively evaluate and compare by making informed choices it helps to do.

3. RESULTS AND DISCUSSIONS

TABLE 1. Aircraft Type Selection

	Capacity	Revenue	Customer expectation	Maintenance Cost
Boeing738	147	2	6	6
Boeing78C	135	5	2	5
Boeing79L	135	4	4	8
Airbus321	168	2	8	7
Airbus32C	156	1	4	6
Airbus320	147	8	3	8
Airbus319	114	9	9	7

Table 1 shows the aircraft type selection making using the Analysis method in TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution). Alternative: Boeing78C, Boeing79L, Airbus321, Airbus32C, Airbus320, Airbus319 Evaluation preference: Capacity, Revenue, Customer expectation, Maintenance Cost.

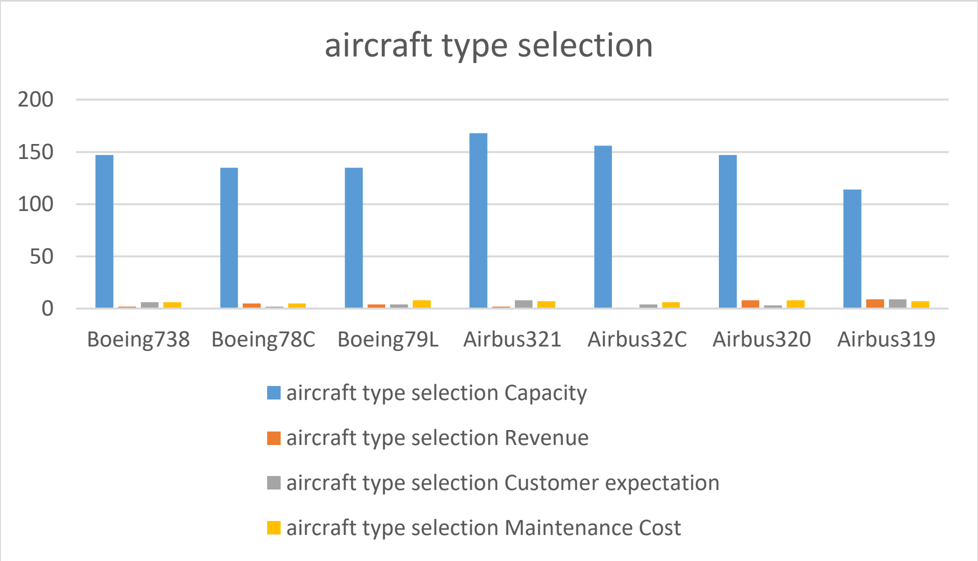

FIGURE 3. Aircraft type selection

Figure 3 shows the aircraft type selection making using the Analysis method in TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution). Alternative: Boeing78C, Boeing79L, Airbus321, Airbus32C, Airbus320, Airbus319 and Evaluation preference: Capacity, Revenue, Customer expectation, Maintenance Cost in the form of graphs.

TABLE 2. Normalized Data

Capacity	Revenue	Customer Expectation	Maintenance Cost
1	0.01361	0.04081633	0.040816327
1.0888889	0.01481	0.04444444	0.044444444
1.0888889	0.01481	0.04444444	0.044444444
0.875	0.0119	0.03571429	0.035714286
0.9423077	0.01282	0.03846154	0.038461538
1	0.01361	0.04081633	0.040816327
1.2894737	0.01754	0.05263158	0.052631579

Table 2 shows the normalized data making using the Analysis method in TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution). Alternative: Boeing78C, Boeing79L, Airbus321, Airbus32C, Airbus320, Airbus319. Evaluation preference: Capacity, Revenue, Customer expectation, Maintenance Cost.

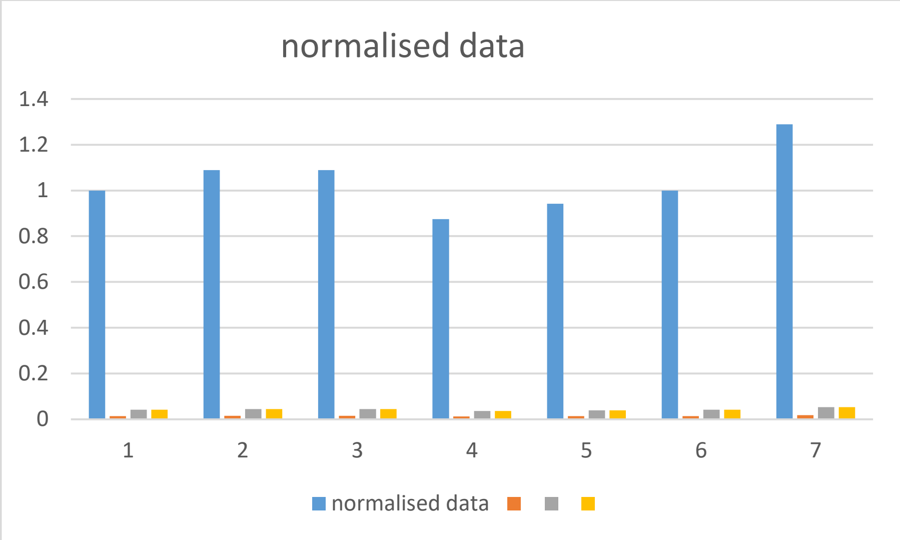

FIGURE 4. Normalized Data

Figure 4 shows the normalized data graph and the values making using the Analysis method in TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution). Alternative: Boeing78C, Boeing79L, Airbus321, Airbus32C, Airbus320, Airbus319. Evaluation preference: Capacity, Revenue, Customer expectation, Maintenance Cost.

TABLE 3. Weightages

Capacity	Revenue	Customer Expectation	Maintenance Cost
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25

Table 3 presents the weightages utilized for the analysis, where equal weights are assigned to all parameters for the analysis.

TABLE 4. Weighted normalized decision matrix

Capacity	Revenue	Customer Expectation	Maintenance Cost
0.25	0.0034	0.01020408	0.010204082
0.2722222	0.0037	0.01111111	0.011111111
0.2722222	0.0037	0.01111111	0.011111111
0.21875	0.00298	0.00892857	0.008928571
0.2355769	0.00321	0.00961538	0.009615385
0.25	0.0034	0.01020408	0.010204082
0.3223684	0.00439	0.01315789	0.013157895

Table 4 shows the Weighted normalized decision matrix using the Analysis method in TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution). Alternative: Boeing78C, Boeing79L, Airbus321, Airbus32C, Airbus320, Airbus319. Evaluation preference: Capacity, Revenue, Customer expectation, Maintenance Cost.

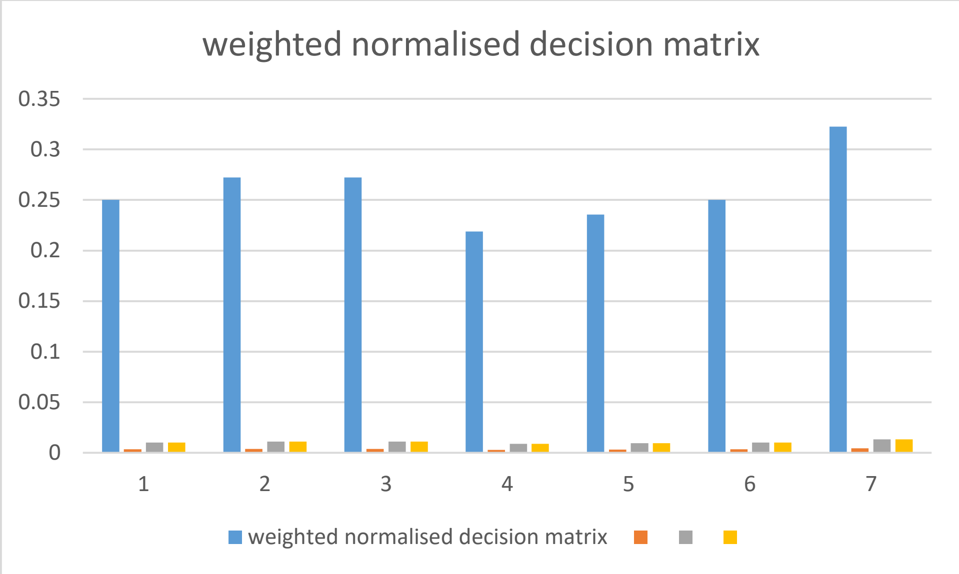

FIGURE 5. Weighted Normalized Decision matrix

Figure 5 shows Weighted normalized decision matrix graph and the values making using the Analysis method in TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution). Alternative: Boeing78C, Boeing79L, Airbus321, Airbus32C, Airbus320, Airbus319. Evaluation preference: Capacity, Revenue, Customer expectation, Maintenance Cost.

TABLE 5. Positive matrix

Capacity	Revenue	Customer Expectation	Maintenance Cost
0.3223684	0.00439	0.01315789	0.013157895
0.3223684	0.00439	0.01315789	0.013157895
0.3223684	0.00439	0.01315789	0.013157895
0.3223684	0.00439	0.01315789	0.013157895
0.3223684	0.00439	0.01315789	0.013157895
0.3223684	0.00439	0.01315789	0.013157895
0.3223684	0.00439	0.01315789	0.013157895

Table 5 shows the Positive Matrix using the Analysis method in TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution). Alternative: Boeing78C, Boeing79L, Airbus321, Airbus32C, Airbus320, Airbus319. Evaluation preference: Capacity, Revenue, Customer expectation, Maintenance Cost.

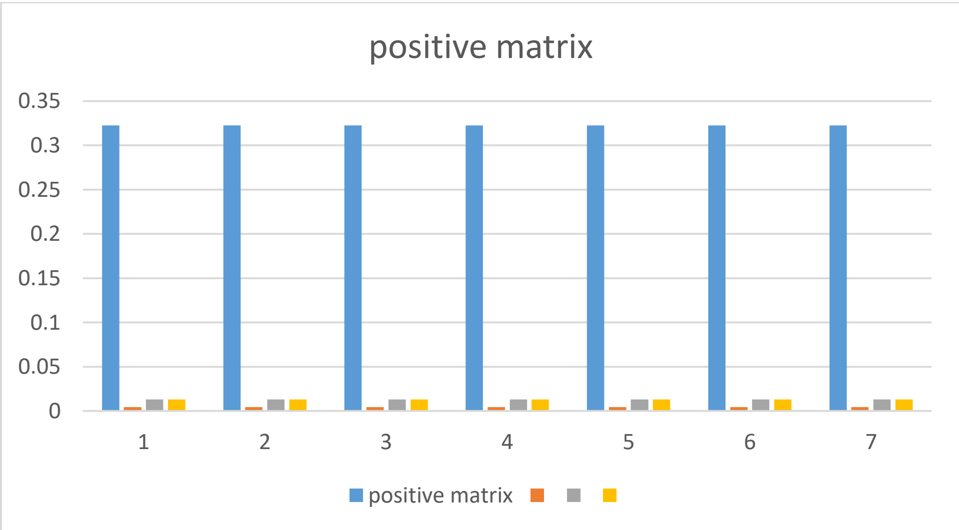

FIGURE 6. Positive matrix

Figure 6 shows Positive matrix graph and the values making using the Analysis method in TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution). Alternative: Boeing78C, Boeing79L, Airbus321, Airbus32C, Airbus320, Airbus319. Evaluation preference: Capacity, Revenue, Customer expectation, Maintenance Cost.

TABLE 6. Negative Matrix

Capacity	Revenue	Customer Expectation	Maintenance Cost
0.21875	0.00298	0.00892857	0.008928571
0.21875	0.00298	0.00892857	0.008928571
0.21875	0.00298	0.00892857	0.008928571
0.21875	0.00298	0.00892857	0.008928571
0.21875	0.00298	0.00892857	0.008928571
0.21875	0.00298	0.00892857	0.008928571
0.21875	0.00298	0.00892857	0.008928571

Table 6 shows the Negative Matrix using the Analysis method in TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution). Alternative: Boeing78C, Boeing79L, Airbus321, Airbus32C, Airbus320, Airbus319. Evaluation preference: Capacity, Revenue, Customer expectation, Maintenance Cost.

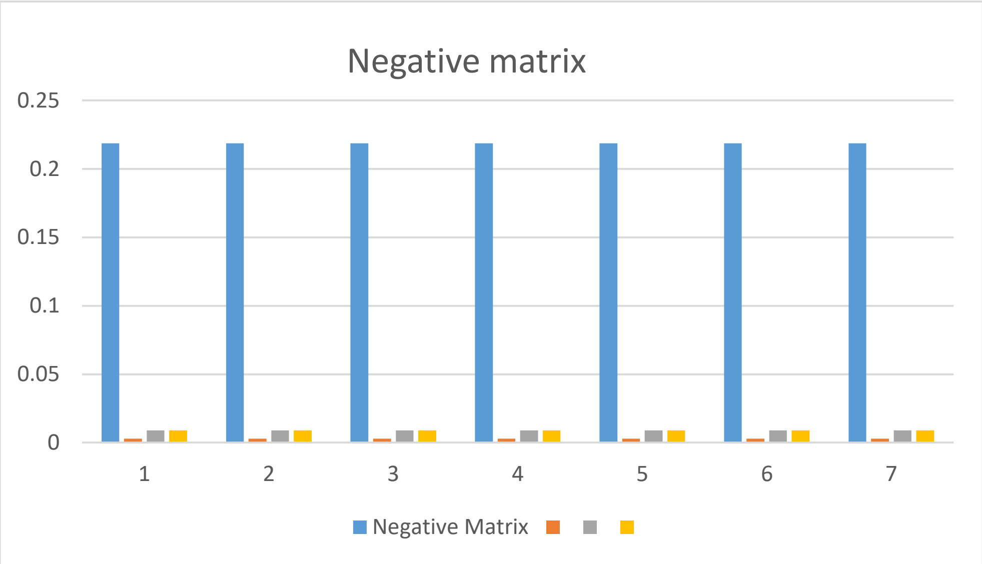

FIGURE 7. Negative matrix

Figure 7 show the Negative matrix graph and the values making using the Analysis method in TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution). Alternative: Boeing78C, Boeing79L, Airbus321, Airbus32C, Airbus320, Airbus319. Evaluation preference: Capacity, Revenue, Customer expectation, Maintenance Cost.

TABLE 7. Si plus, si negative &ci

	SI plus	SI negative	Ci
Boeing738	0.072496	0.415349	0.463123
Boeing78C	0.050234	0.415349	1.119893
Boeing79L	0.050234	0.415349	1.119893
Airbus321	0.1038	0.415349	0
Airbus32C	0.086944	0.415349	0.210734
Airbus320	0.072496	0.415349	0.463123
Airbus319	0	0.415349	0

Table 7 shows SI PLUS, SI NEGATIVE &Ci using the Analysis method in TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution).

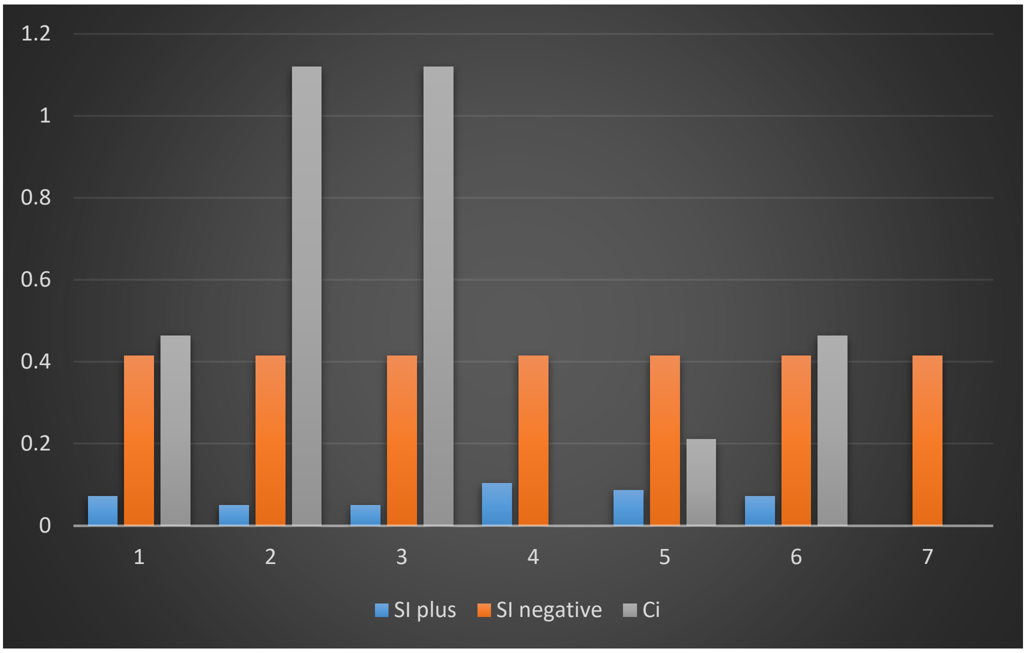

FIGURE 8. Si Plus, Si Negative &Ci

Figure 8 show SI PLUS, SI NEGATIVE &Ci graph and the values making using the Analysis method in TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution).

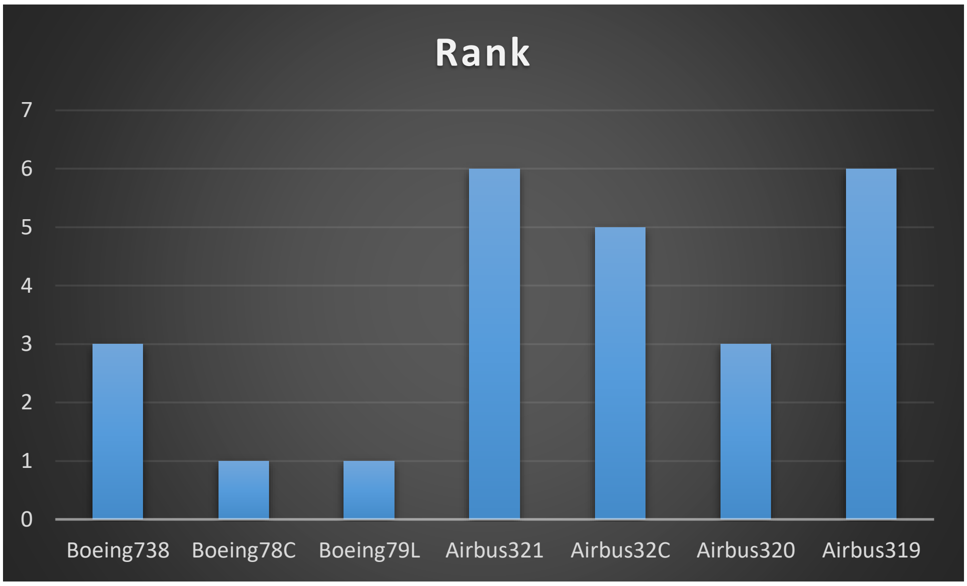

FIGURE 9. Rank

Figure 9 shows RANK graph and the values making using the Analysis method in TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution). By the final rank graph, we can conclude that Airbus321 and Airbus 319 values are high.

4. CONCLUSION

Finally, the appropriate flight Choosing a category is a complex decision, it is many Factors and objectives considered. TOPSIS (By simulating the Ideal Solution technique for order of preference) The method is a valuable tool. can aid in the aircraft type selection process by providing a systematic approach to evaluate and compare different options. Through the application of the TOPSIS method, airlines can consider various criteria such as capacity, revenue potential, customer expectations, maintenance costs, fuel efficiency, range, and other relevant factors. By assigning weights to these criteria based on their relative importance, a comprehensive evaluation of the aircraft types can be conducted. The TOPSIS method allows for the identification of the ideal solution, which is the aircraft type that best aligns with the airline's specific requirements and objectives. It considers both the positive and negative aspects of each option, enabling a more holistic decision-making process. By using the

TOPSIS method, airlines can make more informed decisions, considering not only financial factors but also customer satisfaction, operational efficiency, and long-term sustainability. It helps ensure that the selected aircraft type will meet the airline's needs, provide a positive passenger experience, and contribute to the overall profitability of the operation. However, it is important to note that the effectiveness of the TOPSIS method in aircraft type selection relies on the accuracy and reliability of the data and criteria used in the evaluation. Additionally, market conditions, regulatory requirements, and technological advancements may change over time, requiring periodic reassessment of the aircraft type selection process. In conclusion, the TOPSIS method is a valuable tool that can assist airlines in selecting the most suitable aircraft type by considering multiple criteria and objectives. It facilitates a structured and systematic approach, enabling airlines to make informed decisions that optimize operational efficiency, customer satisfaction, and financial performance.

REFERENCES

[1]. Dožić, Slavica, and Milica Kalić. "An AHP approach to aircraft selection process." *Transportation Research Procedia* 3 (2014): 165-174.

[2]. Harasani, Wail. "Evaluation and selection of a fleet of aircraft located in Madniah, Saudi Arabia." *Journal of Air Transport Studies* 4, no. 2 (2013): 40-53.

[3]. Torğul, Belkız, Enes Demiralay, and Turan Paksoy. "Training aircraft selection for department of flight training in fuzzy environment." *Decision Making: Applications in Management and Engineering* 5, no. 1 (2022): 264-289.

[4]. Đukić, Đorđe Nikola, Ivan Petrović, Darko Božanić, and Boris Delibašić. "Selection of Unployed Aircraft for Training of Small-Range Aircraft Defense System AHP–TOPSIS Optimization Methods." *Yugoslav Journal of Operations Research* 32, no. 3 (2022): 389-406.

[5]. Zobary, Firas Fawzy. "Applying TOPSIS method for software defined networking (SDN) controllers comparison and selection." In *Communications and Networking: 11th EAI International Conference, ChinaCom 2016 Chongqing, China, September 24–26, 2016, Proceedings, Part II 11*, pp. 132-141. Springer International Publishing, 2018.

[6]. Guo, Shengnan, Youfang Lin, Ning Feng, Chao Song, and Huaiyu Wan. "Attention based spatial-temporal graph convolutional networks for traffic flow forecasting." In Proceedings of the AAAI conference on artificial intelligence, vol. 33, no. 01, pp. 922-929. 2019

[7]. Murugamani, C., S. Shitharth, S. Hemalatha, Pravin R. Kshirsagar, K. Riyazuddin, Quadri Noorulhasan Naveed, Saiful Islam, Syed Parween Mazher Ali, and Areda Batu. "Machine Learning Technique for Precision Agriculture Applications in 5G-Based Internet of Things." *Wireless Communications and Mobile Computing* 2022, no. 1 (2022): 6534238.

[8]. Varma, P. Bharat Siva, Prathap Adimoolam, Yamini Lahari Marna, Anantharamaiah Vengala, VS Divya Sundar, and MVT Ram Pavan Kumar. "Enhancing robust object detection in weather-impacted environments using deep learning techniques." In 2024 2nd International Conference on Self Sustainable Artificial Intelligence Systems (ICSSAS), pp. 599-604. IEEE, 2024.

[9]. Rani, Dr V. Vasudha, D. Vasavi, and K. Kumar. "Significance of multilayer perceptron model for early detection of diabetes over ml methods." J. Univ. Shanghai Sci. Technol 23, no. 08 (2021): 148-160.

[10]. Harasani, Wail I. "Evaluation and Selection of a Fleet of Aircraft for a Local Airline." *Journal of King. Abdulaziz University: Engineering Sciences* 17, no. 2 (2006): 3-16.

[11]. Bakır, Mahmut, Şahap Akan, and Emircan Özdemir. "Regional aircraft selection with fuzzy PIPRECIA and fuzzy MARCOS: A case study of the Turkish airline industry." *Facta Universitatis, Series: Mechanical Engineering* 19, no. 3 (2021): 423-445.

[12]. Manjula selvam, Vidhya Prasanth, M. Ramachandran, Ramya Sharama, "A Study on Economic Models of Animal Communication Methods" Journal on Innovations in Teaching and Learning, 3(2), June 2024, 13-19.

[13]. Simon, Donald L., and Aidan W. Rinehart. "Sensor selection for aircraft engine performance estimation and gas path fault diagnostics." *Journal of Engineering for Gas Turbines and Power* 138, no. 7 (2016).

[14]. Jeßberger, Philipp, Christiane Voigt, Ulrich Schumann, Ingo Sölch, Hans Schlager, Stefan Kaufmann, Andreas Petzold, Dominik Schäuble, and J-F. Gayet. "Aircraft type influence on contrail properties." *Atmospheric Chemistry and Physics* 13, no. 23 (2013): 11965-11984.

[15]. Ardil, C. "Advanced Jet Trainer and Light Attack Aircraft Selection Using Composite Programming in Multiple Criteria Decision Making Analysis Method." *International Journal of Aerospace and Mechanical Engineering* 15, no. 12 (2022): 486-491.

[16]. Kartika, Astrid, and Alberto Daniel Hanani. "Analytic hierarchy process (ahp) approach to aircraft type selection on high-frequency domestic routes." *International Journal of Engineering and Advanced Technology* 8 (2019): 697-704.

[17]. Barros, Carlos Pestana, and Peter Wanke. "An analysis of African airlines efficiency with two-stage TOPSIS and neural networks." *Journal of Air Transport Management* 44 (2015): 90-102.

[18]. Tanti, Lili, Yan Yang Thanri, Deny Adhar, and Wirhan Fahrozi. "Decision Support System Selection of Aviation Student Departments with TOPSIS method." In *2019 7th International Conference on Cyber and IT Service Management (CITSM)*, vol. 7, pp. 1-6. IEEE, 2019.

[19]. Manikandan, G., and S. Srinivasan. "Mining spatially co-located objects from vehicle moving data." Eur. J. of Sci. Res 68, no. 3 (2012).
[20]. Mohan, VakaMurali, MalliKarjuna Reddy, and KRN Kiron Kumar. "A New Approach to Optical Networks Security: Attack-Aware Routing and Wavelength Assignment." In IJCA Special Issues on "2nd National Conference- Computing, Communication and Sensor Network" CCSN. 2011.
[21]. VUPPALA, VENKATA PRAVEEN KUMAR, PAZHANIRAJAN SAMBANDAM, and INDRANEEL SREERAM. "An efficient point-of-interest recommendation for LOcation-based social networks system with spatio-temporal model." (2022).
[22]. Sen, Souptik, Ramesh Krishnamaneni, and Ashwin Narasimha Murthy. "THE ROLE OF MACHINE LEARNING IN ENHANCING SLEEP STAGE DETECTION ACCURACY WITH SINGLE-CHANNEL EEG." (2021).
[23]. Karad, S., and S. S. Mundhe. "Smart NPK Soil Sensor: Step towards Precision Agriculture." (2023).
[24]. Gueret, Christelle, Narendra Jussien, Olivier Lhomme, Claire Pavageau, and Christian Prins. "Loading aircraft for military operations." *Journal of the operational research society* 54 (2003): 458-465.
[25]. Filippone, Antonio. "Data and performances of selected aircraft and rotorcraft." *Progress in Aerospace Sciences* 36, no. 8 (2000): 629-654.
[26]. Ertuğrul, İrfan, and Nilsen Karakaşoğlu. "Performance evaluation of Turkish cement firms with fuzzy analytic hierarchy process and TOPSIS methods." *Expert Systems with Applications* 36, no. 1 (2009): 702-715.
[27]. Dhara, Aishwarya, Gurpreet Kaur, Pon Maa Kishan, Arunava Majumder, and Rakesh Yadav. "An efficient decision support system for selecting very light business jet using CRITIC-TOPSIS method." *Aircraft Engineering and Aerospace Technology* 94, no. 3 (2022): 458-472.
[28]. Torlak, Gokhan, Mehmet Sevkli, Mehmet Sanal, and Selim Zaim. "Analyzing business competition by using fuzzy TOPSIS method: An example of Turkish domestic airline industry." *Expert Systems with Applications* 38, no. 4 (2011): 3396-3406.
[29]. Ragavan, V. K., N. S. Nithya, Anantharamaiah Vengala, Balambigai Subramanian, and C. Ambhika. "Refractive Index Biosensor–Based Detection of Mycobacterium Tuberculosis Using Sea Lion Political Optimizer and Deep Learning." Plasmonics (2025): 1-19.
[30]. Kodati, Sarangam, Kumbala Pradeep Reddy, Sreenivas Mekala, PL Srinivasa Murthy, and P. Chandra Sekhar Reddy. "Detection of fake profiles on twitter using hybrid svm algorithm." In *E3S Web of Conferences*, vol. 309, p. 01046. EDP Sciences, 2021.
[31]. VUPPALA, VENKATA PRAVEEN KUMAR, PAZHANIRAJAN SAMBANDAM, and INDRANEEL SREERAM. "An efficient point-of-interest recommendation for LOcation-based social networks system with spatio-temporal model." (2022).
[32]. Rajendra Prasad, D., B. Kiran Kumar, and S. Indraneel. "Mobility in wireless sensor networks." In International Conference on Innovative Data Communication Technologies and Application, pp. 165-171. Cham: Springer International Publishing, 2019.
[33]. Priyadarshini, R., and N. Malarvizhi. "Secured data transfer between fog nodes using blockchain." In *Proceedings of the 2nd International Conference on Computational and Bio Engineering: CBE 2020*, pp. 417-422. Singapore: Springer Singapore, 2021.
[34]. Karad, S. C., A. K. Chaitanya, and O. J. Sujayasree. "Advancement of sensors vision-based robotics (SVR) in precision farming: An imperative tool for crop productivity assurance." *Indian J. Plant Prot.* 48 (2020): 51-56.
[35]. Raja, SA Kalaiselvan R., P. Udayakumar, C. Murugamani, and M. Shanmukhi. "A Novel Framework for Evaluation of Trust in Mobile Adhoc Networks using Flower Pollination Algorithm." Annals of the Romanian Society for Cell Biology, Volume25, Issue4, Pages17631 17639 (2021).
[36]. Ranjith Kumar, A., N. Nagabhooshanam, M. Naresh Kumar, D. Sendil Kumar, Gadde Raghu Babu, A. K. Chakravarthy, Neti Praveen, P. Ganeshan, and Sathish Kannan. "Energy optimization in additive manufacturing based on cluster-aware enhanced spider monkey optimization." *The International Journal of Advanced Manufacturing Technology* (2023): 1-11.
[37]. Bhuvaneswari, G., and G. Manikandan. "An intelligent intrusion detection system for secure wireless communication using IPSO and negative selection classifier." *Cluster Computing* 22, no. Suppl 5 (2019): 12429-12441.
[38]. Kumar, KRN Kiran, and K. Bhavani. "Folded spined cube: new topology in interconnection networks." In 2022 6th International Conference on Computing Methodologies and Communication (ICCMC), pp. 314-319. IEEE, 2022.
[39]. Rajes Kannan, S., and S. Amutha. "Railway wagon health monitoring system using E-BMA protocol in wireless sensor networks." In Artificial Intelligence Techniques for Advanced Computing Applications: Proceedings of ICACT 2020, pp. 117-125. Singapore: Springer Singapore, 2020.
[40]. Murthy, Ashwin Narasimha, Souptik Sen, and Ramesh Krishnamaneni. "Enhanced image retrieval and classification frameworks for brain disease diagnosis using hybrid deep learning models." International Journal of Computer Science and Information Technology Research 3, no. 1 (2022): 37-47.
[41]. Karad, Sachin Chandravadan, Balpreet Singh, Gopal Krishna, C. Ambhika, Kanchan Yadav, and Shailendra Singh Sikarwar. "EAI Endorsed Transactions: AI Research." In *2025 IEEE International Conference on Interdisciplinary Approaches in Technology and Management for Social Innovation (IATMSI)*, vol. 3, pp. 1-5. IEEE, 2025.
[42]. Karad, Sachin C., and Deepak Waikar. "WIRELESS CHARGING TECHNIQUES FOR ELECTRICAL VEHICLE APPLICATIONS." 8(4), 2021, 15-20.

[43]. Sridhar, P., S. Sri Nandhini Kowsalya, M. Venkatasudhahar, T. Sathish Kumar, Amit Gangopadhyay, Koppuravuri Gurnadha Gupta, and G. Manikandan. "Revolutionary building approach for maximal photovoltaic system results to improve maximum power point tracking in solar inverter." In MATEC Web of Conferences, vol. 392, p. 01146. EDP Sciences, 2024.
[44]. Vamsikrishna, M., Srinivasa Rao Bogireddy, Amit Gangopadhyay, Nilamadhab Mishra, Ajith Sundaram, and Priya Sharma. "Investigating Writer-Independent Deep Learning Techniques for Offline Handwritten Signature Verification." In 2024 1st International Conference on Advances in Computing, Communication and Networking (ICAC2N), pp. 1658-1663. IEEE, 2024.
[45]. Krishnamaneni, Ramesh, A. N. Murthy, and S. Sen. "A comparative study of big data mining algorithms for early detection of heart attack risk factors in electronic medical records." International Journal of Computer Engineering and Technology (IJCET) 10, no. 6 (2019): 139-154.
[46]. Ma, Jungmok. "Training Aircraft Selection of the Vietnam People's Air Force Using a Hybrid BWM-Fuzzy TOPSIS Method." *Periodica Polytechnica Social and Management Sciences* 30, no. 2 (2022): 141-157.
[47]. Khorshidi, R., A. Hassani, A. Honarbakhsh Rauof, and M. Emamy. "Selection of an optimal refinement condition to achieve maximum tensile properties of Al–15% Mg2Si composite based on TOPSIS method." *Materials & Design* 46 (2013): 442-450.
[48]. Saraswathi, S. Sabeetha, and N. Malarvizhi. "Distributed deduplication with fingerprint index management model for big data storage in the cloud." Evolutionary Intelligence 14, no. 2 (2021): 683-690.
[49]. Balraj, Lavina, A. Prasanth, KK Devi Sowndarya, and T. Kuntavai. "A lightweight blockchain scheme for secure data communication in internet of things-enabled wireless sensor network." In *2024 International Conference on Smart Systems for applications in Electrical Sciences (ICSSES)*, pp. 1-6. IEEE, 2024.
[50]. Vidhya Prasanth, Ramya Sharma, M. Ramachandran, Sathiyaraj chinnasamy, "Evaluation of Automotive Brake Disc Material Selection Using Weighted Sum Method (WSM)", REST Journal on Advances in Mechanical Engineering, 3(3), September 2024, 9-18.
[51]. Mei, Yanlan, and Kefan Xie. "An improved TOPSIS method for metro station evacuation strategy selection in interval type-2 fuzzy environment." *Cluster Computing* 22 (2019): 2781-2792.
[52]. Ardil, C. "Fighter Aircraft Selection Using Technique for Order Preference by Similarity to Ideal Solution with Multiple Criteria Decision-Making Analysis." *International Journal of Transport and Vehicle Engineering* 13, no. 10 (2021): 649-657.
[53]. Yilmaz, Ayse Kucuk, Konstantinos Malagas, Muhammad Jawad, and Nikitas Nikitakos. "Aircraft selection process with technique for order preference by similarity to ideal solution and AHP integration." *International Journal of Sustainable Aviation* 6, no. 3 (2020): 220-235.
[54]. Arabzad, S. Mohammad, Ahmad Kamali, Badia Naji, and Mazaher Ghorbani. "DEA and TOPSIS techniques for purchasing management: the case of aircraft manufacturing industry." *International Journal of Logistics Systems and Management* 14, no. 2 (2013): 242-260.
[55]. Prabowo, Luhur Prakoso, and Teuku Yuri M. Zagloel. "Aircraft Selection for Cargo Purposes in Air Charter Company Using the Fuzzy AHP–TOPSIS Method."
[56]. Torlak, Gokhan, Mehmet Sevkli, Mehmet Sanal, and Selim Zaim. "Analyzing business competition by using fuzzy TOPSIS method: An example of Turkish domestic airline industry." *Expert Systems with Applications* 38, no. 4 (2011): 3396-3406.
[57]. Balasubramanian, Kannan, and S. Amutha. "Secure Routing Protocols for Wireless Adhoc Networks." In Encyclopedia of Information Science and Technology, Third Edition, pp. 1475-1484. IGI Global Scientific Publishing, 2015.
[58]. Kuntavai, T., and A. Jeevanandham. "RETRACTED ARTICLE: Adaptive wavelet ELM-fuzzy inference system-based soft computing model for power estimation in sustainable CMOS VLSI circuits." *Soft Computing* 24, no. 15 (2020): 11755-11768.
[59]. Chakraborty, R., S. Sen, M. Kurni, A. N. Murthy, and R. Krishnamaneni. "A Novel Framework for Enhancing Speech Pattern Recognition for Early Detection of Alzheimer's Disease Using machine learning Approach." International Journal of Intelligent Systems and Applications in Engineering 12 (2024): 421-428.
[60]. Giri, Animesh, and D. Annapurna. "Multi-Objective RPL to Support Heterogeneous Traffic for LLNs with Multiple Instances." International Journal of Computer Science & Network Security (2025): 37-48.
[61]. Singh, Anuj Pratap, Ranjith Kumar Anandan, Rajat Rana, Harsh Prakash Dwivedi, P. Avinash, and Akshat Narendra Sakharkar. "Forecasting of Stock Market Data Frame Analysis Using Relative Strength Index (RSI) and Deep Learning." In *Computer Science Engineering and Emerging Technologies*, pp. 109-113. CRC Press, 2024.
[62]. Reshma, V. K., Nancy Arya, Sayed Sayeed Ahmad, Ihab Wattar, Sreenivas Mekala, Shubham Joshi, and Daniel Krah. "[Retracted] Detection of Breast Cancer Using Histopathological Image Classification Dataset with Deep Learning Techniques." *BioMed Research International* 2022, no. 1 (2022): 8363850.
[63]. Agrawal, Vikash K., Lalit N. Patil, Vikas S. Panwar, Lalit K. Toke, Srinivasa Rao Bogireddy, Kaustabh Vijay Chavan, U. D. Nimbalkar, Mahesh M. Sonekar, and Narendra R. Bhople. "Optimizing ventilated disk brake design for enhanced thermal performance: an analytical and experimental approach." Multiscale and Multidisciplinary Modeling, Experiments and Design 8, no. 4 (2025): 213.

[64]. Bhuvaneswari, G., and G. Manikandan. "A novel machine learning framework for diagnosing the type 2 diabetics using temporal fuzzy ant miner decision tree classifier with temporal weighted genetic algorithm." *Computing* 100, no. 8 (2018): 759-772.
[65]. Ravuri, Ananda, R. Josphineleela, G. V. S. Kumar, and T. SathishKumar. "Machine learning-based distributed big data analytics framework for IoT applications." J. Electr. Syst. 20, no. 3 (2024): 1788-1802.
[66]. Sreeram, Indraneel, and Venkata Praveen Kumar Vuppala. "HTTP flood attack detection in application layer using machine learning metrics and bio inspired bat algorithm." Applied computing and informatics 15, no. 1 (2019): 59-66.
[67]. Cheekati, Venkateswararao, D. Natarajasivan, and S. Indraneel. "Ensemble approaches can aid in the early detection of coronary heart disease." (2021): 12224-12239.
[68]. Malarvizhi, Nandagopal, and V. Rhymend Uthariaraj. "A new mechanism for job scheduling in computational grid network environments." In International Conference on Active Media Technology, pp. 490-500. Berlin, Heidelberg: Springer Berlin Heidelberg, 2009.
[69]. Rajeshkumar, C., S. Siamala Devi, K. Ruba Soundar, G. Nallasivan, S. Amutha, and J. S. Sujin. "Cybersecurity Strategies for Enabling Smart City Resilience: Guardians of the Digital Realm." In *Cybersecurity and Data Science Innovations for Sustainable Development of HEICC*, pp. 459-472. CRC Press.
[70]. Seetha, J., D. Nagaraju, T. Kuntavai, and K. Gurnadha Gupta. "The Smart Detection and Analysis on Skin Tumor Disease Using Bio Imaging Deep Learning Algorithm." *ICTACT Journal on Image & Video Processing* 13, no. 4 (2023).
[71]. Prabhakara, T., V. Vidyasagar, and I. Naga. "Deep Long and Short Term Memory with Tunicate Swarm Algorithm for Skin Disease Detection and Classification." J. Electrical Systems 20, no. 7s (2024): 613-624.