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The Effect of Aircraft Type on Aircraft Maintenance of Selected Airlines Nairobi County

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Abstract

The aircraft maintenance industry, which is highly regulated and safety-critical, is currently encountering unprecedented challenges due to its complexity. Aircraft manufacturers were under pressure from their customers to design aircraft with extended maintenance intervals. The industry was experiencing a decline in customers, and the grounding of aircraft worldwide was resulting in significant decreases in business. The objective of the study was to determine the effects of aircraft type on aircraft maintenance of selected aviation companies in Kenya. The study used the resource-based theory. The study adopted an explanatory research design. The target population for the study was 135, comprising 40 engineers, 60 mechanics/technicians, 15 operations personnel, 10 ground handling staff, and 10 managers. This study used a census survey. A semi-structured questionnaire served as the primary data collection instrument. The data analysis was conducted using SPSS version 24, which is a Statistical Package for the Social Sciences. Data analysis involved the utilization of descriptive and inferential statistics. The descriptive statistics encompassed frequency, percentages, means, minimum and maximum values, as well as the standard deviation. The inferential statistics encompassed correlation and regression models. Data analysis results were displayed in tabular format. The study findings revealed that there was a positive linear effect of aircraft type and aircraft on aircraft maintenance ($\beta1=.244$, $p=0.030$). Technological advancements had a negative and significant moderating effect on the relationship between aircraft type and aircraft maintenance ($\beta=-.187$; $p<0.05$). The study concluded that aircraft type significantly affect maintenance requirements, emphasizing the need for customized maintenance strategies. The study recommends that the training programs for personnel. Collaborative efforts between aircraft manufacturers, maintenance organizations, and regulatory bodies are crucial to ensure a seamless adoption that improves efficiency and safety without compromising quality.

Keywords: Aircraft Type Maintenance, Aircraft Maintenance, Technological Advancements & Selected Airlines.

Introduction

Background of the Study

Aircraft maintenance encompasses various procedures aimed at guaranteeing the ongoing airworthiness of an aircraft or its components. These procedures include overhaul, inspection, replacement, defect rectification, and other related activities (Weerasekera, 2020). The main objective of aircraft maintenance is to ensure that the aircraft remains in a condition of airworthiness, which implies that it is safe for the crew, passengers, and anyone within its operational vicinity. Maintenance is a meticulous and continuous procedure that entails regular inspections of diverse elements, including engines, hydraulic and electrical systems, avionics, airframe, and landing gear, to guarantee their proper functioning and absence of defects or damages (Bergkvist & Sabbagh, 2021).

Aircraft maintenance is a crucial aspect of the aviation industry, involving various stakeholders such as the airline's maintenance team, aircraft manufacturer, regulatory authorities, and service providers (Mofokeng et al., 2020). Line maintenance checks, which are performed every 24 to 60 hours of accumulated flight time, are the most routine maintenance services (Weerasekera, 2020). Maintenance costs can account for up to 45% of an airline's total operating expenses, and can vary depending on the aircraft class and type. Factors such as older aircraft, complex aircraft types, and harsh environments can affect maintenance costs.

To reduce maintenance costs, airlines can invest in newer aircraft, schedule regular maintenance, and use predictive maintenance (Kinnison & Siddiqui, 2018). Newer aircraft are more fuel-efficient and require less maintenance than older ones. Regular maintenance helps identify and fix problems before they cause major damage, while predictive maintenance uses data to predict when maintenance is needed.

The aviation industry is subject to rigorous regulation, which includes the implementation of ongoing inspection programs by aviation authorities (Kinnison & Siddiqui, 2018). The Federal Aviation Administration (FAA) in the United States is responsible for supervising aircraft maintenance programs. One such program is the Continuous Airworthiness Maintenance Program (CAMP), which specifies regular and thorough inspections to guarantee the safety and airworthiness of aircraft. Airlines can enhance profitability and guarantee the safety and reliability of their aircraft by minimizing maintenance expenses (Russell et al., 2019).

The Malaysia Aviation Group (MAG) was a worldwide aviation conglomerate consisting of three distinct business divisions: Airlines, Loyalty and Travel Solutions (LTS), and Aviation Services. The Airlines business portfolio at that time included Malaysia Airlines, Firefly, MASwings, and AMAL by Malaysia Airlines. Malaysia Airlines served as the national carrier of Malaysia, while Firefly and MASwings were regional airlines that focused on serving communities within Malaysia. AMAL by Malaysia Airlines was a leading one-stop pilgrimage travel solutions center (Werne, 2016). MAG also prioritized its Aviation Services division, which encompasses maintenance, repair, and overhaul (MRO), cargo operations, ground handling, and training. This division includes MAB Engineering, MASKargo (a comprehensive cargo logistics and terminal operations service provider), Aerodarat Services (a ground handling solution provider), and MAB Academy (a center of excellence for aviation and hospitality training).

The Nigerian aircraft maintenance, repair, and overhaul market involves comprehensive procedures for repairing, servicing, and inspecting aircraft to guarantee their safety. The Nigerian market for aircraft maintenance, repair, and overhaul was categorized based on type. The market was categorized into engine, component, interior, airframe, modification,

and field maintenance based on type. The Nigerian aircraft maintenance, repair, and overhaul market exhibited a moderate level of competition, with notable participants such as ExecuJet, Sky Jet Aviation Services, AJW Group, Arik Air, and Jet Maintenance Solutions (Tokarski, 2021). The market was significantly influenced by the licensing approval granted by the Nigerian Civil Aviation Authority (NCAA) and the ability to maintain large fleets. Although Aero Contractors and 7Star Hangar had acquired licenses, their limited capability to handle only three to four aircraft maintenance tasks may have hindered their potential for expansion. Additionally, numerous prominent global entities were pursuing authorization from the NCAA, potentially resulting in heightened investments in Nigeria's aircraft maintenance, repair, and overhaul industry.

Aircraft maintenance in Kenya encompasses a sequence of necessary procedures that an aircraft undergoes during the assessment period. Optimizing speed, efficiency, and accuracy is crucial in ground handling services to minimize turnaround time. There was a positive correlation between faster turnaround maintenance and higher profits. According to Vos et al (2019), there existed multiple classifications of maintenance services. The items that were included are as follows: The purpose of Cabin Service is to enhance passenger comfort during the flight. The primary task of cabin cleaning entails the majority of the labor and restocking of consumable items on board. Catering encompassed the task of restocking the aircraft, which involved managing different aspects of passenger reservations. The ramp service was carried out using a unique set of procedures. The task entailed guiding the aircraft to its optimal location for both entry and exit points.

Various companies participated in providing ground handling support, with Kenya Airways and Swiss Port Limited being the prominent players. These companies collectively managed the needs of more than 230 million passengers, along with other services offered by related firms. Kenya Aerotech Limited was recognized as the dominant supplier of ground handling services in the East African region due to its effective capabilities and state-of-the-art equipment. The company's extensive experience in catering to global airlines has resulted in exceptional operational proficiency in offering comprehensive ground handling services (Mugoh, 2017). Additional companies such as Trade Winds Limited, Eurocraft Agencies Limited, and Africa Flight Services operated from Nairobi, Mombasa, and other major cities. Africa Flight Services (AFS) was a subsidiary of the global airport services group Worldwide Flight Services (WFS), which received a favorable vote. According to September 2016 data, AFS was the largest cargo handler in Nairobi. During the month, Jomo Kenyatta International Airport managed more than 54% of the total 19.4 million kilograms of import and export cargo (Mugoh, 2017).

Airlines in Nairobi County have access to a wide range of aircraft maintenance services, both from their own in-house facilities and from third-party providers (Koskei, 2023). This helps to ensure that their aircraft are well-maintained and meet the highest safety standards. Phoenix Aviation possesses state-of-the-art aircraft repair and maintenance facilities located at Wilson Airport in Nairobi. Their Aircraft Repair and Maintenance Organization (AMO) has received approval from the Kenya and Tanzania Civil Aviation Authorities, granting them the authority to conduct repair and maintenance operations for both their own fleet aircraft and aircraft belonging to other parties. SGS Kenya specializes in offering preventive and remedial maintenance services for the aviation industry to clients worldwide. Aberdair Aviation offers a range of services including the operation of both fixed-wing and helicopter aircraft, as well as aircraft maintenance, sales, and other related services. Wilson Airport is the most active general aviation airport in Africa and functions as the primary hub for maintaining small

aircraft in the region. Nevertheless, they do not provide maintenance services directly (Koskei, 2023).

Technology, which was a result of human intelligence, continued to advance as fast as man progressed qualitatively through the process of evolution (Berdimuratova & Mukhammadiyarova, 2020). However, though technology had really improved the quality of our lives, it had in most cases been accompanied by various deleterious consequences on our environment. Thus, the double-effect of our technological advancement gave us a major intellectual challenge as to which ethical code of behavior we should adopt so as to lead the best and enjoyable life possible without causing any environmental dereliction (Marcuse, 2017).

The incorporation of contemporary technologies has facilitated the implementation of condition-based maintenance, wherein maintenance activities are carried out according to the real-time condition of the aircraft rather than predetermined time intervals. This approach enhanced maintenance schedules, resulting in a reduction of unnecessary downtime and a decrease in operational expenses. Additionally, advanced technologies facilitated remote monitoring and diagnostics, allowing maintenance experts to assess and troubleshoot aircraft conditions from a central location, further streamlining the maintenance process (Ghaleb, Taghipour & Zolfagharinia, 2021).

Statement of the Problem

Historically, the field of aircraft maintenance was subject to strict regulations due to its critical role in ensuring safety. This industry encountered exceptional difficulties and complexities. Aircraft manufacturers faced pressure from their customers to design aircraft with extended maintenance intervals. The industry was experiencing a decrease in customers, and the large number of grounded aircraft worldwide was resulting in significant declines in business. Within the European-funded ergonomics/human factors project 'Human Integration in the Lifecycle of Aviation Systems,' a major European aircraft maintenance organization, as an industrial partner, proposed the following agenda to be addressed as part of the project's scope: enhancing the aircraft base maintenance check to enhance efficiency (both in terms of process and cost) and customer satisfaction, while simultaneously ensuring quality and safety.

Kenyan airlines continue to face challenges in crucial operational aspects such as on-time performance. These challenges arise from inadequate planning, system failures, and aircraft breakdowns caused by a failure to adhere to maintenance schedules. Additionally, there were problems with the loss and mishandling of baggage, including pilferage. The airline had limited capacity to carry customer bags, resulting in long passenger queues. This was exacerbated by an unreliable online check-in system and a shortage of aircraft to service the available routes. The level of service occasionally failed to meet customer expectations. In contrast, international airlines were increasing their capacity by utilizing wide-body aircraft, enhancing the quality of service both during ground operations and in-flight, and introducing innovative features. Roberts and Griffith (2019) conducted case studies on Ryanair in Europe and Southwest Airlines in the USA, demonstrating their successful implementation of an operations strategy focused on cost objectives through efficient operations. However, the reviewed literature failed to focus on technological advancements on aircraft conditions and aircraft maintenance. In addition, most of the studies were done in other regions and not Kenya. It was against this backdrop that the study sought to investigate the moderating effect

of technological advancements on the relationship between aircraft conditions and aircraft maintenance of selected airlines in Nairobi County.

Purpose of the Study

The aim of the study was to establish the effect of aircraft type on aircraft maintenance of selected airlines Nairobi County.

Research Objectives

To establish the effect of aircraft type on aircraft maintenance of selected airlines Nairobi County.

Hypotheses of the Study

H_{01} Aircraft type has no significant effect on aircraft maintenance of selected airlines in Nairobi County.

Literature review

In their study, Huang et al (2021) assessed the effectiveness of airlines and analyzed the factors contributing to inefficiency. This study utilized a two-stage network data envelopment analysis methodology and a truncated regression model to examine the operational efficiency of nine airlines based in the United States during the period from 2015 to 2019. The empirical findings indicate that airlines' operational efficiency consistently improved over the sample period, while their efficiency in terms of profitability remained stagnant. Hence, airlines required strategic resource allocations in order to achieve further enhancements in their overall efficiency. Low-cost airlines generally achieved higher efficiency scores compared to full-service airlines. The size of an airline, as measured by its total assets, positively affected its operating efficiency. However, a higher number of full-time employee equivalents had a negative impact on efficiency outcomes. This suggests that improving labor efficiency is crucial for airlines. The current study did not specify the type of aircraft.

Ong'esa (2020) examined the impact of organizational capability on the performance of Air Kenya Express Limited. The study concluded that the airline's performance was significantly influenced by its operational, human resource, marketing, and information communication and technology capabilities. The management of Air Kenya Express Limited should implement automated customer services, such as online booking and check-in, as well as effective methods for collecting customer feedback. These measures would be integrated to enhance the airline's service delivery. The marketing department should prioritize enhancing the features of new and existing products by investing in improved research and development.

Gwako (2018) aimed to investigate the measurement of supply chain performance in the aviation industry. The study aimed to identify the supply chain performance measures utilized by the company and to ascertain the difficulties faced in measuring supply chain performance. The research was carried out at Kenya Airways Ltd. Data was collected using a structured questionnaire and analyzed using descriptive statistics, specifically focusing on the mean. The research findings revealed that the company assessed multiple aspects of performance within their supply chain. The primary dimensions assessed encompassed Quality, Efficiency of the procurement operations, Inventory turnover, Quantity of Supplies rejections, Cost, Flexibility, and other relevant factors. The dimensions were regularly measured and the obtained results were communicated to both the internal channel members and the company's suppliers. The research findings indicated an increasing utilization of the supply chain concept and its

management within the company. In light of the impact of competition, globalization, and technological advancements on business operations, it was imperative to focus all efforts on cost-saving measures. Contrary to the present study, the previous study specifically examined the performance of the supply chain, while the current study is centered around the type of aircraft.

Resource Based Theory

The study was informed by the Resource-Based View Theory, which was formulated by Wernerfelt in 1984. The Resource-Based View Theory of strategy places significant emphasis on the role of individuals in the development of strategy. It specifically focuses on the factors of motivation, politics, and organizational culture, as well as the desires of individuals within the organization (Jackson et al., 2014). The resource-based business strategy theories offer an internal perspective on strategy development, aiming to explain the Aircraft maintenance outcomes that cannot be solely attributed to industry-level factors proposed by industry-based theories. Resource-based theories facilitated the formulation of business strategies that could exploit a company's distinctive resources.

This theory was relevant to this study since it proposed that the airport should have compared their skills with those of the markets and other firms and should not have outsourced core competencies or competencies involving special skills or strategies. The resource-based theory argues that possessing strategic resources gives an organization a valuable opportunity to gain competitive advantages over its competitors. The resource-based view (RBV) highlights the firm's resources as the primary factors that determine competitive advantage and performance.

Materials and Methods

Research Design

The study utilized an explanatory research design. This was chosen for the study because it played a crucial role in investigating the correlation between aircraft conditions and aircraft maintenance of specific airlines in Nairobi County.

Target Population

The target population for the study was senior employees at Jomo Kenyatta International and Wilson Airports. In total, the target population was 135 respondents which included 40 engineers, 60 mechanics/technicians, 15 operations personnel, 10 ground handling staff, and 10 managers because they had the required information concerning the moderating effect of technological advancements on the relationship between aircraft conditions and aircraft maintenance in Kenya.

Census Survey

This study employed a comprehensive census survey to gather data from every individual within the population. This was because the study focused on a small and easily controllable group of people, which meant that sampling was not necessary. Data was gathered from a total of 135 employees who work at Jomo Kenyatta International and Wilson Airports. The researcher successfully gathered precise and comprehensive data through the utilization of a census survey.

Research Instruments

The study utilized primary data. The primary instrument used for data collection was a semi-structured questionnaire. Questionnaires were a collection of inquiries that prompted responses from the research participants in a predetermined manner. As per Creswell and Hirose (2019), a questionnaire is a research tool used to collect data from a significant sample size. Questionnaires offer the benefit of acquiring standardized responses to items, enabling the comparison of different sets of data. The participants were afforded the opportunity to express their personal viewpoints on the matter in question.

Data Analysis Procedures

The process of data analysis entailed the meticulous tasks of purifying, organizing, and categorizing pertinent data obtained from the participants. The data analysis was conducted using SPSS version 24, which is a Statistical Package for the Social Sciences. Data analysis involved the utilization of descriptive and inferential statistics. The descriptive statistics encompassed frequency, percentages, means, minimum and maximum values, as well as the standard deviation. The inferential statistics encompassed correlation and regression models. Correlation facilitated the researcher in elucidating the linear association between independent variables and dependent variables. The correlation analysis revealed both the direction and magnitude of the relationship between the variables under study. Regression analysis was conducted to assess the correlation between the dependent and independent variables, with the aim of identifying the independent variable that most accurately predicted the value of the dependent variable.

Results and dicussion

Descriptive Statistics Findings for Aircraft Type Maintenance

The study objective was to establish the effect of aircraft type on aircraft maintenance of selected airlines Nairobi County. The study results are presented in the summary Table 1.

Table 1

Descriptive statistics Findings for Aircraft type maintenance

Statements		SA	A	UD	D	SD	Mean	Sd
The aircraft type has a significant effect on the level of maintenance required.	F	40	39	9	9	15	3.71	1.37
	%	35.7	34.8	8.0	8.0	13.4		
Aircraft with more complex systems require more frequent and extensive maintenance.	F	45	34	5	12	16	3.71	1.44
	%	40.2	30.4	4.5	10.7	14.3		
Well-maintained aircraft are less likely to experience mechanical problems.	F	11	23	8	31	39	2.42	1.39
	%	9.8	20.5	7.1	27.7	34.8		
Aircraft type varies with level of maintenance.	F	49	33	4	12	14	3.81	1.41
	%	43.8	29.5	3.6	10.7	12.5		
Maintenance frequency and system complexity jointly impact aircraft reliability and efficiency.	F	39	46	9	7	11	3.84	1.24
	%	34.8	41.1	8.0	6.3	9.8		
Total number of respondents (n=112)								

Sources: Research Data (2023)

The study results in Table 1 showed that majority 79(70.5%) of the respondents agreed that the aircraft type has a significant effect on the level of maintenance required. On contrary, 24.5(21.4%) of the respondents disagreed that the aircraft type has a significant effect on the level of maintenance required. The aircraft type has a significant effect on the level of maintenance required (Mean=3.71, standard deviation=1.37). Study findings by Deng (2020) align with the study results. Deng revealed that aircraft type indeed plays a crucial role in maintenance requirements. The study found that certain aircraft models with more advanced technology and complex systems tend to have higher maintenance demands compared to older, simpler aircraft.

Also, the study findings noted that 79(70.6%) of the respondents agreed and 18(25.0%) disagreed that aircraft with more complex systems require more frequent and extensive maintenance. It was further revealed that Aircraft with more complex systems require more frequent and extensive maintenance (Mean=3.71, standard deviation=1.44). Study conducted by Siyaev (2021) found results that aligned with the study findings. Their results revealed that aircraft with advanced and complex systems indeed necessitate more frequent and extensive maintenance procedures. This means that planes with advanced technologies and complicated systems often need more care and maintenance work to keep them running safely and efficiently.

The study further revealed that, 35(30.3%) of the participants agreed that well-maintained aircraft are less likely to experience mechanical problems. On contrary to that, 70(62.5%) of the respondents disagreed that well-maintained aircraft are less likely to experience mechanical problems. Well-maintained aircraft are less likely to experience mechanical problems (Mean=2.42, standard deviation=1.39). Contrastingly, a study conducted by Mofokeng (2020) reported findings that do not align with the statement. Their study showed that maintenance is important, but it is not the only reason why things break down. Mechanical problems can also be caused by things like the quality of the making, the environment, and the stresses of operation. These results show that there is not a direct link between maintenance practices and preventing mechanical problems. Instead, there is a more complicated set of factors at play.

The study nonetheless showed that 82(73.2%) of the participants agreed that Aircraft type varies with level of maintenance. On contrary to those findings, 16(23.2%) of the respondents disagreed that aircraft type varies with level of maintenance. Aircraft type varies with level of maintenance (Mean=3.81, standard deviation=1.41). A research by Kowalski, (2021) found results that align with the study findings. Their findings revealed that aircraft type indeed varies with the level of maintenance required. Their study demonstrated that different aircraft models and types have distinct maintenance profiles, influenced by factors such as design, technology, and operational demands. This corroborates the findings that aircraft type plays a significant role in determining maintenance needs.

Finally, 85(75.9%) agreed that maintenance frequency and system complexity jointly impact aircraft reliability and efficiency. However, 18(16.1%) of the respondents disagreed that maintenance frequency and system complexity jointly impact aircraft reliability and efficiency. Maintenance frequency and system complexity jointly impact aircraft reliability and efficiency (Mean=3.84, standard deviation=1.24). A study conducted by Insley (2020) agreed with the study findings. Their study found compelling evidence that maintenance frequency and system complexity indeed jointly impact aircraft reliability and efficiency. Their research emphasized that the interplay between these factors is critical in determining an aircraft's overall operational performance.

Inferential Statistics Results

A correlation analysis was conducted to assess the direction and strength of relationship between the study's independent and dependent variables. The findings are presented in Table 2 & 3.

Table 2
Correlation Analysis Results

		Aircraft type maintenance	Aircraft Maintenance
Aircraft type maintenance	Pearson Correlation Sig. (2-tailed)	1	
Aircraft Maintenance	Pearson Correlation Sig. (2-tailed)	.720** .000	1

**. Correlation is significant at the 0.01 level (2-tailed).

The findings in Table 2 indicated that Aircraft type and Aircraft maintenance had a positive strong and statistically significant correlation ($r= 0.720$; $p<0.01$).

Results for Multiple Regression Analysis

A regression analysis was conducted to determine the impact of independent variables on the dependent variable. The coefficient of determination (R2) and correlation coefficient (R) indicate the level of correlation between aircraft type, operational environment, airline maintenance policies, and aircraft maintenance. Table 3 displays the results.

Table 3
Interpretation of Multiple Regression Models

R	R Square	Adjusted R Square	Std. Error of the Estimate
.785[a]	.616	.605	.59679

The regression results in Table 2 show that the coefficient of determination (R^2) is 0.616 and the correlation coefficient (R) is 0.785. The R-value provides evidence of a robust linear correlation between the type of aircraft and the level of aircraft maintenance. The R^2 value denotes that the independent variables account for 78.5% of the variance in the dependent variable. This indicates that approximately 78.5% of the variability in aircraft maintenance can be accounted for by the regression model. Adjusted R^2 is a revised form of R^2 that has been corrected for the number of predictors in the model, ensuring it is not lower than what would be expected by chance. The adjusted R^2 value of 0.605 is marginally lower than the R^2 value.

Multiple Regression Model Fitness Results

The model's fitness was checked to test if it provided the best possible fit for the data. The study results were presented in Table 4.

Table 5
Multiple Regression Model Fitness Results

	Sum of Squares	df	Mean Square	F	Sig.
Regression	61.693	3	20.564	57.739	.000[b]
Residual	38.465	108	.356		
Total	100.159	111			

The F test, as shown in Table 5, offers a comprehensive assessment of the significance of the regression model that has been fitted. The F value signifies the significance of all the variables in the equation, indicating that the overall regression is statistically significant. The F-statistics obtained (F = 57.739) were statistically significant at p = 0.000, providing confirmation of the model's adequacy. Therefore, it can be inferred that the multiple regression model adequately matched the data. Hence aircraft type, operation environment, airline's maintenance policies have effects on aircraft maintenance therefore they should put emphasis on them.

Regression Model Coefficients

The execution of a regression model produced coefficients that can be utilized in the regression equation. The study's findings are outlined in Table 5.

Table 5
Regression Model Coefficients

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.898	.228		3.931	.000
Aircraft type maintenance	.242	.110	.244	2.193	.030

Table 5 indicates there was a positive linear effect of aircraft type on aircraft maintenance (β1=.244, p=0.030). This reveals that an increase in aircraft type leads to an increase in aircraft maintenance by 0.244 units. The resulting regression equation is as follows

$Y= 0.898 +0.244X_1$

Hypotheses Testing

The hypothesis H_{01} posited that the type of aircraft does not have a substantial impact on the maintenance of selected airlines in Nairobi County. The findings indicate that the type of aircraft has a statistically significant positive impact on the maintenance of selected airlines in Nairobi County (β_1=0.244, $p<0.05$), leading to the rejection of the null hypothesis H_{01}.

Conclusions and Recommendations

In conclusion, the research focus on different aircraft types uncovered distinct maintenance needs with airplanes indicating a substantial demand for high maintenance, possibly due to their intricate operational requirements. Contrasting this, rotorcraft exhibited a more balanced distribution of maintenance needs, suggesting a consistent range of demands. The study's examination of specific aircraft categories, such as gliders, lighter-than-air aircraft, and unmanned aerial vehicles (UAVs), revealed unique patterns of maintenance requirements, shedding light on the diverse factors influencing their servicing needs.

Theory recommendations: The study findings provide a foundation for developing new theoretical frameworks for understanding the complex and dynamic nature of aircraft maintenance. For example, the study's identification of distinct maintenance needs for different aircraft types could be used to develop a more nuanced understanding of the factors that influence aircraft reliability and safety.

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Conflict of Interest

The authors assert that they have no conflicts of interest pertaining to the publication of this paper.

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