AIRCRAFT CONDITIONS, TECHNOLOGICAL ADVANCEMENTS AND AIRCRAFT MAINTENANCE OF SELECTED AIRLINES IN NAIROBI COUNTY

BY

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A RESEARCH THESIS SUBMITTED TO THE SCHOOL OF BUSINESS AND ECONOMICS IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF EXECUTIVE MASTERS OF BUSINESS ADMINISTRATION DEGREE IN MANAGEMENT

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DECLARATION

Declaration by Candidate

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DEDICATION

I wish to dedicate this research thesis to my family for their inspiration, motivation, patience and their support in climbing the academic ladder.

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ABSTRACT

Aircraft maintenance was a highly regulated, safety-critical, complex industry that was facing unprecedented challenges. Pressure was on aircraft manufacturers, from their customers, to design aircraft with pushed-out maintenance schedules. Customers were disappearing from the industry, and grounded aircraft around the world were translating into substantial declines in business. The purpose of the study was to investigate the moderating effect of technological advancements on the relationship between aircraft conditions and aircraft maintenance of selected airlines in Nairobi County. The study was guided by the following specific objectives: to determine the effects of aircraft type, operational environment, and airline's maintenance policies on aircraft maintenance of selected aviation companies in Kenya. The study used the resource-based theory, theory of constraints, and control 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. The main data collection instrument was a semi-structured questionnaire. Statistical Package for the Social Sciences (SPSS) version 24 was used for data analysis. Descriptive and inferential statistics were used to analyse data. Descriptive statistics included frequency, percentages, means, minimum, and maximum, and standard deviation. Inferential statistics included correlation and regression models. Correlation showed the direction and strength of the relationship between study variables. Regression analysis examined the relationship between the dependent and independent variables that best predicted the value of the said dependent variable. Analysed data were presented in the form of tables. The study findings revealed that there was a positive linear effect of aircraft type and aircraft on aircraft maintenance (β_1=.244, p=0.030). Operation environment has a positive and significant effect on aircraft maintenance (β_2=.298, p=0.045). Airline's maintenance policies have a positive and significant effect on aircraft maintenance (β_3=.289, p=0.025). Technological advancements had a negative and significant moderating effect on the relationship between aircraft type and aircraft maintenance (β=-.187; $p<0.05$). Technological advancements has a negative and significant moderating effect on the relationship between operation environment and aircraft maintenance (β=-1.711; $p<0.05$). Technological advancements has a positive and significant moderating effect on the relationship between airline’s maintenance policies and aircraft maintenance (β=.673; $p<0.05$). The study concluded that aircraft type and operational environment significantly affect maintenance requirements, emphasizing the need for customized maintenance strategies. Airline maintenance policies are clear and easy to understand, with a majority of respondents finding them clear and up-to-date. The study recommends that the training programs for personnel. Continuous review of policies to remain relevant, clear, and easily understandable by maintenance personnel, thereby contributing to safer and more efficient practices. 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.

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ABBREVIATIONS

AFRAA	African Airlines Association
AFS	Africa Flight Services
BSC	Balanced scorecard
CAMP	Continuous Airworthiness Maintenance Program
CS	Customer Satisfaction
CSR	Corporate Social Responsibility
DEA	Data envelopment analysis
EASA	European Union Aviation Safety Agency
ES	Employee satisfaction
FAA	Federal Aviation Administration
IATA	International Air Transport Association
KCAA	Kenya Civil Aviation Authority
LTS	Loyalty and Travel Solutions
MAG	Malaysia Aviation Group
MRO	Maintenance, Repair and Overhaul
NACOSTI	National Commission for Science, Technology & Innovation
NCAA	Nigerian Civil Aviation Authority
SE	Scale efficiency
SPSS	Statistical Package for Social Sciences
TE	Technical Efficiency
TQM	Total Quality Management
USA	United States of America
WFS	Worldwide Flight Services

DEFINITION OF TERMS

Aircraft conditions refer to the overall state and operational status of an aircraft at a specific point in time (Cao, Wu, Su & Xu, 2015).

Aircraft maintenance refers to the measure of an aviation company's or airline's success in achieving its operational, financial, safety, and customer service goals (Sprong, Jiang & Polinder, 2020).

Aircraft type refers to a specific model or design of an aircraft that possesses distinct characteristics, specifications, and configurations (Ardil, 2021).

Airline's maintenance policies refer to the set of rules, guidelines, and procedures that govern the maintenance activities and practices for its fleet of aircraft (Lagos, Delgado & Klapp, 2020).

Operational environment refers to the conditions and factors that aircraft and flight crews encounter during flight operations (Kelly & Efthymiou, 2019).

Technological advancements refer to the progress and improvements made in various fields of science and engineering that lead to the development of new or enhanced technologies (Ranasinghe, Guan, Gardi & Sabatini, 2019).

CHAPTER ONE

INTRODUCTION

1.0 Overview

In the past, this chapter included the background of the study, statement of the problem, research objectives, research hypothesis, significance of the study, and the scope of the study.

1.1 Background of the Study

In the past, aircraft maintenance, also known as aircraft maintenance, referred to the comprehensive set of activities and processes undertaken to ensure the safety, airworthiness, and reliability of aircraft within an airline's fleet (Mofokeng, Mativenga & Marnewick, 2020). It was a critical aspect of the aviation industry and played a crucial role in ensuring the safe and efficient operation of aircraft during flight. Aircraft maintenance was a continuous and collaborative effort involving various stakeholders, including the airline's maintenance team, the aircraft manufacturer, regulatory authorities, and maintenance service providers. Through this collective effort, aviation airlines could ensure the highest level of safety, reliability, and performance of their aircraft, providing passengers with the confidence to travel and contributing to the overall success and sustainability of the aviation industry (Vieira & Loures, 2016).

Line maintenance checks were the most routine. Sometimes called post-flight, maintenance pre-flight, service check, and overnight checks, these were the most typical maintenance services performed on aircraft (Knežević, 2018). Line checks required minimal tools and were usually done at the airport gate under the "open sky." Line checks happened the most frequently, as they covered basic inspection checks. Commonly, aircraft maintenance technicians inspected things like wheels, brakes, and fluid levels (oil, hydraulics) during line checks. Performing a line maintenance check ensured an aircraft was airworthy and safe to continue service. Aircraft needed line maintenance every 24 to 60 hours of accumulated flight time, but it depended on the operator of the aircraft (Weerasekera, 2020).

The cost of maintenance was a major factor in the aviation industry. It could account for up to 45% of the total operating expenses for an airline. Maintenance costs varied according to the class of aircraft, for example, jets vs. turboprops vs. pistons vs. helicopters. Maintenance costs also varied according to aircraft type, that is, a light jet vs. a medium vs. a long range (Fu, Zhang & Lei, Z2018). Regardless of the class or type of aircraft, industry literature, surveys, records, and conversations indicated that maintenance costs could range from 10 to 45 percent of the total yearly operating expenses. The cost of maintenance could be affected by a number of factors, including: Older aircraft tended to require more maintenance than newer aircraft. Also, some aircraft types were more complex and required more maintenance than others. In addition, aircraft that operated in harsh environments, such as hot and humid climates, tended to require more maintenance. The cost of maintenance could have a significant impact on an airline's profitability. Airlines with high maintenance costs might have had to charge higher fares or reduce the number of flights they offered in order to remain profitable (Harris, 2017).

There were a number of things that airlines could do to reduce their maintenance costs. These included, first, investing in newer aircraft. Newer aircraft tended to be more fuel-efficient and required less maintenance than older aircraft. Scheduling regular maintenance, regular maintenance could help to identify and fix problems before they caused major damage (Morrell, 2020). In addition, using predictive maintenance.

Predictive maintenance used data to predict when maintenance was needed, which could help to reduce the number of unexpected repairs. The cost of maintenance was a complex issue, but it was one that was important for airlines to understand. By taking steps to reduce their maintenance costs, airlines could improve their profitability and ensure that their aircraft were safe and reliable (Wensveen & Leick, 2019).

The aviation industry was highly regulated, meaning that airlines and other commercial airline companies had to practice continuous inspection programs established by aviation authorities (Kinnison & Siddiqui, 2018). In the United States, aircraft maintenance programs were overseen by the Federal Aviation Administration (FAA). The FAA required each airline/operator to establish a Continuous Airworthiness Maintenance Program (CAMP). The CAMP outlined routine and detailed inspections or "checks" of aircraft they had in their fleet. Checks were important to continually perform as they kept aircraft safe and airworthy. Having such a rigorous maintenance program ensured that passengers would get to their destinations safely on an aircraft that had been fully vetted for any issues prior to leaving the airport gate (Russell et al., 2019).

Malaysia Aviation Group (MAG) was a global aviation organization comprising three focused business portfolios from Airlines, Loyalty and Travel Solutions (LTS) and Aviation Services. Its Airlines business portfolio at that time served the global, domestic, and segmented market and comprised Malaysia Airlines – the national carrier of Malaysia, Firefly and MASwings the regional airlines focused on serving communities across Malaysia, and AMAL by Malaysia Airlines – leading one-stop pilgrimage travel solutions center (Werne, 2016). MAG also focused on Aviation Services business such as maintenance, repair, and overhaul (MRO), cargo, ground handling, and training that housed MAB Engineering, MASKargo – one-stop cargo logistic and terminal operations service provider, Aerodarat Services– one-stop ground handling solution provider, and MAB Academy – one-stop Aviation and Hospitality Centre of Excellence.

The Nigerian aircraft maintenance, repair, and overhaul market encompassed all types of repairs, service, or inspection of an aircraft to ensure its safety. The Nigerian aircraft maintenance, repair, and overhaul market was segmented by type. By type, the market was segmented into engine, component, interior, airframe, modification, and field maintenance. The Nigerian market for aircraft maintenance, repair, and overhaul was moderately competitive, with a few key players including ExecuJet, Sky Jet Aviation Services, AJW Group, Arik Air, and Jet Maintenance Solutions (Tokarski, 2021). The licensing approval from the Nigerian Civil Aviation Authority (NCAA) and the capacity to maintain large fleets were significant drivers of the market. While Aero Contractors and 7Star Hangar had obtained licenses, their capacity to handle only three to four aircraft maintenance may have posed a potential constraint to their growth. Several other major players worldwide were also seeking approval from the NCAA, which could have led to increased investments in the aircraft maintenance, repair, and overhaul sector throughout Nigeria.

Aircraft maintenance in Kenya was described as a series of actions that an aircraft needed during the period of assessment. Speed, efficiency, and accuracy were important in ground handling services in order to minimize the turnaround time. Faster turnaround maintenance was correlated to better profits. There were several categories of maintenance services (Vos, Santos & Omondi, 2019). They included; Cabin Service-It aimed at providing passenger comfort during the flight. Cabin cleaning involved the bulk of the effort and replenishing onboard consumables. Catering involved replenishment of stock to the aircraft that included various aspects of passenger reservations. Ramp service was conducted in a special form of prons. It involved directing the aircraft to its ideal position for both entry and exit positions.

Different firms were involved in ground handling support that included; Kenya Airways and Swiss Port Limited as key players that handled over 230 million passengers and other related companies' services. Kenya Aerotech Limited was regarded as the largest provider of ground handling services in the E.A. region through its efficient capabilities and equipment. The company's experience in serving world airlines had ensured excellent operational expertise in provision of ground handling survey all round (Mugoh, 2017). Other companies included Trade Winds Limited, Eurocraft Agencies Limited, Africa Flight services among others that operated from Nairobi, Mombasa, and other big cities. Africa Flight Services (AFS) was part of Worldwide Flight Services (WFS) global airport services group it was voted. In Nairobi, AFS was then the largest cargo handler, according to data for September 2016. It handled over 54% of the 19.4 million kilos of import and export cargo moving through Jomo Kenyatta International Airport during the month (Trans global, 2016).

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 (Muyesu & Kimaku, 2023). This helps to ensure that their aircraft are well-maintained and meet the highest safety standards. Phoenix Aviation owns modern aircraft repair and maintenance facilities at Wilson Airport in Nairobi. Their Aircraft Repair and Maintenance Organization (AMO) is approved by the Kenya and Tanzania Civil Aviation Authorities, allowing them to perform repair and maintenance activities for all their fleet aircraft and third-party aircraft (Gilbert & Njuguna, 2022). SGS Kenya specializes in providing preventative and corrective maintenance services for the aviation sector for clients across the globe. Aberdair Aviation operates both fixed-wing and helicopter aircraft while also providing supporting aircraft maintenance, sales, and other services. Wilson Airport is the busiest general aviation airport in Africa and serves as the regional small aircraft maintenance center. However, they do not offer maintenance services themselves (Holovniak, 2020).

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 integration of modern technologies also enabled condition-based maintenance, where maintenance actions were performed based on the actual condition of the aircraft rather than fixed time intervals. This approach optimized maintenance schedules, reducing unnecessary downtime and lowering operational costs. 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).

1.2 Statement of the Problem

In the past, aircraft maintenance was a highly regulated, safety-critical, complex industry that faced unprecedented challenges. Pressure was on aircraft manufacturers, from their customers, to design aircraft with pushed-out maintenance schedules. Customers were disappearing from the industry, and grounded aircraft around the world were translating into substantial declines in business. As part of the European-funded ergonomics/human factors project 'Human Integration in the Lifecycle of Aviation Systems,' one of the industrial partners, a large European aircraft maintenance organization, set forward the following agenda to be covered as part of the project's remit: to improve the aircraft base maintenance check with the aim of improving efficiency (process and cost) and customer satisfaction while at the same time ensuring quality and safety.

Kenyan airlines were still struggling with key operational areas like on-time performance, which resulted from sub-optimal planning, system failure, aircraft breakdown due to lack of adherence to the maintenance schedules. There were also issues of baggage loss and mishandling (pilferage), less capacity to carry customer bags, long passenger queues due to unreliable on-line check-in system and fewer numbers of aircraft to operate the available routes. Quality of service sometimes fell below customer expectations. On the other hand, foreign airlines were bringing on board capacity by operating wide-body aircraft, quality of service both on the ground and in-flight, as well as innovations. Roberts and Griffith (2019) in their cited case studies about Ryanair in Europe and Southwest airlines in the USA successfully implemented their operations strategy based on cost objectives through efficient operations. The efficiency was driven by: short turn-rounds, uniform fleet for standardization of parts and maintenance, economies of scale due to manufacturer discounts, lowest fares, direct sale of tickets to customers avoiding travel agency costs and nil meals. Nyamwange (2001) investigated operations strategies applied for competitiveness of Kenya large manufacturing firms and found out that implementation and management of strategy is key and everyone has to be involved. 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.

1.3 Research Objectives

The study was be guided by both general and specific objectives;

1.3.1 General Objective

The main objectives of this study was to investigate the moderating effect of technological advancements on the relationship between aircraft conditions and aircraft maintenance of selected airlines in Nairobi County.

1.3.2 Specific Objectives

i. To establish the effect of aircraft type on aircraft maintenance of selected airlines Nairobi County
ii. To determine the effects of operation environment on aircraft maintenance of selected airlines Nairobi County
iii. To assess the effect of airline's maintenance policies on aircraft maintenance of selected airlines in Nairobi County

iv. iv)a. To determine the moderating effect of technological advancements on the relationship between Aircraft type maintenance of selected airlines in Nairobi County

v. iv)b. To determine the moderating effect of technological advancements on the relationship between operation environment and aircraft maintenance of selected airlines in Nairobi County.

vi. iv)c. To determine the moderating effect of technological advancements on the relationship between airline's maintenance policies and aircraft maintenance of selected airlines in Nairobi County.

1.4 Research Hypotheses

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

H_{02} Operation environment has no significant effect on aircraft maintenance of selected airlines in Nairobi County

H_{03} Airline's maintenance policies has no significant effect on aircraft maintenance of selected airlines in Nairobi County

H_{04a} Technological advancements has no significant effect on the relationship between Aircraft type maintenance of selected airlines in Nairobi County.

H_{04b} Technological advancements has no significant effect on the relationship between operation environment and aircraft maintenance of selected airlines in Nairobi County.

H_{04c} Technological advancements has no significant effect on the relationship between airline's maintenance policies and aircraft maintenance of selected airlines in Nairobi County.

1.5 Significance of the Study

This study's findings were useful to various stakeholders in the aviation industry. The information was helpful to airline management in determining the appropriate technological strategies to put in place to enhance maintenance of aircraft for aviation firms. Airline governing bodies like ICAO, FAA, EASA, KCAA, AFRAA, and IATA could learn about the kind of support the airlines needed and offer relevant training to enhance appropriate technological development. Investors in the aviation industry, both current and potential, were able to get information on trends in the airline industry as a result of strategy implementation. Customers were able to know about developments in the airline industry, and they could be part of the future developments in the industry by actively giving their feedback, which could form a basis for strategy formulation. Travel agents were also made aware of the technology and other innovations in the low-cost framework adopted by some airlines. The study's findings were available to academicians and researchers for reference. The study gave a base for future research, thereby contributing to the existing body of knowledge.

1.6 Scope of the Study

The main aim of this study was to investigate the moderating effect of technological advancements on the relationship between aircraft conditions and aircraft maintenance of selected airlines in Nairobi County. The contextual scope of the study was limited to an examination of the moderating effect of technological advancements on the relationship between aircraft conditions and aircraft maintenance. The geographical scope of the study was limited to airline firms operating in Kenya. The study was carried out of selected airlines in Nairobi County. The study was conducted from the month of August to November 2023.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This section reviewed other literatures done by other scholars in relation to study objectives.

2.1 The Concept Aircraft maintenance

Aircraft maintenance is the process of ensuring that an aircraft is safe and reliable for flight through regular inspections, repairs, and replacements of its components, systems, and structures. It is a critical aspect of aviation safety, as even minor malfunctions or defects can have serious consequences in the air (Latorella & Prabhu, 2017). Aircraft maintenance is governed by strict regulations and standards set by national and international aviation authorities, and it requires skilled technicians and mechanics to perform the necessary tasks. The main objective of aircraft maintenance is to keep aircraft in airworthy condition, meaning that they are safe to fly and meet the required performance standards set by aviation authorities. This involves regular checks of various components, such as engines, hydraulic and electrical systems, avionics, airframe, and landing gear, to ensure that they are functioning properly and free from defects or damages (Tavares & De Castro, 2017).

Aircraft maintenance is that part of the process of aircraft technical activity which is conducted on aircraft whilst it remains in the line maintenance or base maintenance environment. Aircraft maintenance is intended to keep the aircraft in a state which will or has enabled a certificate of release to service to be issued. A hangar environment may be available but is often not necessary. Maintenance will consist of a mixture of preventive and corrective work, including precautionary work to ensure that there have been no undetected chance failures (Latorella & Prabhu, 2017).

The maintenance activities in aviation airlines are governed by stringent regulations and standards set by aviation authorities, such as the International Civil Aviation Organisation (ICAO), Federal Aviation Administration (FAA) in the United States or the European Union Aviation Safety Agency (EASA) in Europe. These regulatory bodies dictate the requirements for maintenance programs, the qualifications of maintenance personnel, and the documentation and record-keeping practices (Batuwangala, Gardi & Sabatini, 2016). Compliance with these regulations is crucial to obtain and maintain the necessary airworthiness certifications for the aircraft. Aircraft maintenance is conducted by highly skilled and trained maintenance engineers, technicians, and mechanics. These professionals are responsible for performing a wide range of tasks, from routine checks and inspections to more complex repairs and overhauls. They utilize specialized equipment, diagnostic tools, and technical manuals provided by aircraft manufacturers to ensure that the maintenance is carried out according to industry best practices (Rao, Chaitanya & Vidhu, 2017).

Furthermore, modern aviation airlines employ advanced technologies, such as condition monitoring systems, data analytics, and predictive maintenance algorithms, to enhance the efficiency and effectiveness of maintenance operations. These technologies enable real-time monitoring of aircraft systems, the early detection of potential issues, and the ability to perform maintenance actions proactively based on the actual condition of the aircraft, known as condition-based maintenance (Pech, Vrchota & Bednář, 2021). Aircraft maintenance is a continuous and collaborative effort involving various stakeholders, including the airline's maintenance team, the aircraft manufacturer, regulatory authorities, and maintenance service providers. Through this collective effort, aviation airlines can ensure the highest level of safety, reliability, and performance of their aircraft, providing passengers with the confidence to travel and contributing to the overall success and sustainability of the aviation industry (Al Sarrah, Ajmal & Mertzanis 2021).

2.2 Concept of Technological Advancements

Technological advancements refer to the continuous progress and improvements made in various fields of science and engineering that lead to the development of new and enhanced technologies (Pan, 2018). It involves the application of knowledge and innovation to create more efficient, sophisticated, and advanced solutions to address existing challenges or to meet evolving needs. These advancements span across diverse domains, including information technology, biotechnology, artificial intelligence, renewable energy, robotics, space exploration, and more. In essence, technological advancements drive societal progress by providing solutions that enhance our daily lives, industries, and economies.

The pace of technological advancements has accelerated significantly in recent times, fueled by factors like increased computing power, access to vast amounts of data, collaboration among researchers and organizations globally, and the drive to address pressing global challenges (Li, Hou & Wu, 2017). As technology continues to evolve, it holds the potential to revolutionize multiple sectors, solve complex problems, and shape the course of humanity's future. However, it also raises ethical, societal, and environmental considerations, highlighting the need for responsible and thoughtful implementation to ensure that these advancements lead to a better and sustainable world. They enable us to achieve tasks more efficiently, improve communication, access information readily, and open up new possibilities that were previously unimaginable. From the invention of the wheel to the advent of the internet, every major technological advancement has had a profound impact on human civilization, transforming the way we live, work, and interact with the world (Kotler, Kartajaya & Setiawan, 2021).

Technological advancements have a significant effect on the airlines' maintenance practices. As new technologies emerge and are integrated into aircraft design and maintenance processes, they bring about improved monitoring, diagnostics, and maintenance capabilities (Sreenath, Sudhakar & Yusop 2021). This, in turn, enhances the overall efficiency and safety of aviation operations. Traditionally, aircraft maintenance heavily relied on manual inspections and periodic checks to identify potential issues and ensure airworthiness. However, with the advent of advanced sensors, data analytics, and predictive maintenance algorithms, airlines can now proactively monitor the condition of their aircraft in real-time. These technologies continuously collect and analyze data from various aircraft systems, allowing maintenance teams to detect early signs of wear, damage, or component failures (Korba et al., 2021).

Technological advancements play a vital role in ensuring compliance with strict aviation regulations and safety standards. With better data-driven insights, airlines can demonstrate the airworthiness of their fleets more effectively to regulatory authorities, fostering trust and confidence in their operations (Du, Cheng & Yao, 2021). Technological advancements act as a crucial enabler in the relationship between aircraft conditions and aviation airlines' maintenance practices. By embracing and integrating these innovations, airlines can proactively manage the health of their aircraft, minimize disruptions, and ultimately enhance the safety, efficiency, and reliability of their operations (Torres, 2016).

2.3 Theoretical Review

The study used the resource-based theory, theory of constraints, and control theory

2.3.1 Resource Based theory

This study was guided by Resource-Based View Theory developed by Wernerfelt in 1984. Resource-Based View Theory of strategy emphasized the people element in strategy development and highlighted the motivation, politics, and cultures of organizations and the desires of individuals (Jackson, 2014). Resource-based business strategy theories provided an inside-out approach to strategy formulation, emerging to help explain many of the Aircraft maintenance results that could not necessarily be traced to industry-level factors proposed by industry-based theories. Resource-based theories promoted the development of business strategies that could leverage a firm's unique 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. Resource-based theory contended that the possession of strategic resources provided an organization with a golden opportunity to develop competitive advantages over its rivals. The resource-based view (RBV) emphasized the firm’s resources as the fundamental determinants of competitive advantage and performance.

2.3.2 Theory of Constraints

The theory of constraints (TOC) is an overall management philosophy introduced by Goldratt (1984). The theory of constraints (TOC) is a management paradigm that views any manageable system as being limited in achieving more of its goals by a very small number of constraints. The primary theoretical anchorage of this study is the Theory of Constraints (TOC), a management paradigm that postulates that any manageable system faces a number of constraints that limit the achievement of its organizational goals (Moyo, 2016). The TOC largely takes a process-based view of Aircraft maintenance and identifies the rate determining steps, that is, those that are most critical in affecting project performance, and by extension, Aircraft maintenance. When these are resolved, they have a net effect of enhancing the flow of work and effective allocation and distribution of firm resources (Şimşit, Gunay & Vayvay, 2014).

In applying TOC to airport capacity, there is recognition of the fact that existing and future constraints are liable to become business growth risks. Risk events are thus prioritized according to their potential impact at any given stage in a business. Using the feedback loop implied in the last focusing step of TOC approach ensures that risk events are effectively managed by continually reducing the most critical current risk, thereby ensuring that the overall risk is reduced gradually, continually and systematically. This ensures that scarce resources are directed at managing the risks that may impact adversely on the business at any given point, and that emergent risks obtain the required attention, in terms of resource allocation, at the right stage.

2.3.3 Control Theory

Control theory, invented by Eisenhardt (1985) uses the notion of modes of control to describe all attempts to ensure that individuals in organizations act in a way that is consistent with organizational goals and objectives (Kirsch, 1997). The concept of control is based on the premise that the controller and the controlee have different interests. These different interests will be overcome by the controller's modes of control (Tiwana, 2009). Modes of control may distinguish between formal and informal mechanisms. Formal modes of control are defined as Behavior control and Outcome control. Behaviour control consists of articulated roles and procedures and rewards based upon those rules. Outcome control is mechanisms for assigning rewards based on articulated goals and outcomes. The informal modes of control are carried out by the control modes labelled as clan and self. Clan are the mechanisms of a group sharing common values, beliefs, problems, and these mechanisms work through activities as hiring & training of staff, socialization etc. The control mode of the self is about individually defined goals and can be carried through the mechanisms of individual empowerment, self-management, self-set goals (Hauck & Prugl, 2015).

In order for the project manager to control cost and schedules during the project execution phase, he has to come up with different modes that ensure that teams are compliant. The control mechanisms and rules must also be aligned with the overall construction goals as well as the goals of individual teams. Based on this understanding, PM this research will use control theory to focus on modes of monitoring in different phases of business implementation.

2.4 Empirical Review

This section covered the empirical review related to study variables.

2.4.1 Aircraft type maintenance Of Selected Aviation Airlines

Huang, Hsu, and Collar (2021) evaluated airline performance and disentangled the causes of inefficiency. This paper applied a two-stage network data envelopment analysis approach and a truncated regression to investigate the performance of nine U.S.-based airlines from 2015 to 2019. The empirical results revealed that during the sample period, airlines' operating efficiency steadily improved, but the efficiency in the profitability stage stagnated. Therefore, strategic resource allocations were needed for airlines to see further advances in their overall efficiency. On average, airlines operating in the low-cost business model yielded higher efficiency scores than their peers operating in the full-service framework. While an airline's size, measured in terms of total assets, had a positive influence on operating efficiency, a larger number of full-time employee equivalents hindered efficiency outcomes, which indicated the importance of enhancing labor efficiency among carriers. Aircraft type was not indicated, as in the case of the current study.

Ong'esa (2020) investigated the effects of organizational capability on the performance of Air Kenya Express Limited. The study deduced that the operational, human resource, marketing, and information communication and technology capabilities possessed a significant impact on the airline's performance. Air Kenya Express Limited management ought to have automated customer services such as online booking and check-in while at the same time using effective methods for customer feedback collection that would be incorporated to improve the airline's service delivery. The marketing department ought to have improved research and development to enhance the features of new and existing products.

Gwako (2018) sought to explore Supply Chain Performance Measurement in the Aviation Industry. The key objectives of the study were to establish the supply chain performance measures used by the company and to determine the challenges encountered in supply chain performance measurement. The study was conducted at

Kenya Airways Ltd. Primary data was collected through the use of a structured questionnaire and subsequently analyzed using descriptive statistics, mainly the mean. The research findings indicated that the company measured several dimensions of performance within their supply chain. Major dimensions measured included Quality, Effectiveness of the procurement activities, Stock turnover, Number of Supplies rejections, Cost, Flexibility, among others. These dimensions were measured regularly, and the results obtained were communicated to the internal channel members, as well as the company's suppliers. The research findings revealed a growing application of the concept of supply chain and its management in the company. As competition, globalization, and technological advancements continued to affect how business was done, every effort should have been geared towards ways of saving on costs. The study, however, focused on supply chain performance, unlike the current study, which is on aircraft type.

2.4.2 Operation Environment and Aircraft maintenance of Selected Aviation Airlines

Using data from 2014 to 2018 of 31 global airlines, Kim and Son (2021) compared environmental efficiency in the aviation industry by continent and individual airline. Data envelopment analysis (DEA), which was actively used in efficiency studies, was adopted as an analysis method. The study found out that, first, airlines in Europe and Russia had the highest environmental efficiency, and airlines in North America and Canada were the second highest, which could be a good benchmark for other airlines. Second, in technical efficiency (TE) values, airlines in Africa and the Middle East and Latin America generally had low efficiency; but, in the airlines in Africa and the Middle East, environmental efficiency steadily improved slightly. In comparison, airlines in Latin America showed a decrease in environmental efficiency value, requiring a lot of effort and investment to improve efficiency. Third, for airlines in North America and Canada, the scale efficiency (SE) value was the lowest, even though there was a high level of overall environmental efficiency, indicating the need for efficiency improvement through economies of scale. This study had implications, in that, it suggested how airlines could perform efficient environmental management for sustainability according to the continent to which they belonged. The study was done in global states, that is, Europe, USA, and China hence its results could not be used to generalize for the findings of the current study.

Gwako (2018) investigated the relationship between Total Quality Management (TQM) and OP: Empirical Evidence from Selected Airlines in Nigeria Aviation Industry. Total Quality Management (TQM) was perceived to be a very important factor for an organization's long-term success, and its implementation was an important aspect of increasing operational efficiency. The results indicated that Customer Satisfaction (CS) and Employee satisfaction (ES), which served as the dimensions of TQM, had a favorable connection with OP. Therefore, to make use of these outcomes, it merely implied that organizations needed to pay more attention to achieving TQM in terms of products or services by efficiently fulfilling their customers and staff need, as they served as criteria for OP, which ultimately led to organizational diversification. The study, however, was specific on Total Quality Management (TQM), unlike the current study, which is general on the operational environment.

Mukhezakule and Tefera (2019) assessed the relationship between corporate strategy, strategic leadership, and sustainable organizational performance of the South African aviation industry. The aviation industry was one of the main supporters of the growth of the tourism and hospitality sectors in most countries. Specifically, it was crucial in linking clients/customers to touristic destinations. Some of the African aviation companies had emerged at the frontier of global markets, even though evidence suggested that the majority were essentially uncompetitive. Their failure was not merely on market share dominance in the global aviation marketplace but also on leadership. The lack of an efficient and effective aviation service could adversely affect and hinder the growth of the tourism industry. It was therefore high time for the aviation industry to be robust and become highly competitive in nature so as to enhance the tourism sector and eventually the country's economy. In South Africa, there had been a total collapse of 'fair' competition due to anti-competitive behaviors associated with some airline companies. The economic conditions and the nature of competition had resulted in the creation of a hindrance for a new entrant to penetrate the market. In addition, most of the airlines had limitations in gaining and sustaining competitive advantages. This could be attributed to challenges the industry faced with regards to its leadership.

Ombuna and Obere (2019) sought to investigate employee relations and organization performance of selected aviation firms in Kenya. To accomplish the research objective, the study employed descriptive survey research design with a target population of 2512 with a sample size of 251 as 10% employees of the selected Kenyan aviation firms. Descriptive and inferential statistics were applied in data analysis with support of Statistical Package for Social Sciences (SPSS, version 20). With the aim to find out the relationship between the variables regression analysis was in use. By use of the four research objectives on how Leadership practices, Healthy and safe work environment, organization commitment, and reward system affect organization performance presented using bar charts, graphs, and tables revealed that all the four objectives had a major positive effect on the aircraft maintenance of the selected Kenyan aviation firms.

It was not clear, however, from the study how the operational environment influences aircraft maintenance of aviation airlines.

Njeri and Susan (2018) sought to establish the influence of macro-environmental factors on organizational performance of Kenya Airways. Data was grouped into frequency distribution tables to indicate variable values and the number of occurrences in terms of frequency. Tables and other graphical presentations were used to present the data collected for ease of understanding and analysis. In addition, multiple regression was used. The study established that political and legal factors affected the organizational performance of Kenya Airways Limited. The study found that economic factors affected organizational performance of Kenya Airways Limited. The study revealed that technological factors affected organizational performance of Kenya Airways Limited. The study found that social factors affected the organizational performance of Kenya Airways Limited. The airline business depended on the well-being of international trade and the stability of the environment in which they operated. Kenya Airways should have taken great interest in the macro-environmental forces of its markets both locally and internationally. Statistics indicated that Kenya Airways posted a $290m loss in the 2014/2015 financial year, and this was largely attributed to changes in the macro-environmental forces. The effect of macro-environmental forces on the organizational performance of the airline industry especially in Kenya had received little attention in academic research. The study was very important in informing the current study on the operational environment influences aircraft maintenance of aviation airlines.

2.4.3 Airline's Maintenance Policies and Aircraft maintenance of Selected Aviation

Meissner, Rahn and Wicke (2021) did a study on developing prescriptive maintenance strategies in the aviation industry based on a discrete-event simulation framework for post-prognostics decision making. The aviation industry is facing an ever-increasing competition to lower its operating cost. Simultaneously, new factors, such as sustainability and customer experience, become more important to differentiate from competitors. As aircraft maintenance contributes about 20% to the overall cost of airline operations and can significantly influence other objectives of an airline as well, maintenance providers are required to constantly lower their cost share and contribute to a more reliable and sustainable aircraft operation. Subsequently, new condition-monitoring technologies have emerged that are expected to improve maintenance operations by reducing cost and increasing the aircraft's availability. As many of these technologies are still in their technological infancy, it is necessary to determine the expected benefit for the airline operations with the given technological maturity and to develop suitable maintenance strategies that incorporate the newly gained insights. Therefore, it enables the adjustment of the optimization goal for the developed strategy to incorporate performance features beyond the frequently used financial indicators. The developed capabilities will be demonstrated for the tire pressure measurement task of an Airbus A320.

Pereira and Caetano (2017) aimed to identify the business models adopted by airlines and identify how the innovation occurs at these organizations. The methodology adopted is characterized as empirical, exploratory and descriptive research by multiple case study with three major Brazilian airlines. The results demonstrate that the search for paradigm breaks, related to the dichotomic traditional models of low-cost and full-service, toward hybrid business models occur linearly, as examples highlighted by companies, in which internal changes in business models are considered major organizational innovations. The business models innovation in airlines can contribute to the creation of value, competitive advantage and profitability with new possibilities of action.

Namukasa, (2018) examined the influence of airline service quality on passenger satisfaction and loyalty. To achieve this, the research was guided by four specific objectives to which data collection was affected mainly by interview method using fully structured questionnaires. The study used random sampling technique and it covered 303 respondents on international flights using Entebbe International Airport. Data was analyzed using SPSS 16, where chi-square was used to determine the relationship between variables. In Uganda there is no study that has been carried out examining the influence of airline service quality on passenger satisfaction and loyalty. Findings indicate that the quality of pre-flight, inflight and post-flight services have a statistically significant effect on passenger satisfaction. In addition to that, passenger satisfaction as a mediating variable also had a significant effect on passenger loyalty. It was noted that passenger satisfaction differed from person to person as some were more interested in off board facilities, others onboard, others in the quality of food while others wanted more extra luggage. The study however focused on passenger satisfaction unlike the current study which is general on organization performance.

Cowper-Smith and De Grosbois (2019) identifies initiatives related to corporate social responsibility (CSR) in the airline industry and evaluates the overall state of their adoption as reported by members of the three largest airline alliances. Of 41 airlines, only 14 had annual CSR reports publicly available in January 2009. Reports were analyzed using a qualitative content analysis approach. Results showed a stronger focus on environmental issues than on the social or economic dimensions of CSR. Of the seven major environmental themes examined, emission reduction programs predominate. Other environmental issues receive much less attention, with no single other initiative implemented by all airlines. Four social and environmental themes were found, including employee wellbeing and engagement, diversity and social equity, community wellbeing and economic prosperity. The data analysis supported the arguments made in the literature that the airlines report CSR initiatives using differing or inconsistent measurements, making evaluation and comparison of their performance and effectiveness difficult.

2.5 Literature Gaps

The reviewed literature revealed a very important information on aircraft maintenance of selected aviation airlines. Ogachi and Zoltan (2020) uncovered that the studied carriers undertook philanthropic responsibilities whereby the average responses gave a total mean of 4.582 (SD=0.544) suggesting that dominant part of the respondents unequivocally concurred with the things contained in the poll understudy. The discoveries additionally uncovered that the examined airlines had financial duties, for example, creating wage for investors and proprietors, giving quality items and services, offering steady employments for their workers and offering sensible costs for their merchandise and ventures; this upheld by a total mean of 4.82 (SD=0.321). Ong'esa (2020) in his study deduced that the operational, human resource, marketing and information, communication and technology capabilities possess a significant gain to the airline's performance. Air Kenya Express Limited management ought to automate customer services such as online booking and checking in, while at the same time using effective methods for customer feedback collection that will be incorporated to improve on the airline’s service delivery. Using data from 2014 to 2018 of 31 global airlines, Kim and Son (2021) compares environmental efficiency in the aviation industry by continent and individual airline. The study found out that, first, airlines in Europe and Russia have the highest environmental efficiency, and airlines in North America and Canada are the second highest, which can be a good benchmark for other airlines. Meissner, Rahn and Wicke (2021) shows that simultaneously, new factors, such as sustainability and customer experience, become more important to differentiate from competitors. As aircraft maintenance contributes about 20% to the overall cost of airline operations and can significantly influence other objectives of an airline as well, maintenance providers are required to constantly lower their cost share and contribute to a more reliable and sustainable aircraft operation.

2.6 Conceptual Framework

Conceptual framework shows the relationship between the independent variables, moderation and the dependent variable.

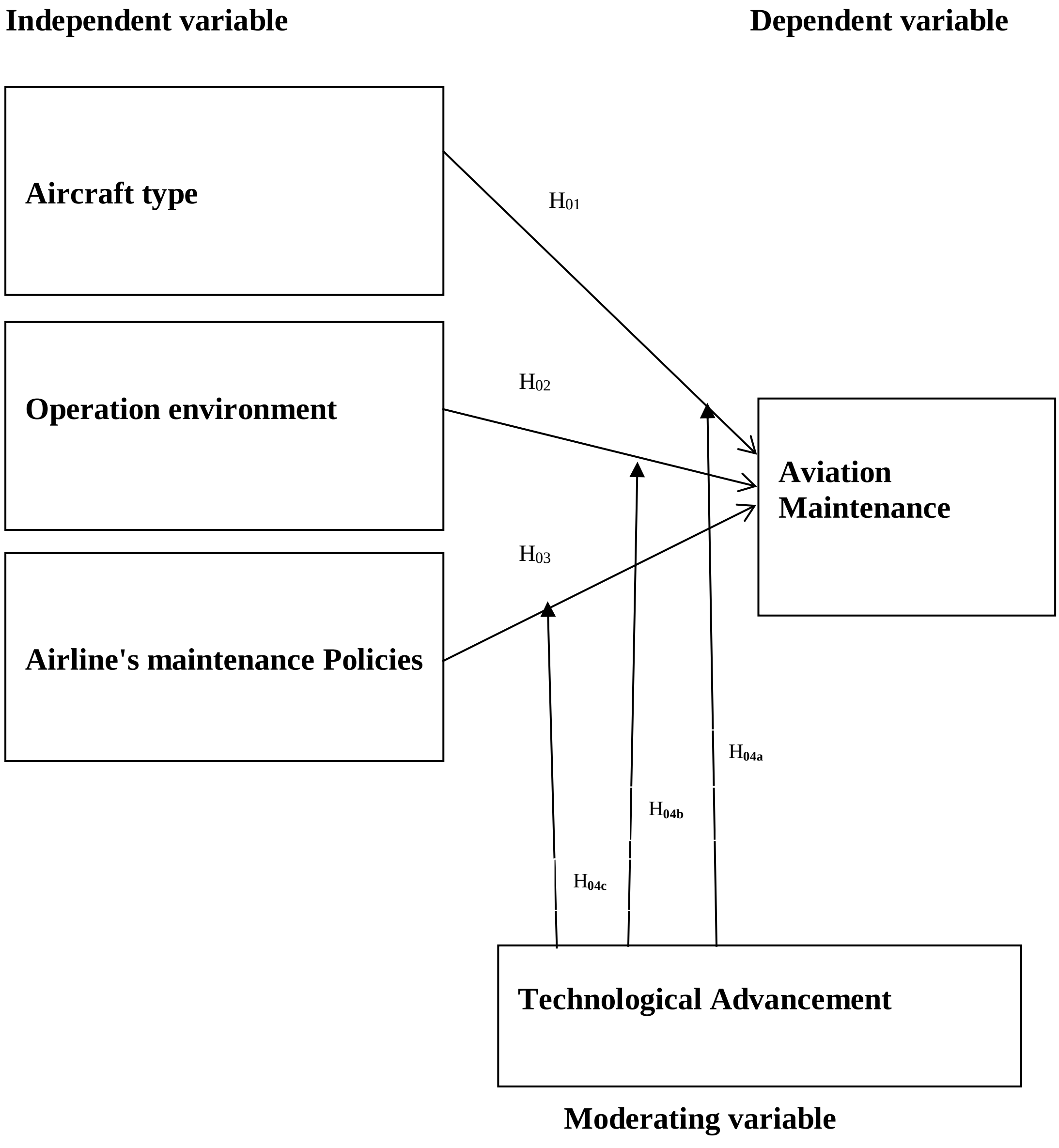

Figure 2.1 Conceptual Framework

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter discussed the expected method of the study. Among the things discussed will be study area, research design, target population, sampling design, Data collection instruments, reliability and validity of data, data analysis and ethical considerations for this study and expected results for the study.

3.1 Study Area

The geographical scope of the study was limited to airline firms operating in Kenya. The majority of the airlines have their head offices at Jomo Kenyatta International and Wilson Airports. The target Airlines are Kenya Airways, Jambojet in Jomo Kenyatta and Bluebird Aviation, Safarilink,748 Air Services, Skyward, Renegade, Air Kenya, Freedom, and Airwork's at Wilson

3.2 Research Design

A research design is a structure, plan and strategy of investigation so conceptualized as to obtain answers to research questions or problems. The plan is the whole scheme or system of the research (Kivunja, 2018). The research employed an explanatory research design. This was selected for the study since it was pivotal in examining the relationship between aircraft conditions and aircraft maintenance of selected airlines in Nairobi County.

3.3 Target Population

The target population for the study was senior employees at Jomo Kenyatta International and Wilson Airports. The employees targeted by the study were 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. In total, 75 respondents were targeted, and their distribution was as shown in Table 3.1.

Table 3.1 Target Population

Airline	**Engineers**	**Mechanics/ Technicians**	**Operation personnel**	**Ground Handling**	**Managers**	**Total**
Jomo Kenyatta						
Kenya Airways	4	6	1	1	1	13
Jambojet	4	6	1	1	1	13
Wilson Airport						
Bluebird Aviation	4	6	2	1	1	14
Safarilink,	4	6	2	1	1	14
748 Air Services	4	6	1	1	1	13
Skyward	4	6	1	1	1	13
Renegade	4	6	1	1	1	13
Air Kenya	4	6	1	1	1	13
Freedom,	4	6	1	1	1	13
Airwork's	4	6	1	1	1	13
Total	**40**	**60**	**15**	**10**	**10**	**135**

Source: Researcher (2023)

3.4 Census Survey

This study used a census survey to collect information from all participants in the population. This was due to the fact that the target population for this study was small and manageable, implying that sampling was not applied. The study collected data from 135 employees of Jomo Kenyatta International and Wilson Airports. Using a census survey, the researcher was able to collect accurate and complete information.

3.5 Data Collection instruments

The research made use of primary data. The main data collection tool, therefore, was a semi-structured questionnaire. Questionnaires were sets of questions which elicited answers from the research participants in a set of ways. According to Creswell and Creswell (2017), a questionnaire was a research instrument that gathered data over a large sample. Questionnaires had the advantage of obtaining standard responses to items, making it possible to compare between sets of data. It allowed the participants to give their own opinions on the issue at stake. These were constructed in line with the research objectives.

3.6 Measurement of Variables

Research instruments were developed using measures from previous studies. Respondents were asked about the extent to which they agreed/disagreed with a series of statements concerning their perceptions regarding the variables on a 5-point Likert scale ranging from (5) strongly agree to (1) strongly disagree, with each variable consisting of five items. This section of the instrument comprised variables that were measured, including the independent variables (aircraft type, operational environment, and airline's maintenance policies), each with its sub-constructs, scale, and source, while the moderator variable was technological advancements, and the dependent variable was aircraft maintenance, as shown in Table 3.2.

Table 3.2 Measurement of Variables

Type	Variables	Measurement	Measurement scale
Dependent variable	Aircraft maintenance	• Pre-flight checks • Daily checks • Line maintenance • Labelling	5-point Likert scale
Independent variable	Aircraft type	• Length • Wingspan • Altitude	5-point Likert scale
Independent variable	Operation environment	• Altitude • Temperature • Wind • Weather	5-point Likert scale
Independent variable	Airline's maintenance policies	• Regulatory Compliance • Preventive Maintenance • Corrective Maintenance • Asset Tracking	5-point Likert scale
Moderator	Technological advancements	• Fuel efficiency • Emissions • Safety • Comfort	

Source: Researcher, (2023)

3.7 Pilot Study

Kothari (2004) argued that before using a questionnaire as a data collection method, it was always advisable to conduct pilot studies of the questionnaires. This helped to bring into light any weaknesses of the questionnaires, and the experience gained in this way could be used to effect improvements. A pilot study of 14 respondents was carried out at Eldoret International Airport, and it was composed of respondents who were not involved in the main research. The respondents used in the pilot test represented 10 percent of the units to be used in data collection.

3.7.1 Validity of the research Instruments

Validity was the degree to which a research instrument measured what it was supposed to measure. Construct validity and content validity were relevant in this study. Construct validity measured the degree to which obtained data reflected the item under study. Validity of research instruments was measured by ensuring that all the constructs indicated in the conceptual framework were captured in the research instrument. Content validity measured the degree to which the collected data represented a specific domain of indicators or content of a particular concept (Kothari, 2004). Content validity was assessed with the help of the supervisor in examining that the questionnaire was in line with the research area. This process allowed weaknesses in the questionnaire to be detected so that they could be removed before the final questionnaire was prepared

3.7.2 Reliability of research instruments

Reliability was defined as the degree of consistency of a research instrument over several trials. It could be internal or external. Internal reliability was the extent to which data collection, analysis, and interpretation remained consistent. If multiple data collectors were used, they should have agreed. External reliability was the extent to which the results could be replicated and was ensured by the quality of the researcher. The study relied on internal reliability, which was measured through the use of Cronbach Alpha. All research variables with an alpha score of 0.7 and above were considered in the research.

3.8 Data Collection Procedures

Data collection procedures referred to the systematic steps that the researcher followed in the correct way to obtain data from the field (Oso & Onen, 2005). The researcher first obtained a letter of permission from Moi University. The researcher also obtained a letter from the National Commission for Science, Technology, and Innovation, to carry out research in the identified area of study. The aviation institutions authority was first contacted, and the intention to drop questionnaires was explained. The respondents were given researchable time to complete the copies of the questionnaire before they were picked for analysis. The researcher prepared and an introductory letter to the respondents.

3.9 Data Processing and Analysis

Data analysis involved cleaning, sorting, and coding of relevant data from the participants. Statistical Package for the Social Sciences (SPSS) version 24 was used for data analysis. Descriptive and inferential statistics were used to analyze data. Descriptive statistics included frequency, percentages, means, minimum, and maximum, and standard deviation. Inferential statistics included correlation and regression models. Correlation helped the researcher describe the linear relationship between independent variables and dependent variables. Correlation showed the direction and strength of the relationship between study variables. Regression analysis examined the relationship between the dependent and the independent variables, which best predicted the value of the said dependent variable. The following regression model was used:

OLS Equation

Model 1 $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3 X_3 + \varepsilon$ ……………………………….….**Equation 3.1**

Hierarchical Regression Model

Model 2 $Y= \beta_0 + \beta_1X_1+ \beta_2X_2+ \beta_3X_3 + \beta_4Z +\varepsilon$…………………………... **Equation 3.2**

Model 3 $Y= \beta_0 + \beta_1X_1+ \beta_2X_2+ \beta_3X_3 + \beta_4Z+ \beta_5Z *X_1+ \varepsilon$…………………. **Equation 3.3**

Model 4 $Y= \beta_0 + \beta_1X_1+ \beta_2X_2+ \beta_3X_3 + \beta_4Z+ \beta_5Z *X_1+ \beta_6Z *X_2+\varepsilon$ ……….**Equation 3.4**

Model 5 $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 Z + \beta_5 Z * X_1 + \beta_6 Z * X_2 + \beta_7 Z * X_3 + \varepsilon$……………………………………………………………………**Equation 3.5**

Where:

Y is the aircraft maintenance

$\boldsymbol{\beta_0}$ represent the Y intercept when x is zero

$\mathbf{X_1}$ is aircraft type

$\mathbf{X_2}$ is operation environment

$\mathbf{X_3}$ is airline's maintenance policies

Z is technological advancements

$\boldsymbol{\beta_1}$**,** $\boldsymbol{\beta_2}$ **and** $\boldsymbol{\beta_3}$ and coefficients of the study variables

$\boldsymbol{\varepsilon}$ is the error term

3.9.1 Assumptions in Multiple Regressions

The study tested for normality, linearity, homoscedasticity, multicollinearity, and independence of errors; Multiple regressions assumed that variables had normal distributions (Austin & Steyerberg, 2015). The assumption was based on the shape of the normal distribution and gave the researcher knowledge about what values to expect (Kucukelbir, Tran, & Blei, 2017). To test the assumption of normality, Kolmogorov-Smirnov was used to find out if residuals followed a normal probability distribution. Linearity defined the dependent variable as a linear function of the predictor (independent) variables (Sellam & Poovammal, 2016). The study tested linearity using a correlation table. Akoglu (2018) indicated that a correlation of 1 showed a perfect linear correlation, a correlation between 0.9 and 1 indicated a positive strong correlation, a correlation between 0.7 and 0.9 indicated a positive high correlation, a correlation between 0.5 and 0.7 indicated a positive moderate correlation, a correlation between 0 and 0.5 indicated a weak correlation, while a correlation of 0 indicated no relationship, and a correlation between -1 and 0 indicated a negative relationship. The assumption of homoscedasticity referred to equal variance of errors across all levels of the independent variables (Rohilla, 2013). Homoscedasticity assumption was tested using Levene's test of equality of error variances. Multicollinearity referred to the assumption that the independent variables were uncorrelated (Yu, Jiang & Land, 2015). To diagnose multicollinearity, the study used inflation factors (VIF) and tolerance. A VIF greater than 10 or tolerance below 0.10 implied a serious multicollinearity problem. Independence of errors referred to the assumption that errors were independent of one another, implying that subjects were responding independently. The goal of research was often to accurately model the ‘real’ relationships in the population (Di Gregorio, 2018). To diagnose violations of this assumption, the Durbin-Watson Statistic test was used.

3.10 Ethical Issues in the Research

The study adopted ethical considerations in the course of the research. Prior to undertaking the research, a debriefing of the research assistant was conducted to ensure they were conversant with the study objectives and scope of the research. The study also sought a research permit from NACOSTI to ensure that the research was licensed to be conducted in the country. The study further sought clearance from the Ethical Review Body of Moi University before starting the data collection process. Furthermore, the researcher ensured that the confidentiality of the respondents was maintained throughout the research.

CHAPTER FOUR

DATA ANALYSIS, FINDINGS AND DISCUSSIONS

4.1 Introduction

In Chapter Four, the data analysis, findings, and discussions are presented to delve into the research outcomes and their implications.

4.2 Response Rate

The research evaluated the response rate of participants in relation to the conducted data collection approach. The response rate results are presented in Table 4.1.

Table 4.1 Instrument Response Rate

Respondents	**Frequency**	**Percentage**
Responded	112	82.96
Not responded	23	17.03
Total	135	**100**

Study findings in Table 4.1 displayed the instrument response rate, revealing that out of a total of 135(100%) respondents, 112 (82.96%) provided responses, while 23 (17.03%) did not participate in the research. This distribution indicated a relatively high level of engagement from participants in the study.

4.3 Demographic Information of the Respondent

This section presents results on the gender, age and number of years of operations in the organization as presented in Table 4.2.

Table 4.2 Demographic Information of the Respondent

Demographic Information	Frequency	Percentage
Gender		
Male	64	57.1
Female	48	42.9
Age		
18-35	23	20.5
35-45	27	24.1
45-50	32	28.6
Above 50	30	26.8
Number of years		
Less than 1 Year	18	16.1
1-5 Years	30	28.6
5-10 Years	31	27.7
10-15 Years	20	17.9
15 and above Years	13	11.6
Total	**112**	**100**

Study findings presented in Table 4.2 illustrates that out of the total 112(100%) participants who responded, 64 (57.1%) were found to be male participants, while 48 (42.9%) were found to be female respondents. These results indicate a balanced representation of gender within the sample, with a slightly higher percentage of male participants. This distribution provides a preliminary insight into the demographic makeup of the study's respondents, which could have implications for potential gender-related variations in the subsequent analysis and discussions. Among the 112(100%) participants, 23 (20.5%) of the respondents were found to be at the age bracket 18-35, 27 (24.1%) of the respondents fell between 35-45, 32 (28.6%) were found to be between 45-50 years of age, and 30 (26.8%) of the respondents were above 50 years. This distribution illustrates a varied age composition within the sample, spanning across different life stages. Such diversity could influence the research outcomes, potentially reflecting distinct perspectives and experiences based on respondents' age brackets. Among the 112(100%) participants, 18 (16.1%) of the respondents had been employed for less than a year, while 30 (28.6%) of the respondents had between 1 and 5 years of experience. Additionally, 31 (27.7%) reported working for 5 to 10 years, 20 (17.9%) for 10 to 15 years, and 13 (11.6%) for 15 years and more.

4.4 Descriptive Analysis

In this study descriptive statistics for independent variables and the dependent variable were analyzed through use of mean, frequencies, percentages and standard deviation as shown below.

4.4.1 Descriptive statistics Findings for Aircraft type

The first objective of the study was to establish the effect of aircraft type on aircraft maintenance of selected airlines in Nairobi County. The study results are presented in Table 4.3.

Table 4.3 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)								

The study results in Table 4.3 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. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that 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) aligns 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. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement 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. Further, the study results also showed, in terms of mean and standard deviation that the respondents disagreed with the statement that 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. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that aircraft type varies with level of maintenance (Mean=3.81, standard deviation=1.41). A research by Kowalski, (2021) found results that aligns 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. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that 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.

4.4.2 Descriptive Statistic Findings for Operation Environment

The second objective of the study was to determine the effects of operation environment on aircraft maintenance of selected airlines in Nairobi County. The study findings are presented in Table 4.4.

Table 4.4 Operation Environment

Statements		SA	A	UD	D	SD	Mean	Sd
The operation environment has a significant impact on the safety of aircraft maintenance.	F	49	46	7	3	7	4.13	1.07
	%	43.8	41.1	6.3	2.7	6.3		
The quality of tools and equipment used in aircraft maintenance is important for safety.	F	46	35	10	12	9	3.86	1.28
	%	41.1	31.3	8.9	10.7	8.0		
The training of aircraft maintenance personnel is essential for safety.	F	48	34	5	13	12	3.83	1.37
	%	42.9	30.4	4.5	11.6	10.7		
The work environment in aircraft maintenance is safe and conducive to error-free work.	F	51	39	3	9	10	4.00	1.27
	%	45.5	34.8	2.7	8.0	8.9		
I am confident in my ability to perform aircraft maintenance safely.	F	14	23	7	30	38	2.50	1.45
	%	12.5	20.5	6.3	26.8	33.9		
Total number of respondents (n=112)								

The study results in Table 4.4 showed that majority 95(84.9 %) of the respondents agreed that the operation environment has a significant impact on the safety of aircraft maintenance. On contrary, 10(9.0%) of the respondents disagreed that the operation environment has a significant impact on the safety of aircraft maintenance. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that the operation environment has a significant impact on the safety of aircraft maintenance (Mean=4.13, standard deviation=1.07). A research conducted by Wang, (2022) provided substantial evidence supporting the idea that the operational environment significantly impacts the safety of aircraft maintenance. Their study highlighted how factors such as weather conditions, infrastructure, and human factors within the operational environment can directly influence the safety of maintenance activities. This corresponds with the study that the operation environment plays a critical role in ensuring the safety of aircraft maintenance.

Also, the study findings noted that 81(72.4%) of the respondents agreed and 21(18.7%) disagreed that the quality of tools and equipment used in aircraft maintenance is important for safety. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that the quality of tools and equipment used in aircraft maintenance is important for safety (Mean=3.86, standard deviation=1.28). A study by Kou, (2022) provided study findings that align with the results of this study. Their research revealed that using high-quality tools and equipment enhances the precision and reliability of maintenance procedures, reducing the risk of errors and accidents. This corresponds with the study that tool and equipment quality is essential for ensuring the safety of aircraft maintenance.

The study further revealed that, 82(73.3%) of the participants agreed that the training of aircraft maintenance personnel is essential for safety. On contrary to that, 25(22.3%) of the respondents disagreed that the training of aircraft maintenance personnel is essential for safety. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that the training of aircraft maintenance personnel is essential for safety (Mean=3.83, standard deviation=1.37). Study findings by Abdelkareem, (2021) agrees with the study findings .Their comprehensive study demonstrated that well-trained personnel are more adept at identifying potential safety hazards, adhering to safety protocols, and conducting maintenance procedures with precision. This corresponds with the study that training of maintenance personnel plays an essential role in ensuring the safety of aircraft maintenance.

The study nonetheless showed that 90(80.3%) of the participants agreed that the work environment in aircraft maintenance is safe and conducive to error-free work. On contrary to those findings, 19(16.9%) of the respondents disagreed that the work environment in aircraft maintenance is safe and conducive to error-free work. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that the work environment in aircraft maintenance is safe and conducive to error-free work (Mean=4.00, standard deviation=1.27). Conversely, a study by Zhang, (2019) reported findings that do not align with the study findings. Their research argued that while safety measures are in place, the work environment may still pose challenges due to factors such as time pressures, high workload, and organizational culture. These findings suggest that the perception of a safe and error-free work environment may not always reflect the reality experienced by maintenance personnel, challenging the notion of the work environment's inherent safety.

Finally, 37(33.0%) agreed that they are confident in their ability to perform aircraft maintenance safely. However, 68(60.7%) of the respondents disagreed that they are confident in their ability to perform aircraft maintenance safely. Further, the study results also showed, in terms of mean and standard deviation that the respondents disagreed with the statement that they are confident in their ability to perform aircraft maintenance safely (Mean=2.50, standard deviation=1.45). Study findings by Khan, (2020) agrees with the findings of this study. Their study found that individuals who receive comprehensive training and experience in aircraft maintenance tend to have higher confidence levels in their ability to perform tasks safely. This research emphasized the role of competence-building programs and hands-on experience in boosting confidence among maintenance personnel.

4.4.3 Descriptive Statistics Findings for Airline's Maintenance Policies

The third objective of the study was to assess the effect of airline's maintenance policies on aircraft maintenance of selected airlines in Nairobi County. Results are presented in Table 4.5.

Table 4.5 Airline's Maintenance Policies

Statements		SA	A	UD	D	SD	Mean	Sd
The airline's maintenance policies are clear and easy to understand.	F	33	51	5	5	18	3.82	1.28
	%	29.5	45.5	4.5	4.5	16.1		
The airline's maintenance policies are regularly updated to ensure safety.	F	49	35	9	11	8	3.94	1.25
	%	43.8	31.3	8.0	9.8	7.1		
The airline's maintenance staff are well-trained and competent.	F	48	34	5	13	12	3.83	1.37
	%	42.9	30.4	4.5	11.6	10.7		
The airline's maintenance procedures are consistently followed.	F	13	21	6	29	43	2.39	1.44
	%	11.6	18.8	5.4	25.9	38.4		
The airline's maintenance quality systems is functional	F	48	38	3	8	15	3.85	1.39
	%	42.9	33.9	2.7	7.1	13.4		
Total number of respondents (n=112)								

Table 4.5 showed that of the respondents 88(78.5%) agreed that the airline's maintenance policies are clear and easy to understand. However, 19(17.0%) of the respondents disagreed that the airline's maintenance policies are clear and easy to understand. Further, the study results also showed, in terms of mean and standard deviation that the respondents disagreed with the statement that the airline's maintenance policies are clear and easy to understand (Mean=3.82, standard deviation=1.28). A study conducted by Lagos, (2020) found that a majority of respondents perceived their airline's maintenance policies as clear and easily understandable Their research revealed that the airline's maintenance policies were generally regarded as clear and comprehensible. This research highlighted the importance of well-communicated and easily understood policies in promoting safety and adherence to maintenance procedures. These findings align with the study regarding the clarity and comprehensibility of the airline's maintenance policies.

Also, 84(75.1%) of the respondents agreed and 19(16.9%) disagreed that the airline's maintenance policies are regularly updated to ensure safety. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that the airline's maintenance policies are regularly updated to ensure safety (Mean=3.94, standard deviation=1.25). A study conducted by Andrade, (2021) supported the perception that airline maintenance policies are regularly updated to enhance safety. Their research found that the airline's maintenance policies are subject to regular updates aimed at improving safety measures. This research emphasized the importance of dynamic and adaptive policies to address evolving safety challenges.

Further, 82(73.3%) of the respondents agreed that the airline's maintenance staff are well-trained and competent. On contrary to that, 25(22.9%) of the respondents disagreed that the airline's maintenance staff are well-trained and competent. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that the airline's maintenance staff are well-trained and competent. (Mean=3.83, standard deviation=1.37). Research conducted by Deng, (2021) aligns with the findings .Their study revealed that well-established training programs and stringent competence assessments are integral components of ensuring that maintenance personnel are adequately prepared for their roles.

The study nonetheless showed that, 34(30.4%) of the participants agreed that the airline's maintenance procedures are consistently followed. However, 72(64.3%) of the respondents disagreed that the airline's maintenance procedures are consistently followed. Further, the study results also showed, in terms of mean and standard deviation that the respondents disagreed with the statement that the airline's maintenance procedures are consistently followed (Mean=2.39, standard deviation=1.44). Research conducted by Öhman et al , (2021) aligns with the findings. Their study found that that the consistent adherence to maintenance procedures within the airline industry can be a challenging aspect. They highlighted various factors contributing to this perception, including time pressures, operational demands, and organizational culture. These findings are in concordance with the study, emphasizing the need for increased attention to ensure the consistent implementation of maintenance procedures.

Finally, 86(76.8%) of the participants agreed that the airline's maintenance quality systems are functional. However, 23(20.5 %) of the respondents disagreed that the airline's maintenance quality systems are functional. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that the airline's maintenance quality systems is functional (Mean=3.85, standard deviation=1.39). In contrast to the findings, a study by Sylva and Amah, (2021) presents a different perspective regarding the functionality of maintenance quality systems. This disagreement highlights the potential for divergent perceptions regarding the functionality of quality systems within the industry and underscores the need for continuous improvement efforts to enhance the effectiveness of these systems.

4.4.4 Descriptive Statistics Findings for Technological Advancements

The research evaluated descriptive statistics findings regarding technological advancements. This revealed how technological factors influence maintenance dynamics. Study findings are presented in Table 4.6.

Table 4.6 Technological Advancements

Statements		**SA**	**A**	**UD**	**D**	**SD**	**Mean**	**Sd**
Advances in automation will make aircraft maintenance more efficient.	**F** **%**	60 53.6	36 32.1	4 3.6	6 5.4	6 5.4	4.23	1.10
The use of lightweight composite materials will make aircraft more fuel-efficient.	**F** **%**	43 38.4	53 47.3	8 7.1	4 3.6	4 3.6	4.13	0.95
Improved air traffic control systems will reduce congestion and delays in air travel.	**F** **%**	61 54.5	38 33.9	4 3.6	4 3.6	5 4.5	4.30	1.02
Enhanced biometrics for airport security will make air travel more secure.	**F** **%**	54 48.2	37 33.0	8 7.1	6 5.4	7 6.3	4.11	1.15
Augmented reality (AR) will improve situational awareness for aircraft maintenance technicians.	**F** **%**	63 56.3	37 33.0	6 5.4	2 1.8	4 3.6	4.36	0.93
Total number of respondents (n=112)								

Table 4.6 showed that of the respondents 96(85.7%) agreed that Advances in automation will make aircraft maintenance more efficient. However, 12(10.8%) of the respondents disagreed that Advances in automation will make aircraft maintenance more efficient. Further, the study results also showed, in terms of mean and standard deviation that the respondents disagreed with the statement that Advances in automation will make aircraft maintenance more efficient (Mean=4.23, standard deviation=1.10) .Study findings by Halili, (2019) agrees with the results of the study. Their research found that advances in automation are perceived to make aircraft maintenance more efficient. Their research findings emphasized the belief that automation technologies, such as predictive maintenance systems and robotics, have the potential to streamline maintenance processes, reduce downtime, and enhance overall efficiency within the airline industry.

Also, 96(85.7%) of the respondents agreed and 8(7.2%) disagreed that the use of lightweight composite materials will make aircraft more fuel-efficient. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that the use of lightweight composite materials will make aircraft more fuel-efficient (Mean=4.13, standard deviation=0.95). Study findings by Appio, (2019) agreed with the results of the study. Their findings found that the use of lightweight composite materials is perceived to make aircraft more fuel-efficient. Their research emphasizes the recognition of lightweight composites' potential to reduce aircraft weight and enhance fuel efficiency.

Further, 89(88.4%) of the respondents agreed that Improved air traffic control systems will reduce congestion and delays in air travel. On contrary to that, 9(8.1%) of the respondents disagreed that Improved air traffic control systems will reduce congestion and delays in air travel. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that Improved air traffic control systems will reduce congestion and delays in air travel (Mean=4.30, standard deviation=1.02). Study findings by Johnson and her team in 2023 agrees with the results of the study. Their research revealed that improved air traffic control systems are have a positive effect on reducing congestion and delays in air travel. The research emphasized the recognition of the role of advanced air traffic control systems in optimizing airspace usage, enhancing routing efficiency, and mitigating congestion-related issues.

The study nonetheless showed that, 91(81.2%) of the participants agreed that Enhanced biometrics for airport security will make air travel more secure. However, 13(12.7%) of the respondents disagreed that Enhanced biometrics for airport security will make air travel more secure. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that Enhanced biometrics for airport security will make air travel more secure (Mean=4.11, standard deviation=1.15). The study conducted by Khan, (2019) aligns with the findings. Their study found that enhanced biometrics for airport security indeed contribute to making air travel more secure. Enhanced biometric technologies, such as fingerprint and facial recognition systems, offer highly accurate means of verifying passengers' identities, making them essential tools in preventing unauthorized access to secure airport areas and aircraft.

Finally, 90(89.3%) of the participants agreed that Augmented reality (AR) will improve situational awareness for aircraft maintenance technicians. However, 6(5.4%) of the respondents disagreed that Augmented reality (AR) will improve situational awareness for aircraft maintenance technicians. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that Augmented reality (AR) will improve situational awareness for aircraft maintenance technicians (Mean=4.36, standard deviation=0.93). Research conducted by Buhalis, (2019) aligns with the results of the study .Their study found that advanced AR technologies have been recognized as valuable tools for enhancing the situational awareness of maintenance technicians. These findings substantiate results of the study and underscore the positive perception of AR's role in improving situational awareness for aircraft maintenance personnel.

4.4.5 Descriptive Statistics Findings for Aircraft maintenance

The following section presents the descriptive statistics findings pertaining to aircraft maintenance. Findings are presented in Table 4.7.

Table 4.7 Airline's Maintenance Policies

Statements		**SA**	**A**	**UD**	**D**	**SD**	**Mean**	**Sd**
There is standard quality aircraft maintenance	**F**	35	59	5	8	5	3.99	1.02
	%	31.3	52.7	4.5	7.1	4.5		
Availability of spare parts has improved aircraft maintenance	**F**	50	43	6	10	3	4.13	1.04
	%	44.6	38.4	5.4	8.9	2.7		
The experience of the technicians who work on aircraft maintenance is high	**F**	65	27	4	7	9	4.17	1.25
	%	58.0	24.1	3.6	6.3	8.0		
There is timeliness of maintenance checks	**F**	43	45	10	10	4	4.00	1.07
	%	38.4	40.2	8.9	8.9	3.6		
There is proper documentation in all aircraft maintenance carried out	**F**	65	27	4	7	9	3.95	1.15
	%	58.0	24.1	3.6	6.3	8.0		
Total number of respondents (n=112)								

Table 4.7 showed that of the respondents 94(84.0%) agreed that there is standard quality aircraft maintenance. However, 13(11.6%) of the respondents disagreed that there is standard quality aircraft maintenance. Further, the study results also showed, in terms

of mean and standard deviation that the respondents disagreed with the statement that there is standard quality aircraft maintenance (Mean=3.99, standard deviation=1.02). Study findings by Delgoshaei and Naserbakht, (2019), aligns with the results of the study. Their research found that the airline industry maintains consistent and standardized quality standards for aircraft maintenance.

Also, 93(83.0%) of the respondents agreed and 13(11.6%) disagreed that availability of spare parts has improved aircraft maintenance. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that availability of spare parts has improved aircraft maintenance (Mean=4.13, standard deviation=1.04). According to findings from a study by Sylva, (2021), their research aligns with the study's results. Their study revealed a positive industry perception, indicating that improved spare parts availability has indeed had a beneficial impact on aircraft maintenance practices.

Further, 92(82.1%) of the respondents agreed that the experience of the technicians who work on aircraft maintenance is high. On contrary to that, 16(14.3%) of the respondents disagreed that the experience of the technicians who work on aircraft maintenance is high. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that the experience of the technicians who work on aircraft maintenance is high (Mean=4.17, standard deviation=1.25). According to findings from a study by Rajee et al. (2020), their research aligns with the findings of the study. Their study revealed a positive industry perception, indicating that experienced technicians are prevalent and highly regarded in the field of aircraft maintenance.

The study nonetheless showed that, 88(78.6%) of the participants agreed that there is timeliness of maintenance checks. However, 14(12.5%) of the respondents disagreed that there is timeliness of maintenance checks. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that there is timeliness of maintenance checks (Mean=4.00, standard deviation=1.07). According to findings from a study by Scott, (2022) , their research aligns with the study's results. Their study revealed a positive industry perception, indicating that maintenance checks are conducted promptly and within expected timeframes. This positive perception suggests that maintenance processes are well-organized and efficient, contributing to the timely execution of maintenance checks as a crucial aspect of ensuring aircraft safety and reliability.

Finally, 91(81.2 %) of the participants agreed that there is proper documentation in all aircraft maintenance carried out. However, 16(15.2%) of the respondents disagreed that there is proper documentation in all aircraft maintenance carried out. Further, the study results also showed, in terms of mean and standard deviation that the respondents agreed with the statement that there is proper documentation in all aircraft maintenance carried out (Mean=3.95, standard deviation=1.15). According to findings from a study by Sprong, (2020), their research aligns with the study's results .Their study revealed a positive industry perception, indicating that comprehensive and accurate documentation practices are prevalent in aircraft maintenance procedures. This aligns with study's results and underscores the importance of thorough documentation in ensuring the safety and accountability of maintenance processes.

4.5 Testing Assumptions of Multiple Linear Regressions

Before running a regression, multiple regression model assumptions test was conducted. The pre-estimation tests conducted in this case were linearity test, homoscedasticity assumption, normality and multicollinearity test while the post estimation tests were normality test and test for autocorrelation. This is usually performed to avoid spurious regression results from being obtained.

4.5.1 Test of Linearity

Correlation analysis was used in testing of linearity of the data. If there is a significant correlation between independent variables and dependent variable it implies that there is a linear relationship between the variables. If the correlation coefficient is significantly not different from zero it implies that there is no significant linear relationship between independent variables and dependent variable. The test for linearity results is presented in Table 4.8.

Table 4.8 Linearity Test Results

Variables	**Linearity**	**Deviation from Linearity**
Aircraft Type	0.030	0.127
Operation Environment	0.014	0.119
Airline's Maintenance Policies	0.011	0.134
Technological advancements	0.023	0.114

Table 4.8 indicated that there was a significance value ($p=0.030<0.05$) between Aircraft type maintenance, indicating that there was a linear relationship. Further, the test for deviation from linearity also has a greater p value ($p=0.127>0.05$) which implies that there was linear relationship between Aircraft type maintenance. The study results revealed that there was a significance value ($p=.014<0.05$), indicating that there was a

linear relationship between operation environment and aircraft maintenance. Further, the test for deviation from linearity also has a greater p value (p=0.119>0.05) which implies that there was linear relationship between operation environment and aircraft maintenance.

The study results indicated that there was a significance value (p=0.011<0.05), indicating that there was a linear relationship between airline's maintenance policies and aircraft maintenance. Further the test for deviation from linearity also has a greater p value (p=0.134>0.05) which implies that there was linear relationship between airline's maintenance policies and aircraft maintenance.

The study results indicated that there was a significance value (p=0.023<0.05), indicating that there was a linear relationship between technological advancements and aircraft maintenance. Further the test for deviation from linearity also has a greater p value (p=0.114>0.05) which implies that there was linear relationship between technological advancements and aircraft maintenance.

4.5.2 Homoscedasticity Assumption

Levene's test of equality of error variances was used to test homoscedasticity assumption. The assumption test results are presented in Table 4.9.

Table 4.9 Homoscedasticity Assumption

Variables	**F**	**df1**	**df2**	**Sig.**
Aircraft type	3.097	18	93	.196
Operation Environment	5.353	18	93	.163
Airline's Maintenance Policies	3.401	20	91	.135
Technological advancements	3.514	19	92	.273

The study findings in Table 4.9 revealed that the p-value for aircraft type maintenance was (p=0.196>0.05). The p-value for operation environment was (p=0.163>0.05) the p-value for airline's maintenance policies was (p=0.135>0.05). Finally the p-value for technological advancements was (p=0.273>0.05).Therefore, the study concludes that there is no significant difference among the study variable variances. The study failed to reject the null hypothesis that the error variance of the independent variables is equal across groups since the p-values were greater than 0.05.

4.5.3 Normality Assumption Test

Kolmogorov-Smirnov was used to test the normality of the data used in the study. If Kolmogorov-Smirnov significant value are greater than 0.05, the data is a normal distribution (Tabachnic, 2001). Normality assumptions tests are presented in Table 4.10.

Table 4.10 Normality Assumption Test

Variables	Statistic	Sig.
Aircraft type	.227	.117
Operation Environment	.347	.252
Airline's Maintenance Policies	.339	.062
Technological advancements	271	143

Normality assumption test results in Table 4.10 established that the data was normally distributed since the significance values for Kolmogorov-Smirnov were greater than 0.05. The study findings indicated that aircraft type maintenance had a Kolmogorov-Smirnov significance value of p=.117>0.05. Operation environment had a Kolmogorov-Smirnov significance value of p=.252>0.05 and airline's maintenance policies had a Kolmogorov-Smirnov significance value of p=.062>0.05. Technological advancements had a Kolmogorov-Smirnov significance value of p=.143>0.05. Since the p-values were greater than the significance level (0.05), this implies that the data were normally distributed.

4.5.4 Multicollinearity Assumption Test

Test for Multicollinearity was done using variance inflation factors (VIF) and tolerance as shown in Table 4.11.

Table 4.11 Multicollinearity Assumption Test

Variables	Tolerance	VIF
Aircraft type maintenance	.286	3.493
Operation Environment	.165	6.064
Airline's Maintenance Policies	.221	4.518
Technological advancements	.454	2.204

The results in Table 4.11 present values tolerance and variance inflation factor value for aircraft type (tolerance=0.286 and VIF=3.493), operation environment (tolerance=0.165 and VIF=6.064) and airline's maintenance policies (tolerance=0.221 and VIF=4.518). Technological advancements had a tolerance of 0.454 and VIF of 2.204. The findings of the study suggest that all three variables examined had tolerance values exceeding 0.10, and their VIF (Variance Inflation Factor) values were all below 10, consistent with the criteria outlined by Field (2009). This implies that there was no evidence of multicollinearity in the dataset.

4.5.5 Autocorrelation Assumption Test

Test for Autocorrelation was done through Durbin-Watson test. The autocorrelation assumption test results are presented in Table 4.12.

Table 4.12 Autocorrelation Assumption Test

Variables	Durbin-Watson
Aircraft type	1.480
Operation environment	1.906
Airline's maintenance policies	1.607
Technological advancements	1.571

The results as indicated in Table 4.12 revealed that the Durbin- Watson statistic value of aircraft type was 1.480. Also, the Durbin-Watson statistic value for operation environment was 1.906. Further, the results indicated that the Durbin-Watson statistic value for airline's maintenance policies was 1.607. Technological advancements had Durbin-Watson statistic value of 1.571. This suggests that the study variables exhibited error independence since they satisfied the Durbin-Watson test's criteria, which falls within the 0 to 4 range. The Durbin-Watson test generates a test statistic ranging from 0 to 4, where 2 indicates the absence of autocorrelation, values between 0 and 2 imply positive autocorrelation, and values greater than 2 indicate negative autocorrelation. According to Field (2009), the general guideline is that test statistic values within the 1.5 to 2.5 range are considered relatively normal, while values outside this range may raise concerns.

4.6 Inferential Analysis

This section presents correlation analysis, regression analysis and hypotheses testing.

4.6.1 Correlation Analysis Results

A correlation analysis was conducted to assess the direction and strength of relationship between the study's independent and dependent variables. The results of this analysis are displayed in Table 4.13.

Table 4.13 Multiple Correlation Analysis Results

		Aircraft maintenance (Y)	**Aircraft type**	**Operation Environment**	**Airline's Maintenance Policies**
Aircraft maintenance (Y)	Pearson Correlation	1			
Aircraft type	Pearson Correlation	.720**	1		
	Sig. (2-tailed)	0.000			
Operation Environment	Pearson Correlation	.758**	.841**	1	
	Sig. (2-tailed)	0.000	0.000		
Airline's Maintenance Policies	Pearson Correlation	.741**	.779**	.879**	1
	Sig. (2-tailed)	0.000	0.000	0.000	
	N	112	112	112	112

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

The findings in Table 4.13 indicated that Aircraft type and Aircraft maintenance had a positive strong and statistically significant correlation ($r= 0.720; p<0.01$). The findings of the study indicate a strong, positive and statistically significant correlation between operation environment, and aircraft maintenance ($r=0.758; p< 0.01$) and finally the study established that there exists a moderate, positive, and statistical correlation between airline's maintenance policies and aircraft maintenance ($r=0.496; p< 0.01$). It was noted that there exists a strong, positive and statistically significant relationship between aircraft conditions and aircraft maintenance ($r=0.741; p < 0.01$).

4.6.2 Multiple Regression Analysis

Multiple regression analysis was run to establish the effect of independent variables on dependent variable. The coefficient of determination (R^2) and correlation coefficient (R) shows the degree of association between aircraft type, operation environment, airline's maintenance policies and aircraft maintenance. The results are presented in Table 4.14.

Table 4.14 Multiple Regression Model Summary

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

The results of the regression in Table 4.14 indicate that R^2 =0.616 and R = 0.785. R-value gives an indication that there is a strong linear relationship between aircraft type, operation environment, airline's maintenance policies and aircraft maintenance. The R^2 indicates that the explanatory power of the independent variables is 0.785. This means that about 78.5% of the aircraft maintenance variation in is explained by the regression model. Adjusted R^2 is a modified version of R^2 that has been adjusted for the number of predictors in the model by less than chance. The adjusted R^2 of 0.605 is slightly lower than the R^2 value.

4.6.3 Model Fitness

Before employing the regression model, the study assesses the fitness of the model. The aim of modelling is to identify the most suitable model for representing the data. The outcomes of this assessment are displayed in Table 4.15.

Table 4.15 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			

From Table 4.15 the F test provides an overall test of significance of the fitted regression model. The F value indicates that all the variables in the equation are important hence the overall regression is significant. The F-statistics produced (F =57.739) were significant at p=0.000 thus confirming the fitness of the model and therefore this implies that the multiple regression model was a good fit for the data. Hence aircraft type, operation environment, airline's maintenance policies have effects on aircraft maintenance therefore they should put emphasis on them.

4.6.4 Regression Coefficients

The study sought to establish the regression model coefficients in order to use them in the regression equation. The study results are presented in Table 4.16.

Table 4.16 Multiple Regression Model Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
	B	**Std. Error**	**Beta**	**t**	**Sig.**
(Constant)	.898	.228		3.931	.000
Aircraft type	.242	.110	.244	2.193	.030
Operation Environment	.284	.140	.298	2.031	.045
Airline's Maintenance Policies	.281	.123	.289	2.279	.025

Table 4.16 indicates there was a positive linear effect of aircraft type on aircraft maintenance (β_1=.244, p=0.030). This reveals that an increase in aircraft type leads to an increase in aircraft maintenance by 0.244 units. It was further established that operation environment has a positive and significant effect on aircraft maintenance (β_2=.298, p=0.045). This implies that an increase in operation environment leads to an increase in aircraft maintenance by 0.298 units and finally airline's maintenance policies was found to have a positive and significant effect on aircraft maintenance (β_3=.289, p=0.025). This indicates that an increase in airline's maintenance policies leads to an increase in aircraft maintenance by 0.289 units. Thus, the regression equation becomes;

$Y = 0.898 + 0.244X_1 + 0.298X_2 + 0.289X_3$………………………. Equation 4.1

Where:

Y represents aircraft maintenance, the dependent variable

X_1 represents Aircraft type

X_2 represents operation environment

X_3 represents airline's maintenance policies

4.7 Hierarchical Moderated Regression Analysis

Hierarchical moderated regression analysis was conducted for each independent variable to identify the unique moderating influence of technological advancements on Aircraft maintenance.

4.7.1 Model Summary

Model summary shows the variations in R^2 from model 1 to model 5 as presented in Table 4.17.

Table 4.17 Multiple Regression Model Summary Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.785[a]	.616	.605	.59679	.616	57.739	3	108	.000
2	.808[b]	.652	.639	.57052	.036	11.174	1	107	.001
3	.819[c]	.672	.656	.55710	.019	6.219	1	106	.014
4	.838[d]	.703	.686	.53236	.031	11.083	1	105	.001
5	.847[e]	.717	.698	.52216	.014	5.140	1	104	.025

Source: Field Data (2023)

The values of R^2 were used to show the proportion of variation in the dependent variable explained by the model in Table 4.17. The R^2 value was statistically significant at $p<0.000$ and indicating that the explanatory power of the independent variables was 0.616. This suggests that 61.6% of the variation in aircraft maintenance was explained by the three independent variables (Aircraft type, operation environment and airline's maintenance policies).

Further, Table 4.17 gave the findings of the R^2 change. The R^2 change from model 1 to model 2 was 0.036 which changed from 0.616 to 0.652 and statistically significant ($p<0.01$). The results showed that by including Aircraft type in the model, the number of observable variables could be increased by 3.6%, hence enhancing the model's predictive power in predicting Aircraft maintenance.

The R^2 change from model 2 to model 3 was 0.019 which changed from 0.652 to 0.672 and statistically significant ($p<0.14$). As a result, statistically technological advancement moderated effect of Aircraft types and airline's maintenance of selected airlines in Nairobi County

The R^2 change from model 3 to model 4 was 0.031 which changed from 0.672 to 0.703 and statistically significant ($p<0.01$). This implied that technological advancements moderated the effect of Aircraft type and operational environment on Aircraft maintenance by 3.1%. The R^2 change from model 4 to model 5 was 0.014 which changed from 0.703 to 0.717 and statistically significant ($p<0.25$). As a result, technological advancements moderates the effect of Aircraft type, operational environment and Airline's maintenance policies on Aircraft maintenances by 1.4%.

4.7.2 Multiple Regression Model Fitness

The regression model's ability to predict the independent variable was tested using an ANOVA for statistical significance as shown in Table 4.18.

Table 4.18 Test Results for Goodness of Fit

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	61.693	3	20.564	57.739	.000[b]
	Residual	38.465	108	.356		
	Total	100.159	111			
2	Regression	65.330	4	16.333	50.177	.000[c]
	Residual	34.828	107	.325		
	Total	100.159	111			
3	Regression	67.260	5	13.452	43.343	.000[d]
	Residual	32.898	106	.310		
	Total	100.159	111			
4	Regression	70.401	6	11.734	41.403	.000[e]
	Residual	29.757	105	.283		
	Total	100.159	111			
5	Regression	71.803	7	10.258	37.622	.000[f]
	Residual	28.356	104	.273		
	Total	100.159	111			

Source: Field Data (2023)

Table 4.18 provided the F test revealing the significance of the fitted regression model. An F statistic in model 1 produced the value of 57.739 implying that the independent variables were predicators of the dependent variables ($F=57.739$; $p< 0.05$). As a result of the good fit, Aircraft type, operation environment and airline's maintenance policies had an effect on aircraft maintenance when the regression was fitted.

F-value of model 2 was 50.177 meaning that even after moderation, there was still a good fit of the model ($F=50.177$; $p< 0.05$). As a result, statistically aircraft type had an effect on aircraft maintenance.

F-test for model 3 has an F-value of 43.343 implying that after moderation by technological advancements, it showed a good predictor of aircraft maintenance and the total model was statistically significant (P-value 0.05) and good predictors of aircraft maintenance.

Model 4 F-test got an F-value of 41.403, indicating that when technological advancements was moderated on Aircraft type, operation environment and airline's maintenance policies separately revealed good predictors of aircraft maintenance and that the overall model was significant as it was less than p- value 0.05 ($P < 0.05$).

F-test for model 5 had an F-value of 37.622 meaning that moderation of Aircraft type, operation environment and airline's maintenance policies by technological advancements showed a good predictor of aircraft maintenance and the total model was statistically significant (P-value 0.05) and good predictors of aircraft maintenance were found.

4.7.3 Multiple Regression Coefficients

The regression of coefficients results is presented in Table 4.19.

Table 4.19 Test Results for Regression Analysis Coefficients with Moderation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	**(Constant)**	.898	.228		3.931	.000
	Aircraft type	.242	.110	.244	2.193	.030
	Operation environment	.284	.140	.298	2.031	.045
	Airline's maintenance policies	.281	.123	.289	2.279	.025
2	**(Constant)**	.541	.243		2.229	.028
	Aircraft type	.232	.105	.235	2.204	.030
	Operation environment	.126	.142	.132	.887	.377
	Airline's maintenance policies	.243	.118	.250	2.054	.042
	Z	.274	.082	.283	3.343	.001
3	**(Constant)**	.223	.269		.826	.411
	Aircraft type	.417	.127	.421	3.289	.001
	Operation environment	.190	.141	.200	1.353	.179
	Airline's maintenance policies	.221	.116	.227	1.903	.060
	Z	.363	.088	.375	4.143	.000
	ZX1	-.057	.023	-.328	-2.494	.014
4	**(Constant)**	-1.111	.476		-2.333	.022
	Aircraft type	.333	.124	.337	2.695	.008
	Operation environment	.823	.233	.864	3.535	.001
	Airline's maintenance policies	.208	.111	.214	1.876	.063
	Z	.740	.141	.764	5.255	.000
	ZX1	-.036	.023	-.210	-1.612	.110
	ZX2	-.159	.048	-1.023	-3.329	.001
5	**(Constant)**	-1.087	.467		-2.327	.022
	Aircraft type	.314	.122	.318	2.584	.011
	Operation environment	1.114	.262	1.170	4.252	.000
	Airline's maintenance policies	-.040	.154	-.041	-.258	.797
	Z	.694	.140	.717	4.975	.000
	ZX1	-.032	.022	-.187	-1.454	.149
	ZX2	-.266	.067	-1.711	-4.001	.000
	ZX3	.108	.048	.673	2.267	.025

a. Dependent Variable: Y

Source: Field Data (2023)

Table 4.19 showed that Aircraft type had a positive and significant effect on Aircraft maintenance (β_1=0.244, $p<0.05$) based on regression coefficients from model 1.

Operation environment had a positive and significant effect on Aircraft maintenance (β_2=0.298, $p<0.05$). Airline's maintenance policies had a positive and significant effect on Aircraft maintenance (β_3=0.289, $p<0.05$).

A regression analysis was used in model 2 to test if technological advancements has a moderating effect on the relationship between aircraft type, operation environment and airline's maintenance policies, and aircraft maintenance. The p-value which was less than 0.05, indicated that the coefficient of technological advancements was significant. Technological advancements had a moderating effect on the relationship between aircraft type, operation environment and airline's maintenance policies and Aircraft maintenance.

In model three a regression analysis revealed that technological advancements had a negative moderating effect on the relationship between aircraft type and aircraft maintenance (β=-.328; $p<0.05$).

In model four a regression analysis revealed that technological advancements had a negative and significant moderating effect on the relationship between aircraft type and aircraft maintenance (β=-.210; $p<0.05$). Further, technological advancements had a positive and significant moderating effect on the relationship between operation environment and aircraft maintenance (β= -1.023; $p<0.05$).

Regression analysis in model five showed that technological advancements had a negative and significant moderating effect on the relationship between aircraft type and aircraft maintenance (β=-.187; $p<0.05$). Technological advancements has a negative and significant moderating effect on the relationship between operation environment and aircraft maintenance (β=-1.711; $p<0.05$). Technological advancements has a positive and significant moderating effect on the relationship between airline's maintenance policies and aircraft maintenance (β=.673; $p<0.05$).

The optimal model was;

$$Y= .898 + 0.244X_1 + 0.298X_2 + 0.289X_3 +0.717Z- 0.187Z*X_1 - 1.711Z*X_2 + 0.673Z*X_3$$

4.8 Hypotheses Test Results

The research hypotheses were evaluated by examining the significance levels of the coefficients in the regression model, as presented in Table 4.20. The study's objective was to test whether the hypotheses could be confirmed or refuted regarding the connection between the independent and dependent variables. The research hypotheses encompassed the following aspects:

4.8.1 Hypothesis Testing of the Effect of Aircraft type on the aircraft maintenance

Hypothesis H_{01} stated that Aircraft type has no significant effect on aircraft maintenance of selected airlines in Nairobi County. Results revealed that aircraft types has a positive and significant effect on the aircraft maintenance of selected airlines in Nairobi County (β_1=0.244, $p<0.05$) hence rejecting the null hypothesis H_{01}.

4.8.2 Hypothesis Testing of the Effect of operation environment on the aircraft maintenance

Hypothesis H_{02} stated that operation environment has no statistically significant effect on aircraft maintenance of selected airlines in Nairobi County. Findings revealed that operation environment has a positive and significant effect on the aircraft maintenance of selected airlines in Nairobi County (β_2=.298, $p<0.05$). The null hypothesis H_{02} was rejected, indicating that operational environment had a significant effect on Aircraft maintenance.

4.8.3 Hypothesis Testing of the Effect of airline's maintenance policies on the aircraft maintenance of selected airlines in Nairobi County

Hypothesis H_{03} stated that airline's maintenance policies has no statistically significant effect on aircraft maintenance of selected airlines in Nairobi County. The findings revealed that airline's maintenance policies has a positive and significant effect on the aircraft maintenance of selected airlines in Nairobi County (β_3=.289, $p<0.05$). The results showed that airline's maintenance policies had a significant effect on aircraft maintenance, rejecting the null hypothesis H_{03}.

4.8.4 Hypothesis Testing of Technological advancements on the Relationship Between Aircraft type and airline's maintenance of selected airlines in Nairobi County

Hypothesis H_{04a} stated that technological advancements has no significant moderating effect on the relationship between Aircraft type and airline's maintenance of selected airlines in Nairobi County. Results revealed that technological advancement has a negative and significant moderating effect on the relationship between Aircraft type and airline's maintenance of selected airlines in Nairobi County (β_{4a}=-.187; $p<0.05$). The null hypothesis H_{04a} was rejected based on the findings, implying that technological advancement moderates the relationship between aircraft type and airline's maintenance of selected airlines in Nairobi County

4.8.5 Hypothesis Testing of technological advancements on the Relationship Between Operational environment and airline's maintenance

Hypothesis H_{04b} technological advancement has no significant moderating effect on the relationship between operational environment and airline's maintenance of selected airlines in Nairobi County. Results revealed that technological advancement has a negative significant moderating effect on the relationship between operational environment and airline's maintenance of selected airlines in Nairobi County (β_{4b}=-1.711; $p<0.05$). The null hypothesis H_{04b} was rejected based on the findings, implying that technological advancement moderates the relationship between operational environment and airline's maintenance of selected airlines in Nairobi County.

4.8.6 Hypothesis Testing of technological advancements on the Relationship Between airline's maintenance policies and airline's maintenance

Hypothesis H_{04c} stated that technological advancements has no significant moderating effect on the relationship between airline's maintenance policies and airline's maintenance of selected airlines in Nairobi County. Results showed that technological advancement has a positive and significant moderating effect on the relationship between airline's maintenance policies and airline's maintenance of selected airlines in Nairobi County (β_{04c}=.673; $p<0.05$). The results showed that technological advancement had a moderating influence on the relationship between airline's maintenance policies and airline's maintenance of selected airlines in Nairobi County, hence rejecting the null hypothesis H_{04c}.

Table 4.20 Summary of Hypotheses Test Results

Hypothesis	β-value	p-value	Decision rule
H_{01} Aircraft type has no significant effect on aircraft maintenance of selected airlines in Nairobi County.	β_1=.244	$p=0.000<0.05$	Rejected the null hypothesis
H_{02} Operation environment has no significant effect on aircraft maintenance of selected airlines in Nairobi County	β_2=.298	$p=0.000<0.05$	Rejected the null hypothesis
H_{03} Airline's maintenance policies has no significant effect on aircraft maintenance of selected airlines in Nairobi County	β3=.289	$p=0.000<0.05$	Rejected the null hypothesis
H_{04a}Technological advancements has no significant effect on the relationship between Aircraft type maintenance of selected airlines in Nairobi County.	β_{4a}=-.187	$p=0.002<0.05$	Rejected the null hypothesis
H_{04b}Technological advancements has no significant effect on the relationship between operation environment and aircraft maintenance of selected airlines in Nairobi County.	B_{4b}=-1.711	$p=0.000<0.05$	Rejected the null hypothesis
H_{04c}Technological advancements has no significant effect on the relationship between airline's maintenance policies and aircraft maintenance of selected airlines in Nairobi County.	B_{4c}=.673	$p=0.025<0.05$	Rejected the null hypothesis

Source: Field Data (2023)

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This part contains a summary of the research, as well as its findings and conclusions, as well as some suggestions.

5.2 Summary of the Findings

The subsequent section provides a concise overview of the research findings.

5.2.1 Aircraft type maintenance

The findings of the study provide valuable insights into the perceptions of aircraft maintenance within the aviation industry. The majority of respondents agreed that the type of aircraft has a significant impact on the required maintenance level. This agreement highlights the industry's recognition of the varying maintenance requirements of various aircraft types, emphasizing the importance of tailoring maintenance procedures to specific aircraft attributes.

The second finding of the study was that the majority of respondents agreed that aircraft with more complex systems require more frequent and extensive maintenance. This understanding highlights the correlation between system complexity and maintenance requirements, highlighting the critical role of meticulous maintenance practices in assuring the safety and reliability of complex aircraft. The null hypothesis H_{01} was rejected and concluded that aircraft types has a positive and significant effect on the aircraft maintenance of selected airlines in Nairobi County (β_1=0.244, $p<0.05$).

5.2.2 Operation Environment

The study's findings reveal crucial insights about aircraft maintenance safety. Firstly, most respondents agreed that the operational environment significantly influences aircraft maintenance safety. This means they recognize that where and how maintenance work is done can impact safety. Working in a well-lit, organized workshop is safer than working in a cluttered, dimly lit space.

Secondly, the majority of participants also emphasized the importance of having high-quality tools and equipment for safe aircraft maintenance. This shows that they believe using good-quality tools reduces the chances of accidents and errors. It is similar to using reliable, well-maintained tools at home. However, it is noteworthy that some respondents lacked confidence in their ability to perform aircraft maintenance safely. This suggests that there might be a need for more training and support to boost their confidence and ensure safe practices. The null hypothesis H_{02} was rejected and concluded that operation environment has a positive and significant effect on the aircraft maintenance of selected airlines in Nairobi County (β_2=.298, $p<0.05$).

5.2.3 Airline's Maintenance Policies

A significant portion of respondents found the airline's maintenance policies clear and easy to understand. Conversely, a noteworthy fraction held differing opinions. Similarly, a substantial number of participants acknowledged the regular updating of the airline's maintenance policies for safety assurance, while others expressed disagreement.

Moreover, participants' views on the airline's maintenance staff and procedures were unveiled. The study highlighted that a considerable proportion viewed the maintenance staff as well-trained and competent, while a notable group disagreed. Similarly, a significant majority believed the airline's maintenance equipment to be well-maintained and up-to-date, with a contrasting view from a smaller percentage. Furthermore, perspectives on the consistency of following maintenance procedures varied, indicating diverse viewpoints among participants.

These findings underscore the range of opinions among participants regarding policy clarity, staff training, procedural adherence, and equipment condition within the airline's maintenance framework. The study's outcomes emphasize the importance of effective policy communication, robust training, procedural alignment, and equipment maintenance to cultivate a safety-oriented culture in the airline's maintenance operations.

The null hypothesis H_{03} was rejected and concluded that airline's maintenance policies has a positive and significant effect on the aircraft maintenance of selected airlines in Nairobi County (β_3=.289, $p<0.05$).

5.2.4 Technological Advancements

A considerable consensus emerged on the potential benefits of automation in making aircraft maintenance more efficient, although a notable fraction held opposing views. A similar trend was observed concerning the use of lightweight composite materials for fuel efficiency, indicating broad agreement. Improved air traffic control systems garnered substantial agreement in terms of their potential to reduce congestion and delays, despite a smaller proportion expressing disagreement. The perceived role of enhanced biometrics for airport security was largely deemed to enhance safety, with a minority holding differing perspectives. Lastly, the potential for augmented reality (AR) to enhance situational awareness for aircraft maintenance technicians was widely acknowledged, despite a smaller group expressing uncertainty.

The null hypothesis H_{04a} was rejected based on the findings, implying that technological advancement moderates the relationship between aircraft type and airline’s maintenance of selected airlines in Nairobi County (β_{4a}=-.187; $p<0.05$). The null hypothesis H_{04b} was rejected based on the findings, implying that technological advancement moderates the relationship between operational environment and airline's maintenance of selected airlines in Nairobi County (β_{4b}=-1.711; $p<0.05$). The null hypothesis H_{04c} was rejected and concluded that technological advancement had a moderating influence on the relationship between airline's maintenance policies and airline's maintenance of selected airlines in Nairobi County, hence rejecting. (β_{04c}=.673; $p<0.05$).

5.3 Conclusions of the Study

The study's exploration of various facets of aircraft maintenance has yielded valuable insights into the operational dynamics and safety considerations within the aviation industry. The research's 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.

The investigation into the operational environment's impact on safety highlighted the significance of clear policies, quality tools, effective personnel training, conducive work environments, and individual confidence in ensuring safe aircraft maintenance practices. Similarly, participants' perspectives on technological advancements emphasized the potential benefits of automation, lightweight materials, enhanced air traffic control, biometrics, and augmented reality, indicating a growing recognition of technology's role in shaping the aviation landscape. Additionally, insights into the perceived quality of maintenance, spare parts availability, technician experience, timeliness of checks, and aircraft safety underscored participants' nuanced perceptions of these critical aspects.

In conclusion, the research findings offer a comprehensive understanding of nature of aircraft maintenance. These insights provide valuable implications for aviation stakeholders, ranging from policymakers to industry practitioners, aiming to enhance safety, efficiency, and overall operational excellence within the realm of aircraft maintenance.

5.4 Recommendations

Based on the research findings and conclusions drawn, recommendations are put forth to enhance various aspects of aircraft maintenance, safety, and efficiency:

5.4.1 Theory

The study's 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. The study's findings also highlight the importance of considering the operational environment and technological advancements in aircraft maintenance research. Future research could explore how these factors interact with each other to influence the safety and efficiency of aircraft maintenance operations.

5.4.2 Practice

The recommends that the aviation stakeholders should focus on developing and implementing clear policies, quality tools, effective personnel training, conducive work environments, and individual confidence to ensure safe aircraft maintenance practices. Aviation stakeholders should also explore the potential benefits of technological advancements, such as automation, lightweight materials, enhanced air traffic control, biometrics, and augmented reality, to improve the efficiency and effectiveness of aircraft maintenance operations.

5.4.3 Managerial

Aviation managers should develop and implement maintenance programs that are tailored to the specific needs of their aircraft fleet and operational environment. Aviation managers should also invest in training and development programs to ensure that their maintenance personnel have the skills and knowledge necessary to safely and efficiently maintain their aircraft. Aviation managers should also monitor the latest technological advancements and consider how they can be used to improve the efficiency and effectiveness of their aircraft maintenance operations. Airlines should develop more risk-based maintenance programs, which would focus on targeting maintenance efforts to the aircraft components and systems that are most likely to fail. Aircraft maintenance providers should develop more efficient maintenance processes and to improve the quality of their maintenance work. Aviation regulators should develop more effective safety regulations and to target their oversight efforts to areas of highest risk.

5.5 Recommendation for Further Studies

Future researchers to assess the cost and time savings associated with new technologies such as predictive maintenance, condition-based monitoring, and automated inspections. It could also identify any potential challenges or risks associated with the adoption of new technologies.

Investigate the use of predictive maintenance to reduce aircraft downtime and improve safety. Predictive maintenance uses data analytics to predict when aircraft components are likely to fail. This allows airlines to schedule maintenance proactively, rather than waiting for a component to fail. This can help to reduce aircraft downtime and improve safety.

5.6 Limitations of the Study

To begin with, the study was limited to using questionnaires to collect data on study objectives. Questionnaires are typically limited to a predetermined set of questions, which limits the amount of information that can be collected. This can be problematic if the researcher is interested in a complex topic or needs to comprehend the nuances of respondents' experiences. The researcher mitigated this by increasing the number of questions per objective in order to obtain in-depth information that would not have been possible otherwise.

Second, because the study was conducted using an explanatory research design, respondents may not have felt encouraged to provide accurate, honest answers. Respondents may not feel comfortable providing answers that portray them negatively. Closed-ended questions in surveys may have a lower validity rate than other question types. This was mitigated by assuring respondents that the information they provided would be kept private. In addition, open-ended questions were used to elicit detailed information.

Third, the research was limited to a few previous studies on the moderating effect of technological advances. As a result, the review of literature pertaining to the study variables in the region was limited. Furthermore, the study was restricted to a few airlines in Nairobi County. Finally, the study's findings and conclusions were based on the respondents' knowledge and experience.

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APPENDICES

Appendix I: Questionnaire

This questionnaire will help in answering formulated research questions on the topic under study. Information given herein will be treated with utmost confidentiality. Please answer all the questions honestly. Tick (√) or fill up the box at the appropriate blank

PART A: BIODATA

Age Bracket

18-35 years [ ] 35-45 years [ ] 45-50 years [ ] above 50 years [ ]

Gender

Male [ ] Female [ ]

How long have you worked in this organization?

Less than 1 year [ ]

1-5 years [ ]

5-10 years [ ]

10-15 years [ ]

Over 15 years [ ]

PART B: Aircraft Type and Aviation Maintenance

This part contains questions on aircraft type on aviation maintenance. On a scale of 1-5 (Where: 5=Strongly Agree; 4=Agree; 3=Neutral; 2=Disagree; 1=Strongly Disagree) tick appropriately to indicate to what extent you agree with these statements.

Statements	**1**	**2**	**3**	**4**	**5**
1. The aircraft type has a significant effect on the level of maintenance required.					
2. Aircraft with more complex systems require more frequent and extensive maintenance.					
3. Well-maintained aircraft are less likely to experience mechanical problems.					
4. Aircraft type varies with level of maintenance.					
5. Does the Aircraft type Manufacturers have effects on maintenance					

PART C: Operation Environment

This part contains questions on operation environment. On a scale of 1-5 (Where: 5=Strongly Agree; 4=Agree; 3=Neutral; 2=Disagree; 1=Strongly Disagree) tick appropriately to indicate to what extent you agree with these statements.

Statements	**1**	**2**	**3**	**4**	**5**
1. The operation environment has a significant impact on the safety of aircraft maintenance.					
2. The quality of tools and equipment used in aircraft maintenance is important for safety.					
3. The training of aircraft maintenance personnel is essential for safety.					
4. The work environment in aircraft maintenance is safe and conducive to error-free work.					
5. I am confident in my ability to perform aircraft maintenance safely.					

PART D: Airline's Maintenance Policies

This part contains questions on airline's maintenance policies. On a scale of 1-5 (Where: 5=Strongly Agree; 4=Agree; 3=Neutral; 2=Disagree; 1=Strongly Disagree) tick appropriately to indicate to what extent you agree with these statements.

Statements	1	2	3	4	5
1. The airline's maintenance policies are clear and easy to understand.					
2. The airline's maintenance policies are regularly updated to ensure safety.					
3. The airline's maintenance staff are well-trained and competent.					
4. The airline's maintenance procedures are consistently followed.					
5. The airline's maintenance quality systems is functional					

PART E: Technological Advancements

This part contains questions on technological advancements. On a scale of 1-5 (Where: 5=Strongly Agree; 4=Agree; 3=Neutral; 2=Disagree; 1=Strongly Disagree) tick appropriately to indicate to what extent you agree with these statements.

Statements	1	2	3	4	5
1. Advances in automation will make aircraft maintenance more efficient.					
2. The use of lightweight composite materials will make aircraft more fuel-efficient.					
3. Improved air traffic control systems will reduce congestion and delays in air travel.					
4. Enhanced biometrics for airport security will make air travel more secure.					
5. Augmented reality (AR) will improve situational awareness for aircraft maintenance technicians.					

PART F: Aircraft maintenance

This part contains questions on aircraft maintenance. On a scale of 1-5 (Where: 5=Strongly Agree; 4=Agree; 3=Neutral; 2=Disagree; 1=Strongly Disagree) tick appropriately to indicate to what extent you agree with these statements.

Statements	**1**	**2**	**3**	**4**	**5**
1. There is standard quality aircraft maintenance					
2. Availability of spare parts has improved aircraft maintenance					
3. The experience of the technicians who work on aircraft maintenance is high					
4. There is timeliness of maintenance checks					
5. There is proper documentation in all aircraft maintenance carried out.					

Appendix II: University Letter

MOI UNIVERSITY
SCHOOL OF BUSINESS AND ECONOMICS
POSTGRADUATE OFFICE

Telephone (053) 43620
Fax No. (053) 43047
Email: hodmarketing@mu.ac.ke

P.O. Box 3900-30100
Eldoret Annex Campus
ELDORET, Kenya

MU/SBE/ML/PG/33

5th September, 2023

TO WHOM IT MAY CONCERN

Dear Sir/Madam

RE: ENOCK KIPLAGAT KORIR - EASA/EMBA/005/16

The above-named is a student of Moi University, School of Business and Economics. He is undertaking Executive Master of Business Administration (Aviation Option).

Mr. Korir has successfully completed his coursework, defended his proposal, and is proceeding to the field to collect his research titled ***"Aircraft Conditions, Technological Advancements and Aircraft Maintenance in Nairobi County"***

Any assistance accorded to him will be highly appreciated.

Yours faithfully,

SCHOOL OF BUSINESS & ECONOMICS
MOI UNIVERSITY
3900 ELDORET-30100

DR. RONALD BONUKE
POSTGRADUATE CHAIR, SBE
cj/RB

Appendix III: Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 314806

Date of Issue: 06/October/2023

RESEARCH LICENSE

This is to Certify that Mr.. ENOCK KIPLAGAT KORIR of Moi University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: AIRCRAFT CONDITIONS, TECHNOLOGICAL ADVANCEMENTS AND AIRCRAFT MAINTENANCE IN NAIROBI COUNTY for the period ending : 06/October/2024.

License No: NACOSTI/P/23/30078

314806

Applicant Identification Number

Director General

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

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Appendix IV: Plagiarism Certificate

SR400

ISO 9001:2019 Certified Institution

THESIS WRITING COURSE

PLAGIARISM AWARENESS CERTIFICATE

This certificate is awarded to

ENOCK KIPLAGAT KORIR

MU/EMBA/EASA/005/16

In recognition for passing the University's plagiarism

Awareness test for Thesis entitled: **AIRCRAFT CONDITIONS, TECHNOLOGICAL ADVANCEMENTS AND AIRCRAFT MAINTENANCE OF SELECTED AIRLINES IN NAIROBI COUNTY.** with a similarity index of 23% and striving to maintain academic integrity.

Word count: 20025

Awarded by

Prof. Anne Syomwene Kisilu

CERM-ESA Project Leader   Date: 22/11/2023