

A STUDY OF THE COMPLEXITIES, CHALLENGES, AND BUSINESS
OPPORTUNITIES AVAILABLE WITHIN THE NIGERIAN AIRCRAFT
MAINTENANCE, REPAIR, AND OVERHAUL SECTOR

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Dedication

I dedicate this research to the memory of my parents, General and Mrs Paulina Tuti, and to my sister,
Helen B. Tuti.

Acknowledgement

Firstly, I wish to express my gratitude to the Almighty for granting me the strength to overcome the challenges inherent in this research and to persevere despite a demanding work and family schedule. I am deeply appreciative of my beloved parents, General and Mrs Paulina Tuti, of blessed memory. My sincere appreciation goes to my family members, including Christy, Pauline, Charles, and my siblings: Menchinodo, Bedakai, Pwangurdi, Pwaluri, David, Betadi, Moreino and Brenda, as well as my nephews and nieces, whose support has been invaluable.

Finally, I extend my heartfelt gratitude to Dr Anuja Shukla, my mentor. Her guidance, wisdom, encouragement, and constructive criticism have been instrumental in shaping my academic journey and in leading to the successful completion of this programme.

Abstract

This research examines the complexities, challenges, and business opportunities within Nigeria's aviation maintenance, repair, and overhaul (MRO) sector. It seeks to investigate the key systemic vulnerabilities that hinder the development of a safe, efficient, and resilient aviation MRO sector in Nigeria, despite the sector's rich history and government investments over the years.

To accomplish this project, we used a multi-part approach, integrating quantitative data from surveys of 205 stakeholders. This data was collated using a structured questionnaire administered via Google Forms, with qualitative insights derived from thematic analysis and an extensive review of global and African MRO case studies. The study is guided by three principal questions: the sector's inherent complexities, the primary challenges to productivity and development, and the business opportunities available for indigenous MRO for enthusiasts and would-be investors alike.

Several statistical analysis tools were used to provide more practical insights. These include Multiple Linear Regression, which revealed a highly significant model ($p < .001$), indicating that strategic drivers, namely, government policy support, stakeholder collaboration, and investment in specialised training, are significant predictors of a positive economic outlook for the sector. The Chi-Square test of independence ($p = 0.239$) further indicates that regulatory hurdles are perceived as a consistent systemic barrier across all experience levels. Empirical findings also identify component repair (86.8%) and training services (87.3%) as the most viable immediate business opportunities for indigenous enterprises.

The research concludes by presenting a data-driven roadmap for investors and policymakers, offering actionable recommendations that can directly influence policy development and guide strategic investment decisions to address challenges in Nigeria's MRO sector.

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Chapter 1 Introduction

1.1 Introduction

The aviation sector is often a crucial driver of economic growth in many countries, as it primarily supports global trade and tourism. Nigeria, with a population of 237.5 million (UNFPA, 2025), has significant economic potential and plays a unique role in the aviation industry by facilitating the movement of goods and services nationwide. Therefore, the smooth operation of this sector depends on a strong and efficient support system within the aviation maintenance industry. A visible and resilient Maintenance, Repair, and Overhaul (MRO) sector ensures aircraft airworthiness, safety, and operational readiness, all of which are vital to a sustainable and prosperous aviation industry.

The Nigerian aviation sector presently depends on foreign MRO facilities for heavy aircraft inspections and repairs. This overreliance has posed several challenges for domestic airlines, including higher operational costs, complex logistics, and substantial foreign exchange expenses.

Nigeria has a high number of grounded aircraft, with 79 out of 123 planes, or nearly 64%, currently out of service. This is a significant issue, as the country operates around 100 commercial aircraft, and over 48 of them are grounded, affecting the country's overall fleet capacity (Mordor Intelligence, 2026). The Nigerian government still needs to fulfil its commitments to the industry, particularly in MRO facilities and aircraft leasing, which are crucial to meeting local demand and reducing capital flight. The substantial number of grounded aircraft in Nigeria has become a driving force behind growth in the country's MRO market.

The global MRO services market is substantial, and building a robust domestic MRO capability could position Nigeria not only to support its own airlines but also to secure a share of the broader African market. With its strategic location and growing aviation sector, Nigeria has the potential to emerge as a key player in the African MRO industry, thereby strengthening its rapidly expanding aviation sector. This study aims to provide a comprehensive review of the current state of aircraft MRO in Nigeria,

examine the inherent complexities and challenges that hinder its growth, and identify key business opportunities to support its development and expansion. Most importantly, it examines the obstacles that hinder the progress of this vital sector, thereby highlighting the business opportunities these challenges present. This is achieved by first addressing three research questions, developing and testing hypotheses, and drawing practical conclusions.

1.2 Problem Statement

Economic activities within the Nigerian aviation industry depend on foreign MRO services (Ajeyalemi and Olarewaju, 2020). This reliance has resulted in several critical issues, including elevated operational costs for airlines and significant expenses for overseas aircraft maintenance, labour, and downtime. These challenges exert substantial pressure on airlines' financial performance, which airlines frequently pass on to passengers through higher airfares (Adediran, 2019).

The need to transport aircraft overseas has also created numerous problems, including inadequate regulatory oversight and insufficient monitoring of maintenance activities. Firstly, economic and financial pressures on contractors often lead to corner-cutting or unsafe practices. Secondly, subcontracting has been associated with hazardous forms of disorganisation, including weakened induction, training, and supervisory processes. Thirdly, regulatory shortcomings, such as insufficient coverage, implementation, and enforcement, have significantly contributed to poorer safety outcomes (Machado *et al*, 2016).

1.3 Research Questions

The research questions are designed to explore the complexities, challenges, and opportunities in Nigeria's MRO sector, guiding the investigation into its development prospects.

1. What are the inherent complexities characterising the Nigerian aviation sector within the domain of aircraft maintenance, repair, and overhaul?

2. What are the key challenges that hinder the operational efficiency and growth of aircraft maintenance, repair, and overhaul facilities within the Nigerian aviation sector?
3. What potential business opportunities exist within the Nigerian aviation sector concerning the establishment and expansion of aircraft maintenance, repair, and overhaul capabilities?

1.4 Research Objectives

This research aims to identify the key factors that have impeded the development of a safe, efficient, and sustainable aviation ecosystem and to proffer a comprehensive analysis of the sector's current state. To pursue these objectives, the study poses three research questions directly aligned with the core goals. Each of these questions provides a pathway to evaluate specific factors and clarify how inherent complexities and challenges shape the sector's development. The research systematically evaluates the identified factors through this process, thereby uncovering the business opportunities arising from these challenges. The study proceeds by addressing the research questions, then developing and testing hypotheses based on these questions to ensure methodological rigour, and finally drawing practical conclusions supported by both the objectives and the empirical findings.

1.5 Significance of the Study

This research makes a novel contribution to the academic literature on aviation maintenance management in Nigeria by providing a comprehensive, data-driven analysis that systematically bridges operational challenges, thereby offering evidence-based business opportunities within the Maintenance, Repair, and Overhaul (MRO) sector projects and human capital initiatives tailored to the distinct needs of the Nigerian MRO ecosystem. Furthermore, by articulating actionable investment opportunities in specialised facilities, component repair, training, and technology adoption, the research establishes a rigorous foundation for future scholarship and strategic decision-making. This work moves beyond descriptive analysis to generate actionable knowledge that advances both academic understanding and industry practice, supporting Nigeria's goal of developing a resilient,

efficient, and competitive aviation sector. This research also adds to the broader academic discussion on the aviation industry in developing economies. It offers novel empirical evidence from the Nigerian context, and the results of this unique benchmarking study can guide future research and provide valuable insights into effective strategies used by other developing countries to establish successful domestic MRO sectors that could be adapted and implemented in Nigeria.

1.6 Scope and Limitations of the Study

This study examines maintenance and repair services for aircraft in Nigeria's aviation sector. It investigates facilities that provide a wide range of MRO services, including airframe maintenance, engine overhauls, component repairs, and avionics servicing, for commercial aircraft operating in Nigeria. These include airline operators, both domestic and international; MRO service markets serving Nigerian carriers; regulatory bodies such as the Nigeria Civil Aviation Authority (NCAA); relevant government agencies; industry associations; and potential investors.

The study has certain limitations. Firstly, confidentiality concerns and competitive sensitivities in the airline industry may restrict access to detailed financial and operational data from private MRO companies in Nigeria. Secondly, the focus may be on larger commercial aircraft, with less emphasis on the specific MRO needs of general aviation or military aircraft. Despite these limitations, the study aims to provide a comprehensive analysis of the research area, offering valuable insights and recommendations to strengthen the Nigerian MRO sector.

1.7 Definition of Key Terms

Aircraft Servicing, Restoration, and Revitalisation (SRR) involve activities to maintain aircraft airworthiness, safety, and reliability, including maintenance, inspections, repairs, modifications, and overhauls of airframes, engines, and components, following regulations and industry best practices.

Complexity encompasses factors that affect the establishment, operation, and growth of Nigerian MRO facilities, including regulatory hurdles, bureaucratic processes, infrastructure deficits, technological limitations, skill gaps, financial constraints, and stakeholder impacts (Umezurike and Ganiyu, 2020).

Challenges, including funding shortages, staffing issues, supply chain problems, infrastructure gaps, and a tough business environment, hinder the growth of Nigerian aviation repair and maintenance organisations (Umezurike and Ganiyu, 2020; Orikpete *et al*, 2023).

Nigeria's MRO industry offers opportunities such as creating new facilities, upgrading existing ones, providing specialised services, developing regional hubs, and establishing training centres.

Operational efficiency means delivering high-quality, timely, cost-effective, and safe MRO services by optimising processes, reducing aircraft downtime, managing resources, and maintaining quality standards (Chandola *et al*, 2023; Hallensleben, 2025).

The Nigerian MRO sector is a growing industry with potential for new facilities, improved services, technological advances, increased investment, and greater economic impact (Orikpete *et al*, 2023; Paul *et al*, 2025). The NCAA and other agencies set regulations for MROs, including rules and standards to ensure aircraft safety and airworthiness (Nolan and Anderson, 2015; Habib and Turkoglu, 2020).

Chapter 2: Literature Review

2.1 Introduction

The global maintenance, repair, and overhaul (MRO) industry has undergone rapid expansion in recent years. This expansion is partly attributable to rising international air travel demand, an ageing aircraft fleet, and broader technological advancements in aviation, including artificial intelligence (AI), predictive maintenance, automation, and digital twins, all aimed at enhancing efficiency and reliability. Despite progress, Nigeria's MRO sector continues to struggle with underinvestment and operational inefficiency (Umezurike and Ganiyu, 2020).

The Nigerian government, while recognising the economic importance of a strong aviation sector, has committed to enhancing the industry through private sector participation and foreign direct investment (Adediran, 2019). This strategic initiative aims to transform existing operational and financial hurdles into substantial economic opportunities, thereby enhancing the safety, reliability, and cost-efficiency of airline operations in Nigeria and establishing the country as a leading regional aviation hub for West and Central Africa (Nwaogbe *et al*, 2023).

2.2 Historical Overview of Nigerian Aviation

The history of Nigerian aviation dates back to the 1920s (Akpoghomeh, 1999). At the start of World War II, the British Imperial government compelled Nigeria and other West African nations to accelerate the development of air transportation services, mostly for strategic purposes (Adedeji, 2024). The push was to establish an organised route to gather intelligence on troop movements and supplies, and, most importantly, to deliver mail. In 1925, a Royal Air Force aircraft landed in Kano (Oluwakoya, 2011). There are several accounts of the aircraft's arrival, some complementary and others contradictory. The issues are as follows. Firstly, sources agree that it was a British Royal Air Force aircraft but differ on its type. While some stated that the plane was a Bristol Fighter, others claimed it was a De Havilland 9A. Secondly, it is agreed that the year was 1925, even though the actual date and time are disputable (Decker 2008; Oluwakoya 2011)

The period between the 1950s and the 1960s marks the start of a significant phase of growth in Nigeria's civil aviation sector (Orikpete *et al*, 2023), during which the Search and Rescue Units were established in Kano and Lagos. Following Nigeria's independence in 1960, the government invested heavily in the aviation sector to assert national sovereignty and enhance connectivity (Orikpete *et al*, 2023). This effort resulted in the government's full ownership of Nigeria Airways in 1961, which had developed from the West African Airways Corporation (WAAC). Nigeria Airways was established as the national flag carrier and was based in Lagos (Asaju, 2023).

Nigerian Airways operated as a typical government parastatal. They lacked a profit-driven ethos, leading to widespread operational inefficiencies, including frequent overbooking, mismanaged resources, and persistent flight delays and cancellations, which damaged the airline's reputation and reliability. The process for obtaining boarding passes often became cumbersome, resulting in significant passenger dissatisfaction and becoming a national concern by the late 1980s. These operational shortcomings coincided with increasing pressure from influential Nigerians eager to enter the aviation industry and a global trend towards deregulation (Oluwakoya 2011; Shobande and Akinbomi 2020). A military government's underinvestment, which further worsened airport infrastructure and aircraft availability, marked this period of change (Nwaogbe *et al* 2018; Jemirade, 2021).

In 1995, a significant regulatory reform occurred with the dissolution of the Federal Civil Aviation Authority (FCAA), which was replaced by two new bodies, namely the Directorate of Safety Regulation and Monitoring (DSRAM) and the Directorate of Economic Regulation and Monitoring (DERAM), both operating under the Ministry of Aviation. The establishment of the Federal Airports Authority of Nigeria (FAAN) as a parastatal marked the pinnacle of these efforts to reorganise the body. These directorates (DSRAM and DERAM) were subsequently absorbed into the autonomous Nigerian Civil Aviation Authority (NCAA), established by Decree 49 of 1999. Complementary agencies were also set up to ensure compliance with International Civil Aviation Organisation (ICAO) safety standards and to promote secure and efficient air transport within Nigeria's borders.

The Accident Investigation Bureau (AIB) investigates serious aircraft incidents and accidents.

Federal Airports Authority of Nigeria (FAAN): Manages all federal airports in Nigeria.

Nigerian Airspace Management Agency (NAMA): Provides air navigation services and manages Nigerian airspace.

Nigeria's airlines include both domestic and international carriers, such as Arik Air, Air Peace, Ibom Air, United Nigeria Airlines, and XEJet (Ejem 2025; Shobande and Akinbomi 2020). To improve airspace management, NAMA has invested in modernising navigational facilities to provide safe skies for aircraft.

2.3 Global MRO Ecosystem, Dynamics, and Analysis

The global MRO sector is essential to the international aviation industry, ensuring aircraft airworthiness, maintaining strict safety standards mandated by international organisations such as ICAO, and ensuring continuous operational readiness across diverse fleets. However, the global demand for air travel is skyrocketing, driving substantial expansion and improving aircraft utilisation. These innovations aim to boost efficiency, cut costs, and enhance the overall reliability and safety of global air transport. Leading MRO providers worldwide, including Lufthansa Technik in Europe and major OEM service divisions like Boeing and Airbus, are investing in these advancements to remain competitive and meet the evolving demands of modern aircraft. While there are major repair centres in North Africa (EgyptAir Maintenance, Royal Air Maroc), South Africa (Ethiopian Airlines MRO), and Southern Africa (SAA Technical and others), apart from West Africa, which lacks extensive MRO facilities, many of the continent's MROs are limited in size and the scope of services offered.

Nigeria endeavours to foster the growth of the domestic MRO sector by converting operational and financial challenges into significant economic opportunities, thereby encouraging expansion. Establishing an airline's MRO process necessitates substantial investment, often leading new entrants to seek outsourcing options. MRO services are essential to aviation safety and reliability, ensuring that aircraft, engines, and critical components operate as intended and reducing the likelihood of accidents or failures. The discipline of MRO requires a comprehensive understanding of aviation regulations and standards, as well as the technical intricacies of aircraft systems. Aviation professionals, including

pilots, engineers, and technicians, depend on this specialised knowledge to maintain safety, enhance performance, and support well-informed decision-making during flight operations.

The core pillars of an MRO are:

1. Maintenance encompasses the ongoing care and management of an aircraft and its components. It involves regular inspections, repairs, and parts replacements to ensure the aircraft's continued safety. Maintenance activities may be scheduled, unscheduled, or preventive, and may be performed by the aircraft owner or a third-party service provider.
2. Repair pertains to restoring an aircraft or its components to their proper condition following damage or malfunction. Repairs range from minor adjustments to major overhauls of the entire aircraft or engine, which the manufacturer typically conducts at an authorised repair station or by certified mechanics.
3. Overhaul entails the extensive disassembly, inspection, repair, and reassembly of an aircraft or its components. These services focus on critical systems, such as aircraft engines, landing gear, and avionics.

They aim to restore these components to a "like-new" condition, thereby ensuring their reliability and safety.

1. Aircraft maintenance encompasses a range of complex activities that require regulatory oversight.
2. Routine maintenance tasks include:
3. Cleaning the aircraft and its primary avionic components.
4. Checking shelf-life parts in accordance with Standard Operating Procedures (SOPs).
5. Maintaining avionics.
6. Applying the corrosion-inhibiting compound.
7. Lubricating and overhauling the parts.
8. Draining leaked fluids and inspecting or troubleshooting fuel systems.

9. Servicing hydraulic and pneumatic systems.
10. Replacing tables and Line Replaceable Units (LRUs) according to guidelines.
11. Inspecting and assessing for general wear and tear.

Small and low-cost carriers often outsource some maintenance to other companies due to the labour-intensive nature of their operations and the significant investment required in setting up facilities and equipment. In the US, companies outsourced 71% of heavy airframe maintenance in 2007, and engine maintenance is a rapidly growing segment of the MRO market (Olaganathan *et al*, 2020). In-house, ground handling, servicing, and organisational maintenance remain within the company. A strategic partnership bridges the gap between existing services and the development of sufficient capacity, mirroring a model from other sectors. Despite these challenges, investor confidence in Africa's aviation sector is gradually improving. Domestic airlines such as United Nigeria, XEJet, and Ibom Air are spearheading new MRO initiatives. United Nigeria recently signed a memorandum of understanding with Montreal-based Cronos Aviation to establish an MRO facility in Nigeria, which includes technology transfer and technical training for local staff. In January, XEJet began construction on a \$10 million flight support and engineering centre at Abuja's Nnamdi Azikiwe International Airport, with backing from Nigeria's aviation minister (ePlane AI, 2025).

2.4 Global MRO Market Trends (2024-2025 and beyond)

A key function of the wider aviation sector is MRO, which provides maintenance, repair, and overhaul services. These are divided into four main areas: line maintenance, base maintenance, engine and component overhaul, and modifications and upgrades (International Journal of Research Publication and Reviews, 2022, vol. 3, p. 2374). The United States has outsourced heavy maintenance to developing countries to reduce costs by leveraging lower wages and lower facility investment. Although traditionally regarded as an operational expense for airlines, a change in basic assumptions has led some carriers to transform their MRO divisions into profitable business units.

The International Air Transport Association (IATA) projected that total airline revenue in 2023 would reach \$779 billion, indicating a recovery towards the record \$838 billion reported in the 2022 IATA report. Beyond direct revenue, the air transport industry, which encompasses airlines, airports, and general aviation services, plays a crucial role in driving economic growth and development, delivering significant economic and social benefits. Worldwide, the total economic impact of aviation (including direct, indirect, induced, and catalytic effects) is estimated at \$27 trillion, representing 3.5% of global GDP. Five per cent of the world's Gross Domestic Product (GDP) and supporting sixty-two million jobs. This highlights the critical role of aviation in the global economy; its catalytic effects on trade, tourism, and consumer welfare emphasise its indispensable contribution to economic growth in both developed and developing countries. In Africa, the aviation industry generated 6.9 million jobs and contributed \$80 billion to GDP (2023). Traffic in the region grew at an annual rate of 5.8% (Bofinger, 2017). The rates increased by 5.8% between 2001 and 2015, with a more pronounced 7.6% increase between 2003 and 2010 (Bofinger, 2017). Including tourism, the continent accounted for 12% of aviation-supported jobs and 3% of GDP in 2012. South Africa and Egypt are prominent air transport markets in Africa (Heinz and O'Connell, 2013), with South Africa hosting three of the top twenty airports by annual aircraft movements (Adler *et al*, 2017). Egypt has a significant share in intra-North and Sub-Saharan markets, with Cairo Airport ranking highly (Cruz and Mafambissa, 2018). These statistics underscore the substantial economic benefits of aviation, prompting government reforms to enhance the sector's efficiency and responsiveness to passenger needs.

A consistent annual growth rate and a current in-service fleet of 27.4 aircraft are approaching their pre-pandemic size as of January 2020. Despite global economic headwinds, the in-service fleet increased by 7% between January 2022 and January 2023 (Wyman, 2023). Airlines are adopting strategic approaches to their Maintenance, Repair, and Overhaul (MRO) operations. Fully integrated MRO airlines are expanding their networks by acquiring other airlines or independent MRO companies. Those with substantial in-house capabilities can provide MRO services to other carriers in high-growth

markets or regions with MRO support gaps, eliminating the need for individual infrastructure development.

Partnerships between Original Equipment Manufacturers (OEMs) and airline Maintenance, Repair, and Overhaul (MRO) businesses, as well as joint ventures with local airlines, are utilised to enhance market share and deliver improved value to their customers. The International Civil Aviation Organisation (ICAO) has characterised the aviation industry in Sub-Saharan Africa as relatively small and nascent. The region has faced challenges, including safety oversight issues and limited airspace liberalisation, due to slow implementation of the 1999 Yamoussoukro Decision (Njoya, 2015; Bofinger, 2017). Political instability has further impeded the industry's growth (Faure and Malachowski, 2025).

2.5 Maintenance Control and Infrastructure Challenges in the Aviation MRO Sector

The aviation industry, a highly regulated sector vital for economic connectivity and transportation, faces significant challenges in maintaining control systems and addressing infrastructural limitations within the MRO sector. This paper examines the effectiveness of maintenance control, the frequency of incomplete maintenance procedures, and the consequences of incorrect maintenance actions. It highlights the considerable infrastructure constraints faced by MRO operators, with a particular focus on the Indian aviation landscape. To ensure aircraft safety and comply with strict regulatory standards, reliable maintenance control systems are crucial. This analysis systematically reviews common shortcomings in current maintenance practices and discusses the profound implications of inadequate infrastructural support for comprehensive MRO services. Maintenance management is the systematic planning, organisation, monitoring, and evaluation of maintenance activities and their costs (Knotts, 1999). A thorough, methodical approach to improving existing maintenance control frameworks is essential for effectively addressing these widespread issues.

Even when procedures are initiated, their execution often is inadequate, failing to meet strict regulatory standards for certifiable components or Line Replaceable Units (LRUs). This evident lack of compliance can affect aircraft airworthiness, risking operational integrity and safety. Varaprasada noted that the maintenance was performed incorrectly, that the job was completed, but it did not achieve its aim. This further resulted in a more substantial number of second-level descriptors than in Incomplete Maintenance, which is a more significant issue. The incorrect setting is due to improper task performance rather than an omission (Varaprasada, 2014).

Operators of regulatory compliance and ongoing airworthiness management programmes (CAMPs) in the aviation sector are legally obliged to develop and execute a continuous airworthiness maintenance programme (CAMP) under the strict supervision of the relevant regulatory authorities. Furthermore, C and D checks, which increase in intensity, scope, and thoroughness as component wear progresses, thereby reflecting operational engagement, are integral parts of this comprehensive, detailed inspection regime (Ballarin *et al*, 2025).

Maintenance activities can be categorised by their nature and the maintenance programmes they adhere to.

Preventive maintenance, performed at designated intervals according to a maintenance schedule, is considered scheduled maintenance (Kinnison and Siddiqui, 2004).

Following failures or damage, unscheduled maintenance (also known as reactive maintenance) is performed to restore an aircraft to its intended operational condition (Vieira and Lavorato, 2016).

Modifications, although not officially regarded as maintenance, are performed by Approved Maintenance Organisations (AMOs).

EASA defines line maintenance as pre-flight checks performed to ensure that an aircraft is fit to fly

These activities include:

1. Troubleshooting and rectification of defects.
2. Replacement of components, including engines and propellers, often using external testing equipment.
3. Scheduled maintenance checks, including visual inspections, to identify any apparent discrepancies.

Aircraft engines and components, once removed, undergo maintenance in specialised workshops; this process is known as workshop maintenance. This maintenance is performed in accordance with the Component Maintenance Manual (CMM) or the Overhaul Manual (OHM), which require dedicated technology and equipment designed for specific aircraft systems.

The CAMO is restricted from using this indirect approval mechanism unless it is under the oversight of the Member State of Registry, or a specific agreement transfers responsibility to the competent authority (Huttunen, 2019).

The aircraft maintenance program must ensure strict compliance with:

Directives issued by the competent aviation authority (Güneş *et al*, 2020).

Continuing airworthiness instructions provided by type certificate holders and other holders of relevant approvals, in accordance with Regulation (EU) No. 748/2012. Additional or alternative instructions proposed by the aircraft owner or the CAMO, subject to approvals (Kuhle *et al*, 2021).

An exception to this applies to escalated safety-related tasks, which require direct approval (Farinha and Galar, 2014).

This structured approach to aircraft maintenance underscores the importance of standards and procedures in ensuring the ongoing safety, reliability, and overall airworthiness of aircraft in the aviation industry. The maintenance programme must include detailed information on the frequency and nature of all maintenance activities, tailored to the specific characteristics of the aircraft type and

its operational requirements (Deng *et al*, 2021). For complex motor-powered aircraft, including those with a maintenance steering group, logic, condition monitoring, and a reliability component, incorporating these elements into the maintenance programme is essential (Okoro *et al*, 2022). The aircraft maintenance programme is subject to regular reviews and necessary amendments to ensure its validity, informed by operational experience and guidance from relevant aviation authorities (Kafali, 2024). Modifications originating from type certificate and supplementary type certificate holders, as well as other organisations publishing relevant data under Annex I (Part-21) of Regulation (EU) No 748/2012, must also be considered.

In maintenance programmes, key definitions are provided in FAA Advisory Circular 120-17A, which also defines these maintenance processes.

1. Hard Time (HT): The carrier's maintenance manual specifies regular overhaul or removal from service for appliances or parts, as part of a preventive maintenance process known as Hard Time.
2. On-Condition (OC): A preventive maintenance method that involves regular inspections or assessments against established physical standards to verify a part's continued airworthiness, aiming to prevent failure during normal operations.
3. Condition Monitoring (CM): A process designed for items not subject to Hard-Time or On-Condition maintenance procedures, using appropriate techniques to identify and resolve problem areas. Tasks identified during the type certification process, independent of the Maintenance Review Board (MRB) process, are essential for maintaining airworthiness.

The aircraft type certificate holder designates specific tasks in the Certification Maintenance Requirements (CMR) document as CMR One-Star Tasks. Extensions to the prescribed intervals for these tasks depend on approval from the type certifying authority, based on recommendations from the type certificate holder. Manufacturers issue service bulletins that detail permitted modifications or inspection protocols for aircraft and categorise them into four distinct types: alert, mandatory,

recommended, and optional. Alert and compulsory service bulletins arise from related Airworthiness Directives (AD) and require compliance, although they might not always be legally binding. Recommended Service Bulletins offer guidance to operators, while Optional Service Bulletins are available upon request to address specific operational needs. Civil Aviation Authorities issue airworthiness directives when they determine that modifications or maintenance actions are essential to the ongoing airworthiness of aircraft types, groups, or individual units. Compliance with these directives is the responsibility of the aircraft operator, with all recurring ADs required to be incorporated into the comprehensive aircraft maintenance programme, including the following:

1. Airworthiness responsibility
2. Air carrier maintenance manual
3. Air carrier maintenance organisation
4. Execution and approval of maintenance and alterations
5. Maintenance schedule
6. Required inspection items
7. Maintenance record-keeping system
8. Contract maintenance
9. Personnel training
10. Continuing Analysis and Surveillance System (CASS)

Chapter nine of AC 120-16E details the expectations for contract maintenance, emphasising that when an air carrier engages an external maintenance provider to carry out part or all the maintenance work on an aircraft or its components, that provider effectively becomes part of the air carrier's maintenance organisation. Consequently, the external provider falls under the carrier's oversight.

Integrating specialised software for managing and controlling aircraft maintenance alongside Continuing Airworthiness Management software is crucial for effective planning and spare parts management. The MRO industry is vital for ensuring safety, efficiency, and longevity in the global aviation sector. This industry has experienced substantial growth, driven by increasing demand for air travel and the expansion of the worldwide aircraft fleet. The services provided divide the MRO sector into segments: airframe maintenance, engine maintenance, component repair and overhaul, line maintenance, and specialised services; each requiring specific expertise and resources. Key stakeholders in the global MRO landscape include MRO service providers, original equipment manufacturers (OEMs), and third-party maintenance organisations, which offer a range of services, including maintenance contracts, parts supply, and technical support. Technological progress and innovations in the MRO sector have improved maintenance practices and reduced aircraft downtime. Advances in digital technologies, data analytics, and automation have transformed maintenance operations, supporting predictive and condition-based maintenance strategies. These methods enable operators to optimise maintenance schedules, lower operational costs, and enhance aircraft reliability. Advancements in materials science and engineering have led to the development of lighter and more durable aircraft components, thereby reducing maintenance requirements and enhancing overall efficiency. Incorporating augmented reality (AR) and virtual reality (VR) technologies has shown significant potential for training and simulating maintenance procedures, improving technician skills and productivity. Forecasts predict a compound annual growth rate (CAGR) of 3.9% for this market from 2023 to 2030 (Meticulous Research, 2023). Increasing investments in aircraft MRO, rising air travel volumes, and growing government focus on the aviation sector drive this industry's growth. However, strict regulatory frameworks within the aviation industry may constrain market expansion.

2.6 Physical Infrastructure Deficiencies

The effective functioning and growth potential of the MRO sector depend on resilient physical infrastructure. However, the aviation MRO sector faces notable infrastructure deficiencies that extend beyond mere capacity issues. These include essential elements such as adequate airport facilities, well-maintained runways, modern navigation systems, and up-to-date ground support equipment (GSE). Much of the existing infrastructure in regions such as Nigeria was designed for a different scale and type of operations and is now insufficient to meet the current and future demands of the aviation sector, hindering timely and comprehensive MRO activities ([Nweze, 2016](#)). Nigeria lacks critical infrastructure, including airports, seaports, roads, electricity, and healthcare, all of which are fundamental to the nation's growth and modernisation. The government faces limitations not only in its scarce resources to close the infrastructure gap but also in its waning governance capacity (Itu and Kenigua, 2021). As part of efforts to address these issues, the Federal Government entered a Public-Private Partnership (PPP) agreement.

2.9 Capacity Constraints

The demand for MRO services is increasing significantly, driven by several converging factors. The global aircraft fleet is ageing, and airlines are opting to extend the operational lifespan of their existing aircraft due to delays in new aircraft deliveries. This extension increases the need for intensive maintenance, including comprehensive inspections and engine overhauls. The aviation industry is seeing a strong recovery in travel demand following the pandemic. This combination of an ageing fleet and increased operational activity places heavy strain on existing MRO facilities. The MRO sector faces notable capacity constraints in its hangars, workshops, and storage areas. For example, Bird Aviation reported that a newly constructed hangar reached full capacity within three months of opening, underscoring the immediate need for expanded infrastructure.

2.7 Ageing Aviation Infrastructure

The MRO sector faces challenges with ageing infrastructure that extend beyond capacity issues. This includes essential facilities such as airport facilities, runways, navigation systems, and ground support equipment (GSE). The current infrastructure, designed for different scales and types of operations, no longer meets the needs of aviation's present and future operations. Despite a considerable and ongoing increase in traffic, there has been little impact on the airport's overhaul and rebuilding.

Factors contributing to this deterioration include regular wear and tear from continuous use, insufficient investment in proactive maintenance, and constant exposure to harsh environmental conditions typical of airport settings. A persistent issue in aviation is the inadequate availability of hangars, specialised tooling, and navigation infrastructure, as well as outdated runways and neglected ground support equipment, all of which fail to meet the demands of modern aircraft maintenance. Additionally, Nigeria faces ageing aircraft, which require more detailed maintenance. Nigeria's Aviation Round Table Initiative (ARTI), a stakeholder advocacy group, has urged the government to review the country's civil aviation policy, which restricts the age of commercial aircraft to 22 years.

2.8 Supply Chain Infrastructure Bottlenecks

Beyond physical facilities, the effectiveness of MRO operations depends on a robust, transparent supply chain. A significant obstacle to the smooth functioning of the MRO sector is the persistent occurrence of supply chain disruptions, which hinder the procurement and timely delivery of essential spare parts and components. These disruptions often stem from geopolitical tensions, natural disasters that disrupt manufacturing processes, and widespread delays in the manufacturing supply chain.

The impact of these shortages is significant, often resulting in extended turnaround times for maintenance and repair work and posing substantial challenges in meeting operational targets. Logistical difficulties in transporting and shipping these components, exacerbated by port congestion, limited trucking capacity, and fluctuating fuel prices, lead to longer lead times and higher operational

costs. Our reliance on single-source suppliers for certain aircraft parts increases this risk, as it limits our ability to find alternative vendors if primary supply routes are interrupted.

2.9 Parts Availability

A significant challenge in the MRO sector is the persistence of supply chain disruptions that hinder access to essential spare parts. These disruptions can arise from various global factors, including geopolitical tensions that affect raw material sourcing, natural disasters that disrupt manufacturing, and widespread supply chain delays. These disruptions often result in longer maintenance and repair turnaround times and create substantial difficulties in meeting operational targets.

Although the interconnected nature of the global economy offers numerous advantages, it also renders the MRO sector vulnerable to external shocks that can significantly disrupt the flow of critical components. This emphasises the urgent need for more resilient and diversified supply chains. For example, the aviation MRO industry has faced ongoing shortages of essential elements, such as engines, avionics, and landing gear, due to manufacturing delays and the scarcity of vital parts, particularly rotatables. Reliance on single-source suppliers has heightened this vulnerability for specific aircraft components, and parts availability remains one of the most pressing issues, significantly affecting operational efficiency (Hardware, 2025).

2.10 Logistical Challenges

Beyond procuring parts, the MRO sector also faces significant logistical challenges in transporting and shipping them. Factors compounding these difficulties include port congestion, which can delay the movement of goods; shortages of trucking capacity for inland transportation; and volatility in fuel costs, which can affect shipping expenses. These logistical bottlenecks result in longer lead times for essential repairs as the MRO market waits for parts to arrive, and they also increase overall maintenance-related operational costs. Inefficient transportation infrastructure hampers the MRO sector's ability to deliver timely services, particularly in congested ports and with limited trucking

capacity, underscoring the need for a robust coordination network. Infrastructure is crucial for the development of coordination in supply chains. Its condition and level of integration directly impact coordination access, cycle times, reliability, and costs. Sustaining a competitive planning and supply chain ecosystem requires continuous and strategic upgrades to regional infrastructure. The sector also relies on high-performing government institutions, adequate financing, and industry skills (International Trade Administration, 2023).

2.11 Data Visibility and Integration

A lack of transparency and seamless data integration among various stakeholders further hampers the efficiency of the MRO supply chain. This lack of visibility can exacerbate delays in procuring and delivering essential parts. The existence of data silos, where different systems and platforms used by various departments or organisations within the supply chain operate independently and lack effective communication, poses a significant obstacle. This fragmented information prevents a comprehensive understanding of the supply chain's status and potential issues, thereby complicating overall decision-making. The lack of a unified digital infrastructure for tracking parts and managing the entire supply chain leads to significant inefficiencies and delays in MRO operations. This underscores the urgent need for robust data management and integration systems that provide real-time visibility and support better coordination throughout the MRO supply chain.

2.12 Labour Shortages and Skills Gaps

Nigeria faces significant labour shortages and a large skills gap, primarily due to a mismatch between educational output and industry needs. Key issues include outdated curricula, a lack of practical and digital skills among graduates, underfunded training centres, and limited access to quality vocational education. There is also a brain drain issue in which skilled aviation professionals leave for countries with better opportunities; inadequate collaboration between academia and industry; inefficient recruitment practices; and fragmented government initiatives, all of which further exacerbate the problem.

These issues have a significant impact on Nigeria's economy and aviation workforce, leading to high unemployment, particularly among young people, and resulting in billions of pounds in annual economic losses due to slower growth and lower productivity. Innovation is restricted, competitiveness drops, and the country becomes more dependent on foreign labour. Social instability and vulnerability increase, hindering human development, and the skilled workforce faces burnout. Addressing these challenges requires broad education reform, investment in skills training, stronger industry partnerships, and policies to retain talent.

2.13 Training and Development Infrastructure

Substantial investment in comprehensive training programmes and strategic partnerships with educational institutions is essential to address the growing skills gap within the MRO sector. The rapid pace of technological progress in MRO-supported industries necessitates continuous training and upskilling of current personnel to ensure they remain capable of maintaining and repairing complex equipment. Practical experience and skills development for the MRO workforce depend on an adequate training infrastructure, including real-world equipment, such as aircraft, and modern simulation tools. Shortages in this area contribute to the ongoing labour shortage and can impair the quality and efficiency of maintenance operations. In developing economies, the challenges related to training infrastructure are often significant, as many vocational and educational institutions lack access to the necessary equipment for effective practical training. This deficiency in hands-on learning opportunities further widens the skills gap in these regions. The cost of aviation training at the Nigerian College of Aviation Technology (NCAT) is high. Ever-increasing tuition raises the risk that these airlines may operate without sufficient oversight, potentially undermining the effectiveness of safety checks by regulators. Moreover, airlines are often reluctant to train aircrew, fearing that they might leave for better opportunities (Valenta 2018, vol. 10, p. 15; Tran 2020, vol. 4, p. 22).

2.14 Digital Infrastructure Integration Hurdles

The modern MRO sector in Nigeria is undergoing a significant digital transformation driven by the Artificial Intelligence revolution; however, this progress is often hindered by challenges in integrating digital infrastructure and advanced technologies that offer promising opportunities to enhance MRO processes. Also, the Successful adoption of these technologies faces notable barriers. A significant challenge is the complex, time-consuming process of integrating new digital solutions with existing legacy systems, on which many organisations still depend. Data streams from these legacy systems can be outdated, incomplete, or riddled with inaccuracies, reducing the effectiveness of the newly implemented digital tools (Pelt et al. 2019, vol. 35, p. 12; Razmi-Farooji et al. 2019, vol. 52, p. 45).

As Maintenance, Repair, and Operations (MRO) processes become increasingly digitalised and mobile, the industry faces escalating cybersecurity risks. These risks jeopardise the security of operational data, including maintenance records, aircraft configurations, and proprietary information, rendering MRO organisations particularly susceptible to cyberattacks. It is imperative to invest significantly in robust cybersecurity measures to safeguard critical data and ensure the integrity of digital MRO operations. The transition towards a more digitally enabled MRO environment entails modernising legacy IT systems and addressing data silo issues. To adequately protect sensitive information, it is essential to confront these challenges, thereby facilitating seamless information flow between departments, enhancing overall performance, and optimising resource utilisation.

Unlocking the full potential of digital transformation in the MRO sector depends on effectively managing integration challenges and protecting sensitive data. Implementing robust cybersecurity measures and enhancing data integration are crucial for maintaining operational integrity and establishing a secure digital environment within the MRO sector.

2.15 Financial Infrastructure and Investment Needs

The MRO industry is capital-intensive, requiring significant investments in specialised equipment, comprehensive personnel training programmes, and innovative maintenance facilities (Olaganathan,

Miller and Mrusek, 2020). This considerable initial investment acts as an essential barrier to both entry and growth, particularly for smaller organisations and those in developing economies, where access to financial capital is often limited. Nigeria has consistently faced infrastructure deficits, according to the World Bank (Fateye et al. 2021, vol. 11, p. 112; Foster and Pushak 2011, p. 7). The World Bank states that the international benchmark for infrastructure stock was 70% of a country's GDP (Fateye et al. 2021, vol. 11, p. 112; Inderst 2016, p. 15). However, Nigeria's total infrastructure stock currently accounts for 30% of GDP. This highlights Nigeria's substantial infrastructure shortfall and the need for over \$2.3 trillion in infrastructure investments, spread over 30 years to close it (Eneh et al. 2023, vol. 9, p. 45; Fateye et al. 2021, vol. 11, p. 112).

As operational costs rise due to inflation and labour shortages, MROs face significant financial pressures, limiting their ability to invest in critical infrastructure upgrades and expansions (Siriwoharn *et al*, 2023). In developing economies, obtaining sufficient credit remains a substantial economic challenge, as financial institutions often hesitate to lend to MRO businesses due to misconceptions about risk or a lack of understanding of the sector's specific needs (Hanedar et al., 2013). Most often, banks impose strict collateral requirements, further restricting access to credit and hampering MRO operators' capacity to invest in vital infrastructure and compete effectively with more established international firms.

The substantial capital investment required to establish an aviation MRO sector means that expanding MRO capacity to meet rising demand entails significant financial commitments, including the construction of new hangars, the acquisition of advanced tools, and the recruitment and training of a larger, more skilled workforce (Siriwoharn et al., 2023). Therefore, effective cost management is essential for the MRO industry to sustain profitability and competitiveness in an increasingly challenging economic environment.

2.16 Regulatory Infrastructure and Compliance Burdens

The MRO sector operates within a complex framework of global and regional regulatory requirements governing safety, quality, and operational standards (Safoklov et al., 2023; González and Imroz, 2024). Meeting these regulations while implementing new structures presents ongoing challenges that require a proactive approach to compliance management and substantial investments in compliance systems and dedicated personnel, which can strain resources, particularly for smaller organisations (Nam *et al*, 2022; Ison, 2026). Strict audits conducted by regulatory authorities, such as the FAA and EASA, involve detailed examinations of documentation, processes, and facilities (Safoklov *et al*, 2023; González and Imroz, 2024). The licensing and certification processes for facilities and personnel can be time-consuming, thereby delaying the establishment and expansion of MRO facilities (Safoklov et al, 2023). This significant capital requirement makes it difficult for many airlines, especially new entrants, to invest adequately, leading to a shift away from vertical integration towards outsourcing. Training and certifying new maintenance technicians often involve strict regulatory requirements, which also delay the development of qualified professionals and exacerbate existing labour shortages (Karunakaran, 2021). A perception of reduced international trust following a status change can hinder Foreign Direct Investment (FDI) and partnerships and increase operational scrutiny.

While the Nigerian Civil Aviation Authority (NCAA) maintains that the oversight system remains reliable, the change in status has diminished international confidence, hindered potential investments, and increased resource pressures. Nigeria's MRO facilities are significantly underdeveloped, relying on outdated technologies, lacking standardisation, and equipped with obsolete equipment (Ajeyalemi and Olarewaju, 2020). This directly impacts aircraft maintenance, raising costs and compromising safety and reliability (Habib and Turkoglu, 2020). Frequent power shortages and dependence on imported materials worsen these problems, compounded by ongoing labour shortages in aircraft maintenance. Overall, although the FAA offers a clear regulatory framework for maintenance programmes, complex regulatory challenges and inadequate infrastructure impede Nigeria's growth in

the MRO sector (Orikpete et al. 2023, vol. 47, p. 170). As the global MRO industry is expected to grow significantly, Nigeria must address these issues to compete internationally and meet the evolving demands for aviation safety and reliability.

In September 2022, Nigeria experienced a major regulatory change when it was delisted from the FAA's Category 1 status. This decision stemmed from the implementation of a new U.S. FAA law that states carriers unable to operate to the United States for more than two years would be delisted, rather than being linked to safety concerns (2024).

The Nigerian Civil Aviation Authority (NCAA) maintains that this regulatory change does not indicate deficiencies in its safety or security oversight, but rather reflects a technical adjustment with broader implications for international trust. This change in status is undermining Foreign Direct Investment (FDI) and hampering international collaborations. It increases operational scrutiny and exacerbates regulatory challenges. Therefore, regaining Category 1 status is vital to capitalise on MRO opportunities and foster ongoing regulatory reforms and infrastructure development.

The concept of aviation safety is inherently complex, involving a variety of principles, practices, and regulatory requirements. As shown by Nigeria's aviation sector, safety is considered a key prerequisite for industry development. To comply with international civil aviation standards, a dedicated safety and security framework must be supported by strict certification and standardisation of all aviation components. The Nigerian aviation industry faces challenges, including insufficient infrastructure and a considerable shortage of skilled labour in the MRO sector, which significantly impede its growth and operational efficiency (Paul and Ofuebe, 2019, vol. 8, p. 25).

The persistent underdevelopment of MRO facilities in Nigeria severely limits operational efficiency. Key challenges include reliance on outdated technologies, a lack of modern equipment, and inadequate supporting infrastructure for contemporary MRO practices. A particularly troubling issue is the lack of standardised MRO hangars, which results in the deterioration of many aircraft. This ageing fleet

increases maintenance costs, fuel consumption, contributes to environmental pollution, prolongs aircraft downtime, and undermines overall safety and reliability. Additionally, a critical shortage of skilled labour, including adequately trained technicians and engineers, severely limits the aviation sector's and industry's capacity to maintain aircraft effectively.

The MSG-3 (Operator/Manufacturer Scheduled Maintenance Development), developed by Airlines for America (A4A), offers a systematic framework for establishing scheduled maintenance tasks and intervals that secure regulatory approval from authorities, operators, and manufacturers (SKYbrary, 2014).

The Air Transport Association of America (ATA) plays a crucial role in managing and continuously updating this vital document, which acts as a guideline for developing maintenance procedures for new aircraft types. The ATA states that the primary objective of this document is to establish a standardised approach to scheduling maintenance tasks and intervals that are approved by regulatory authorities, aircraft operators, and manufacturers. Experts from operators, manufacturers, and the national regulatory authority responsible for aircraft production collaboratively develop these tasks and intervals. This document outlines the organisational and decision-making processes for identifying scheduled maintenance requirements throughout an aircraft's operational life.

The Federal Aviation Administration (FAA) states that establishing standards is an integral part of risk management, acknowledging that legal frameworks permit varying levels of acceptable risk. Air transportation regulations are comprehensive and specialised, notably in comparison to the uniform regulations governing other aspects of air commerce. Specifically, Parts 119, 121, and 135 pertain to air carrier maintenance protocols and uphold safety standards, whereas Parts 43, 65, 91, and 145 may not fully satisfy all safety requirements. Advisory Circular 120-16E outlines the framework for maintenance organisations operating under Parts 121 or 135, underscoring that certificate holders are responsible for airworthiness, even when engaging external maintenance providers.

The regulatory environment in Nigeria presents numerous challenges that impede the advancement of the MRO industry, as existing frameworks and bureaucratic complexities deter private investment and constrain innovation. This situation contrasts with the projected trajectory of the global Aircraft MRO industry, which is anticipated to attain a Compound Annual Growth Rate (CAGR) of 4.4% from 2024 to 2031, reaching a market valuation of \$66.7 billion by 2031. Analysts predict that the Asia-Pacific region will hold a substantial market share, surpassing 32% by 2024, primarily driven by demand for engine MRO services and regulatory compliance. According to the Maintenance Steering Group (MSG 3), the primary objectives of scheduled maintenance are to ensure aircraft safety and reliability, restore compromised safety levels, provide essential data for design enhancements, and accomplish these goals with minimal overall maintenance costs. While aircraft maintenance remains undeniably vital, it is inherently limited in scope. Scheduled maintenance programs play a critical role in preventing deterioration in aircraft safety and reliability; however, they cannot address fundamental deficiencies in these domains. Resolving safety and reliability issues necessitates design modifications to implement substantial improvements.

2.17 Case Studies

2.17.1 Nigeria Airways

Nigeria Airways, Nigeria's former flag carrier, was established in 1958 following the dissolution of the West African Airways Corporation. It initially operated as West African Airways Corporation Nigeria (WAAC Nigeria). It became wholly owned by the Nigerian government in 1961, thereby confirming its status as the national airline (IJBM 2009, vol. 4, p. 5).

Nigeria Airways operated from Murtala Muhammed International Airport in Lagos, offering both domestic and international flights that connected Nigeria with West Africa, Europe, North America, and Saudi Arabia. At its peak in the early 1980s, however, mismanagement and rising debt contributed to its decline, culminating in its closure in 2003. The airline commenced operations on 1 October 1958

with an inaugural flight between London Heathrow and Lagos. Over time, Nigeria Airways expanded its fleet with both owned and leased aircraft (Daramola and Fagbemi, 2019). The operational network expanded to include domestic routes from Kano and Lagos, as well as international destinations such as Abidjan, London, and New York.

During this period, leased Boeing 747s operated on UK routes, thereby extending services to Frankfurt, Paris, and Zürich (Pal, 2019). However, financial stability declined in the late 1980s due to the International Monetary Fund's (IMF) unregulated policies, widespread corruption, mismanagement, and an oversized workforce. In early 1987, the International Air Transport Association (IATA) suspended Nigeria Airways for outstanding debts of \$1.1 million, which had risen to \$250 million by late 1987, against revenue of only \$5 million. To stabilise finances, Nigeria Airways attempted to increase fares, which led to a decline in passenger numbers (Oluwakoya and Ajay, 2022). In 1997, the UK Civil Aviation Authority barred Nigeria Airways from entering its airspace due to safety concerns, prompting Nigeria to restrict British Airways operations in retaliation (Akpoghomeh, 1999). Services resumed partially in 1998 through a code-sharing arrangement with British Airways, utilising a leased Boeing 747-200.

By the late 1990s, the Nigerian government aimed to privatise Nigeria Airways and sought the International Finance Corporation's (IFC) collaboration in 1999. Attempts to attract substantial European airline partners were made; however, by 2001, safety concerns persisted, contributing to the airline's downfall (Habib and Turkoglu, 2020). This paper investigates workforce development strategies at Nigeria Airways to cultivate a skilled workforce in its MRO facilities. It includes an assessment of training programmes, partnerships with educational institutions and initiatives to enhance employees' technical skills. The 1979 KLM partnership, emphasising airline management training, highlights workforce development efforts, though it did not detail MRO staff (Nthenya, 2023).

The critique examines the challenges and complexities Nigeria Airways faced in its MRO operations, considering factors such as outdated infrastructure, financial constraints (as evidenced by significant debt and aircraft seizures), regulatory hurdles (such as the UK Civil Aviation Authority's operating ban), and workforce skill gaps. The 1997 UK operating ban highlights ongoing safety concerns, indicating issues with the airline's maintenance and operational procedures.

A case study on Nigeria Airways will provide insights into the complexities and potential developments in Nigeria's MRO sector. This historical review is vital to a comprehensive understanding of MRO facilities in Nigeria's aviation sector and will inform future recommendations for improvement. Access to specific data on Nigeria Airways' MRO operations may vary; therefore, ensuring the data's relevance and availability is crucial for thorough analysis.

2.17.2 Aero Contractors

Aero Contractors of Nigeria, a reputable aviation firm founded in 1959, operated as a wholly owned subsidiary of Schreiner Airways B.V., a Dutch company (Shobande and Akinbomi, 2020). Over time, the airline's ownership structure changed, with Nigerian interests increasing to a 40% stake by 1973 and a 60% majority shareholding by 1976 (Nwude *et al*, 2023). This indigenisation process continued in January 2004, when the Canadian Helicopters Corporation (CHC) acquired Schreiner Airways, resulting in CHC holding a 40% stake in Aero Contractors, while the Ibru family group retained 60% majority ownership. Despite these shifts in shareholding, Aero Contractors has continued to operate as an indigenous Nigerian entity (Shobande and Akinbomi, 2020).

The company built a solid foundation by serving the oil, gas, and related support sectors, shifting from a service-oriented model to a leading regional domestic scheduled carrier. Since beginning scheduled commercial operations in 2000, Aero Contractors has become a preferred airline for regional travellers. Its fleet includes the Bombardier Dash8 Q300, a 50-seat turboprop aircraft, and the Boeing 737-400 and 500 series, with capacities ranging from 104 to 140 passengers. Aero Contractors' operational

ethos is a commitment to safe and punctual air travel, supported by professionalism and excellent customer service. The airline aims to exceed industry standards by delivering innovation, convenience, reliability, and affordability, introducing pioneering e-airline products across sub-Saharan Africa.

Looking ahead, the Rotary Wing Division is expanding its service offerings, and the Fixed Wing Division is also expanding its service offerings. This certification marked the launch of Aero MRO (Maintenance, Repair, and Organisation), which has since provided maintenance services to numerous airlines both within and outside Nigeria. Aero Contractors remains committed to offering affordable air travel options for business, leisure, and family trips. By leveraging advanced technology, the airline aims to ensure that air travel is safe, convenient, affordable, and enjoyable for its passengers. With over six decades of operational experience, Aero Contractors has established a reputation as a respected aviation service provider, demonstrating excellence in flight operations and line and base maintenance. The company is uniquely positioned in the African market to deliver high-quality aircraft maintenance, repair, and overhaul services, consistently adhering to strict international safety standards.

Aero Contractors takes pride in its excellent safety record, having grown from its first C-check on a Boeing Classic in 2017 to achieving full capacity for 6C-checks (D-check). It is the first and only MRO in Nigeria and across West and Central Africa to complete a 6C check on a Boeing Classic aircraft. Aeropro has expanded its service capabilities to include maintenance for Bombardier Q Series airframes, Hawker 125 (all series), and rotary-wing aircraft, including the S76C and EC135T2. Originally established to serve the parent airline's fleet, AeroMRO has broadened its offerings in recent years, extending its expertise and high-quality service to a diverse clientele across the West and Central Africa subregion. AeroMRO provides line maintenance services for various aircraft types at Murtala Muhammed Airport I and II in Lagos, as well as at its major hubs in Abuja and Port Harcourt, supported by an extensive network across Nigeria and West Africa. Experienced, type-rated personnel are available to perform these line maintenance services around the clock to meet operational demands.

A team of skilled and certified professionals provides base maintenance services. They cover a comprehensive range of services, including structural and sheet-metal work, painting, cabin and upholstery work, borescope inspections, non-destructive testing, and avionics. AeroMRO operates two main hangars and two bays at Murtala Muhammed Airport I (Local Airport) to support these extensive maintenance services for both local and international fleets. The transaction involves five new Embraer E-175 aircraft, valued at \$300 million, with deliveries scheduled to begin in 2024 (Embraer, 2024). Embraer representatives emphasised the importance of this collaboration in fostering growth, creating jobs, and stimulating investment within the airline industry (Embraer, 2024). In 2019, Air Peace announced the purchase of 30 Embraer 195-E2 aircraft, comprising thirteen firm orders and seventeen purchase options. As of 2021, five of the thirteen firm orders had been delivered (Air Peace, 2021). Air Peace remains committed to advancing the Nigerian aviation sector through ongoing investments and development initiatives, thereby contributing positively to the national economy.

2.17.3 Bristow Helicopters

Bristow Helicopters' aviation authorities enforce strict standards that the company consistently meets or surpasses. Bristow uses a two-tiered maintenance system to maintain the airworthiness and operational readiness of its diverse fleet. The first level includes routine or Line Maintenance, which involves standard tasks performed on aircraft in operation. Local or regional bases usually complete these tasks within hours or days. Examples include regular inspections and minor repairs, such as replacing damaged parts.

Since 1971, Bristow has been providing search and rescue (SAR) services to governments and the energy sector. To date, Bristow has conducted over 30,000 SAR missions, rescuing or assisting more than 19,000 people worldwide. SAR operations require specialised expertise, and our trained pilots, technical crew, paramedics, engineers, and ground personnel carry out these missions safely and reliably.

Bristow's Nigerian operations seamlessly integrate into this global MRO (Maintenance, Repair, and Overhaul) framework and have developed significant local capabilities. BGI Aviation Technical Services (BATS) provides aviation engineering and technical services in Nigeria. With a large maintenance hangar and management offices in Lagos, and another full hangar in Port Harcourt, Bristow can provide local maintenance and ensure prompt access to spare parts, effectively addressing common issues in African aviation, including supply chain delays and foreign exchange liquidity constraints. This comprehensive strategy enhances Bristow's operational resilience and reduces costs.

Nigeria's Civil Aviation Authority (NCAA) oversees Bristow's MRO operations to ensure compliance with local regulations. A Total Assurance Programme (TAP) enables Bristow to operate its S-92 fleet within a set budget, reducing the risk of unforeseen expenses. The TAP covers more than 90% of replacement costs for vital components, guaranteeing an average availability of over 90% for the S-92 fleet throughout its lifespan. Bristow also holds numerous OEM authorisations, including certification as a Leonardo-authorised Service Centre for various aircraft types. Bristow Helicopters has demonstrated a strong commitment to enhancing local content and investing in Nigeria's workforce, recognising these as crucial to sustained operational success. The company's efforts to train Nigerian pilots and engineers had been extensive, dating back to 1986, when Bristow first sponsored students at the Zaria Aviation College. The training programme has graduated over 210 Nigerian helicopter engineers and a considerable number of pilots from Bristow Academy.

The success of these programmes is evident in the numerous Nigerian professionals who hold leadership positions in the region's international oil companies. This strategic focus on local integration enhances Bristow's long-term viability as it navigates Nigeria's complex business environment.

Bristow's local initiatives extend beyond mere regulatory compliance; they foster a robust talent pipeline that benefits both its operations and the broader Nigerian aviation sector. Appointing Nigerians to leadership positions enhances the company's social licence and enables it to address local challenges more effectively than its foreign competitors.

Looking ahead, Bristow has proposed several significant partnerships to strengthen local content and human capital investments. Plans include collaborating with the NCDMB to establish a Centre of Excellence for workforce training in the aviation sector, and further investments are proposed to introduce light-wing aircraft into Nigeria, training locals as pioneers of this new fleet. They aim to utilise their global search-and-rescue (SAR) expertise to fill gaps in Nigeria's SAR support system. The proposed initiatives, including a Centre of Excellence and the introduction of light-wing aircraft, emphasise Bristow's proactive approach to meeting local needs and shaping the future of Nigerian aviation.

Bristow today reported a net income of \$27.4 million, or \$0.92 per diluted share, for the quarter ending 31 March 2025 (the "Current Quarter") on total revenues of \$350.5 million, compared to a net income of \$31.8 million, or \$1.07 per diluted share, for the quarter ending 31 December 2024 (the "Preceding Quarter") on total revenues of \$353.5 million. (2025) Bristow's strong financial foundation demonstrates a stable base for expansion and investment in MRO capabilities, despite previous safety issues and macroeconomic uncertainties.

2.18 Regional Analysis of the MRO Market

The global aviation MRO market exhibits regional differences in size, growth, and key trend factors. North America is the largest aircraft MRO market, accounting for a substantial share of global revenue. Its dominance is driven by its largest commercial and military aircraft fleet, well-established aviation infrastructure, and high concentration of MRO service providers. The region also emphasises innovation and quickly adopts advanced technologies, such as artificial intelligence and predictive maintenance. The United States is a leading aircraft manufacturer with substantial demand for MRO services to maintain and upgrade its extensive fleet. Asia-Pacific is expected to be the fastest-growing region in the aviation MRO market, driven by rising air travel demand and the rapid expansion of airline fleets in countries such as China and India. Growing investments in aviation infrastructure,

including MRO facilities, further support this region's market growth. The Asia-Pacific region accounts for a substantial share of the global commercial aircraft fleet, and this share is projected to increase in the coming years.'

Europe has a mature and established aircraft MRO market with several key global players. While the market in Western Europe is well developed, Eastern Europe is experiencing rapid growth in low-cost carrier traffic, thereby boosting demand for new aircraft and related MRO services. This region is increasingly emphasising regulatory compliance, alongside growing collaborations and partnerships between the MRO sector and original equipment manufacturers (OEMs). Countries such as the UK, Germany, and France play vital roles in the European MRO market.

Other regions show different market conditions and growth prospects. The Middle East is experiencing rapid growth in its aviation sector, driven by large aircraft orders and the expansion of major airlines; however, fierce competition can impact profitability in this region. Alternatively, Latin America faces challenges such as pilot shortages and an ageing fleet of regional jets. Africa's air passenger traffic has recovered, but the area still faces political instability and infrastructure issues.

These regions offer potential growth opportunities but also present unique challenges for the MRO market. Competitive landscape.

Year	Size(M USD)	CAGR (%)	Region	Market Firm
2023	21,560		North America	VMR
2024	29,400		Asia Pacific (Air)	Precedence
2024	10,460	4.22	North America (Wide body)	Precedence
2025	1,610	4.79	MEA and Africa	Mordor/GII
2025	10,040		MEA and Africa	Mordor
2030	2040	4.79	MEA and Africa	Mordor/GII
10,460	12860	5.06	MEA and Africa	Mordor
2030	18731	7.3	MEA and Africa	Grand View
2031	28610	4.1	North America	VMR
2034	48810	5.25	Asia Pacific	Precedence
2034	39070	4.10	North America (wide body)	Precedence

Table 1: Analysis of Regional Aviation MRO Market Data

The table presents projected market sizes and growth rates for key regions in the global Aviation MRO market. The data highlight varying market scales and growth dynamics across North America, Asia-Pacific, and the "Other Regions" (comprising the Middle East and Africa). Leading Regions by Market Size:

Asia Pacific emerges as a dominant or expanding region. Precedence Research estimates its Air Transport MRO market at USD 29.4 billion in 2024 and forecasts it to reach USD 48.81 billion by 2034. This aligns with broader industry trends, indicating that the Asia-Pacific region is a major driver of aviation growth (Precedence Research, 2025).

North America also constitutes a major market. Verified Market Research predicts the market will reach USD 21.56 billion in 2023 and grow to USD 28.61 billion by 2031. Precedence Research also provides data on North America's wide-body MRO segment, underscoring its considerable scale.

Other Regions (MEA and Africa) are smaller in absolute market size than North America and Asia Pacific, but demonstrate robust growth potential, especially when the Middle East is included. Grand View Research predicts that the Middle East and Africa combined will reach USD 18.73 billion in 2030, from a 2023 baseline of USD 11.415 billion. This indicates a notable contribution from the Middle Eastern market. Africa alone is smaller, with Mordor Intelligence / GII Research estimating it at USD 1.61 billion in 2025 and USD 2.04 billion by 2030.

Growth Rates (CAGR) Comparison

Asia Pacific experiences rapid growth, with Precedence Research projecting a 5.25% CAGR (2024-2034) for its Air Transport MRO market, reinforcing its position as a high-growth region.

North America demonstrates steady growth. Verified Market Research predicts a 4.1% CAGR (2024-2031), while Precedence Research estimates a similar 4.10% CAGR (2025-2034) for its Wide Body MRO segment. These rates indicate mature yet consistent growth in a developed market.

"Other Regions (MEA and Africa)" exhibit varied, but often robust growth.

Mordor Intelligence/GII Research projects a 4.79% CAGR for Africa from 2025 to 2030, indicating notable progress across the continent.

The long-term outlook for the aviation MRO industry remains positive, offering significant growth and return potential. Adapting to the evolving technological landscape and market dynamics is critical to success in this sector.

Year	Market Size (USD Billion)	CAGR (%)	Market Research Firm	Notes
2024	114	-	Oliver Wyman	Base Year (Original table)
2024	91	-	ResearchNester	Base Year (Original table)
2025	119	-	Oliver Wyman	Surpasses 2019 by 12% (Original table)
2025	-	-	The Insight Partners	Projected up to 2030 (as of January 2025 report)
2030	117.09	5.05 (2024-2030)	Strategic Market Research	(Original table)
2030	134.07	4.8 (Up to 2030)	The Insight Partners	(as of January 2025, report)
2030	120.963	5.2 (2024-2030)	Grand View Research	
2034	292.5	1.4 (2024-2034)	Stratview Research	(as of April 2025, report)
2034	143.55	5.20 (2025-2034)	Precedence Research	(as of May 2025, report)
2035	156	2.7 (2024-2035)	Oliver Wyman	(Original table)
2037	169.48	4.9 (2024-2037)	ResearchNester	(Original table)

Table 2: Forecast of Global MRO by various Market Research Firms

Industry analysts' key projections collectively paint a picture of the future market landscape. (Wyman, 2023) According to the Aircraft MRO Market (2025), the estimated market sizes for 2024 were \$114 billion and \$91 billion, respectively. Oliver Wyman projects that the 2025 market will grow to \$119 billion. Estimates for 2030 vary significantly. The Insight Partners project \$134.07 billion with a 4.8% CAGR (The Insight Partners, 2023), while Grand View Research forecasts \$120.963 billion at a 5.2% CAGR (Hotha, 2023). By 2034, long-term forecasts diverge notably. Stratview Research anticipates \$292.5 billion with a 1.4% CAGR (Nitin, 2025), whereas Precedence Research in 2025 predicts a more modest \$143.55 billion at a 5.20% CAGR. Projections extending to 2037 include estimates of \$156 billion (Oliver Wyman, 2025) for 2035 and \$169.48 billion (Aircraft MRO Market, 2025) for 2037.

The notable differences in market forecasts, particularly over the long term, warrant closer scrutiny and further underscore the market's diversity. In 2034, Stratview Research forecasts a valuation of \$292.5 billion, exceeding Precedence Research's projection of \$143.55 billion for the same year (2025). This discrepancy is likely due to several key factors. MRO market segmentation is another factor: companies are analysing different market segments, according to the sources. Reports range from a "Global Fleet and MRO Market" perspective (Wyman, 2023, 2025) to more specialised studies on the "Aircraft Engine MRO Market" (The Insight Partners, 2023), "Civil Aircraft MRO Market" (2025), and Wide-Body Aircraft MRO Market. Strategic assumptions based on forecasts for a narrow segment are unlikely to be accurate for the entire market.

Fleet retirement, delivery schedules, flight hours, maintenance intervals, and cost inflation exemplify different underlying assumptions used by various firms in their forecasting models. Stratview Research's market valuation and CAGR for 2034 differ from those of other analysts (2025) in terms of the method or base-year assumptions. Firms regularly update their projections to reflect new market trends. According to the data notes, forecast issuance occurred in January, April, and May 2025; assumptions about the economy, global politics, and supply chains can shift quickly, impacting predictions. Variability in market intelligence complicates strategic planning. Initially, thorough due diligence is required. It is crucial to examine the methodology, scope, and assumptions of any market research report before incorporating its data into financial models or investment cases, since reports with similar headlines may evaluate vastly different market segments. Additionally, given the uncertainty, organisations should develop multiple strategic scenarios and consider various growth rates to produce conservative, baseline, and optimistic forecasts. For example, a conservative approach might assume a 2-3% CAGR, as forecast by Oliver Wyman. In comparison, an aggressive growth strategy could align with the 5.2% CAGRs reported by Grand View Research and Precedence Research, both of which were released in 2025. Finally, although the absolute market size figures differ, the consistent projection of positive long-term growth confirms a healthy industry trend.

Therefore, it is essential to strategically understand the key drivers of this growth, such as ageing aircraft fleets and the adoption of digital MRO technologies, to identify and invest in the most promising segments.

When analysing market projections for the coming years, we observe notable trends and differences among various research firms. Oliver Wyman projects \$114 billion for 2024 and \$119 billion for 2025, figures close to Research Nester's estimates of \$91 billion and \$94.57 billion. However, Research Nester's figures are lower. This initial discrepancy arises from different base-year estimates, which provide different foundations for their respective forecasts and lead to a broader range of projections. Strategic Market Research estimates \$117.09 billion, Grand View Research forecasts \$120.963 billion, and The Insight Partners predicts \$134.07 billion. The Insight Partners has a more optimistic outlook for 2030 than the other two firms. This variation indicates that each firm relies on different underlying assumptions regarding key factors, including market drivers, overall economic conditions, and the pace of technological adoption or fleet growth in the aviation sector. These differing assumptions are crucial to understanding why their future outlooks diverge for the same year.

Long-term (2034-2037) market forecasts display significant variability, with Stratview Research's 2034 estimate of \$292.5 billion standing out. This figure is twice the next-largest long-term forecast, Research Nester's \$169.48 billion for 2037, and exceeds Oliver Wyman's \$156 billion for 2035 and Precedence Research's \$143.55 billion for 2035. This substantial gap suggests that these firms may approach their analyses differently. To understand this discrepancy, it is essential to review Stratview Research's methodology, including the specific forecasting models used, the scope of their study, the types of MRO activities, aircraft, or regions included that might differ from others, and their foundational assumptions about market drivers, technological advances, and economic factors. Without a detailed review, it is difficult to compare the figures and assess the reliability of each forecast.

2.19 Overview of the Nigerian (MRO) Market Analysis

The Nigerian aircraft MRO market is currently in a growth phase, with a compound annual growth rate (CAGR) of 10.02 %. Increasing demand for air travel, the expansion of airline fleets, and the need to maintain an ageing aircraft fleet drive this expansion. However, the market also faces significant challenges, including shortages of skilled technicians and engineers, infrastructure limitations, and the effects of foreign exchange fluctuations on operational costs.

Domestic and international MRO service markets dominate the competitive landscape, each striving to capitalise on its market potential. Recent government initiatives and an increasing emphasis on aviation safety regulations are expected to shape the market's future, creating numerous opportunities for growth and investment in the coming years. The aviation industry is vital to Nigeria's economic development by supporting business travel, tourism, and cargo transport. Ensuring aircraft safety and operational efficiency is essential, and this is where the aircraft MRO sector becomes critically important. MRO services encompass a range of activities, from routine inspections and minor repairs to comprehensive overhauls and modifications, all of which are essential for maintaining airworthiness and extending aircraft service life.

Analysis of Nigerian aviation MRO market data forecasts (CAGR) general growth

Verified Market Research predicts a 10.02% CAGR from 2024 to 2031. This shows robust growth, suggesting rapid expansion.

Research Nester also shows rapid growth in its specific segment, with a 10.5% CAGR from 2025 to 2035 for the "Nigeria Civil Aviation MRO Market". This highlights robust growth within its scope.

Mordor Intelligence forecasts a more cautious growth rate of 2.66% CAGR from 2025 to 2030. This suggests a slower growth trajectory for the emerging market than the projections of the other two firms.

The Nigerian Aviation MRO market is a dynamic and growing sector, according to data from Verified Market Research, Mordor Intelligence, and Research Nester. However, a detailed look reveals significant differences in their projected market sizes and growth rates. Verified Market Research (VMR) provides the most optimistic outlook, reporting a 2023 market size of \$815.2 million and projecting a substantial increase to \$1,750 million by 2031. This suggests a resilient market with robust growth prospects.

In contrast, Mordor Intelligence reports lower figures, estimating the market at \$329.92 million in 2024, with modest growth to \$386.48 million by 2030. This indicates a smaller current market and a less aggressive growth trajectory than VMR's forecast. Research Nester provides the most conservative figures for "Nigeria Civil Aviation MRO." They estimate the market at \$45.4 million in 2025 and project it to reach \$93.4 million by 2035. Using "Civil Aviation MRO" implies a narrower scope, excluding military and other MRO segments, which may explain the lower values relative to the other two firms. The wide range in these projections underscores the importance of understanding each firm's methodology, scope, and underlying assumptions when evaluating the Nigerian Aviation MRO market.

Although specific figures vary among Verified Market Research, Mordor Intelligence, and Research Nester, all three companies agree that Nigeria's Aviation MRO market is expanding. The more optimistic Compound Annual Growth Rates (CAGRs) from Verified Market Research and Research Nester suggest that if certain conditions are met, such as increased local investment, improved infrastructure, and favourable policies, the market could grow rapidly.

The data suggests a bullish outlook, but Mordor Intelligence's more cautious forecast reflects a reserved view. The perspective could stem from slower infrastructure development, ongoing regulatory challenges, or local MRO facilities struggling to compete with established international markets. This forecast adopts a "wait and see" approach, recognising potential obstacles to rapid expansion. Experts expect growth in Nigeria's aviation MRO market. While the precise scale and pace

of this growth differ among research firms, the overall trend remains positive. The wide range of market size estimates emphasises the region's early stage of detailed market research and the importance of understanding the scope and methodology behind each report. Investors and stakeholders should consider these differing viewpoints and review the firms' complete reports to understand the underlying assumptions that drive their analyses.

2.20 Comparative Analysis with Other African MRO Markets:

To understand the potential of a well-established MRO and to plan its future course of action, it is beneficial to examine more established MRO markets across Africa. Countries such as Ethiopia, South Africa, Egypt, Ghana, and Morocco provide valuable insights and demonstrate what can be achieved through strategic investment and focus. These nations have not only built impressive MRO facilities but have also attracted business from airlines across the continent and beyond, demonstrating that African MROs can compete globally.

Examining the successes of countries such as Ethiopia, South Africa, and Egypt reveals several common themes. Ethiopian Airlines MRO, for instance, has invested significant resources in its infrastructure and training, thereby enabling a wide range of maintenance services, including heavy checks and engine overhauls for various aircraft types. A vital part of their strategy has been strategic partnerships with OEMs (Original Equipment Manufacturers), which bring advanced technology and expertise into their operations. Their commitment to a skilled workforce is further demonstrated by support for their training centre, which aims to train thousands of aviation professionals (International Civil Aviation Organisation, n.d.).

South Africa, on the other hand, has a well-established MRO sector, with entities such as SAA Technical providing comprehensive maintenance services and an 85,000-square-metre hangar for significant repairs to Boeing and Airbus aircraft. Existing ExecuJet MRO Services, which specialises in business aviation and has a 9,000 sq ft hangar and numerous OEM approvals, further highlight the

sector's diversification and maturity (Raj, 2024). Meanwhile, EgyptAir Maintenance and Engineering has established itself as a leading MRO provider in North Africa, utilising Egypt's strategic geographical position to attract international business (Sanad, 2023). Ghana has recently made notable progress.

The US Trade and Development Agency (USTDA) also provided grant funding for a feasibility study to support the development of an MRO facility at Kotoka International Airport (KIA) in Accra, to establish West Africa's first full-service MRO and training centre (International Trade Administration, 2023). In terms of training, Ghana's Aerojet Aviation Training Academy now offers aircraft maintenance engineering programmes certified by the European Union Aviation Safety Agency (EASA), a crucial step in cultivating a skilled local workforce that meets international standards. The Moroccan government offers incentives to foreign investors, and joint ventures such as Maintenance Aero Maroc (MAM) demonstrate a commitment to expanding MRO capabilities for both military and civilian aircraft. A common recognised factor among these successful African MRO markets is strong government support, which manifests in substantial investments in infrastructure and technology, a relentless focus on developing a skilled workforce, and the attainment of essential international certifications that ensure global recognition, safety, and trust (Siriwoharn *et al*, 2023).

Nigeria can gain many insights from its peers, despite facing significant challenges in areas where other countries have excelled. These include the need for advanced technological upgrades, foreign exchange volatility, inadequate infrastructure, and bureaucratic hurdles. Despite ongoing improvements, such as Dana Air's partnership with Seven Stars Global Hangar and Air Peace's collaboration with Embraer ([Orikpete et al, 2023](#)), Nigeria's aviation sector has significant growth potential by learning from more developed markets. For example, the emphasis on specialised training programmes in South Africa and Ghana, along with strategic alliances with OEMs in Ethiopia, offer valuable models for Nigeria (Embraer, 2023).

It is also crucial to recognise the broader market opportunity within the Nigerian MRO ecosystem. Many Nigerian and other African airlines still send their aircraft outside the continent for major maintenance work, representing a significant missed opportunity for local MRO providers. A key challenge, however, is that aviation maintenance service costs in Africa exceed the global average (Morris, 2016). This means that for Nigerian MROs to succeed, efficiency improvements and competitive pricing are essential in attracting and retaining business. By analysing the paths of these leading African MRO nations, Nigeria can gain valuable insights into developing a thriving, internationally recognised MRO sector that not only serves its own aviation needs but also becomes a prominent player in the continental market.

Nigeria's airline industry, comprising both domestic and international carriers, handles substantial passenger and cargo traffic. The domestic sector features leading airlines such as Arik Air, Air Peace, Ibom Air, United Nigeria Airlines, and XEJet, while numerous international airlines operate routes to and from Nigeria (Shobande and Akinbomi, 2020; Gábiel, 2024). The Nigerian aircraft fleet is expanding to meet increased demand, though it also includes an older segment that requires regular, thorough maintenance (Daramola and Fagbemi, 2019; Habib and Turkoglu, 2020). Recognising the sector's significance, the Nigerian government has initiated several infrastructure projects, including airport upgrades and plans for a new national carrier, Nigeria Air. These developments aim to improve the aviation ecosystem, potentially boosting the MRO market by enabling smoother operations and attracting more airlines to the region. The current state of Nigeria's aviation industry, characterised by fleet growth and increased passenger traffic amid an ageing aircraft fleet, underscores the fundamental need for and the potential of a thriving MRO market.

The Nigerian MRO market has shown considerable growth potential. In 2023, the market was valued at USD 815.2 million, with forecasts indicating a significant rise to USD 1750 million by 2031. A Compound Annual Growth Rate (CAGR) of 10.02% supports this expansion from 2024 to 2031, according to Verified Market Research. Its analysis uses the period from 2018 to 2022 as the baseline,

with projections extending through 2031 (Verified Market Research, 2025). However, it is essential to recognise the variation among estimates across reports. For example, Mordor Intelligence (2024) estimated the market at USD 338.94 million in 2025, with an expected increase to USD 386.48 million by 2030, at a CAGR of 2.66% for the 2025-2030 period. These discrepancies stem from differences in research approaches, market segmentation (including military aviation), and the scope of the data analysed. The increasing volume of aircraft operations at key aviation hubs further drives demand for MRO services (Liangrokapart and Sittiwatethanasiri, 2022; Orikpete *et al*, 2023).

A heightened emphasis on aviation safety regulations also necessitates regular, thorough aircraft maintenance, thereby sustaining demand for MRO services (Albakkoush *et al*., 2020). The Nigerian Civil Aviation Authority (NCAA) serves as the primary regulatory body, and its "Nigerian Civil Aviation Regulations Part 20 Safety Management" outlines safety management requirements and compliance with international standards. The NCAA's role in regulating aircraft maintenance licences and MRO services further demonstrates its commitment to safety and maintenance. Despite promising growth prospects, the Nigerian aircraft MRO market faces several notable constraints. A key obstacle is the shortage of skilled aviation technicians and engineers, which limits the local MRO market's capacity to meet the rising demand for its services. The lack of adequate infrastructure and designated space for MRO activities also poses a challenge, resulting in high operational costs that can strain airlines' financial resources (Aljaly *et al*, 2025). Dependence on foreign exchange to purchase spare parts and contract specialised labour makes the market particularly vulnerable to exchange-rate fluctuations (Karibo, 2017; Adekitan and Salau, 2020). Regulatory hurdles and bureaucratic procedures can further complicate the establishment and operation of MRO facilities (Oguejiofor *et al*, 2023; Akang, 2024). The Nigerian MRO market also faces competition from more established MRO sectors in neighbouring African countries such as Morocco, Ethiopia, and South Africa, which may offer more comprehensive services and certifications (Rhoades, 2004; Bank, 2019; Habib and Turkoglu, 2020).

The growing demand to service an expanding fleet of commercial and military aircraft within the country drives this growth (Orikpete *et al*, 2023). Since 80% of maintenance activities are outsourced to foreign entities, there is a significant opportunity for local MRO markets to capture more market share (Vieira and Lavorato, 2016). Specific MRO segments, such as engine maintenance, are also expected to grow due to demand for innovative technologies and improved engine performance. The Nigerian aircraft MRO market features a diverse range of players, including both domestic and international companies, resulting in a semi-consolidated structure ([Olaganathan *et al*, 2020](#)). Key operators include ExecuJet Aviation Group AG, Avia Solutions Group (JetMS), Arik Air Limited, Aero Technologies, Inc., and Skyjet Aviation Services. Other notable firms contributing to the market are Onedot Aviation, Logos Aviation, Inc., AJW, Sanusi, and TekniTeed Nigeria Limited. These companies provide specialised services that cover various aspects of aircraft maintenance. For example, JetMS focuses on customised maintenance solutions for business aviation (Rodriguez, 2024), while Aero Technologies handles aircraft repair and modernisation in accordance with global standards (Vieira and Lavorato, 2016).

Aero Contractors' significant expansion aims to establish itself as a leading one-stop maintenance hub for Western and Central Africa, enhancing its capability to service a broader range of aircraft. In Uyo, Ibom Air is developing a central MRO facility, aspiring to become a top maintenance centre in Africa, comparable to those in South Africa, Ethiopia, and Egypt. The establishment of an MRO facility in Nigeria, through a collaboration between United Nigeria Airlines and Cronos Aviation, is a strategic initiative to reduce operational costs and enhance the global competitiveness of Nigerian airlines. XEJet's development of its own MRO facility at Abuja's Nnamdi Azikiwe International Airport indicates increased investment in local maintenance infrastructure. Arik Air Limited offers in-house maintenance services to support its fleet operations, further strengthening domestic MRO capacity.

These players offer a wide range of maintenance services, from routine line maintenance and comprehensive base maintenance (C and D checks) to specialised engine overhauls, component repair

and replacement, and airframe modifications. Although field maintenance dominates the African MRO market, the interior MRO segment is poised for significant growth, driven by increasing demand for enhanced passenger comfort and cabin upgrades. Fixed-wing aircraft MRO also accounts for a substantial share of the market. Success strategies in the Nigerian MRO market include investing in innovative technologies to enhance service offerings and operational efficiency, and developing a skilled workforce capable of managing complex maintenance tasks. Collaboration between local and international MRO providers, along with strategic partnerships, can facilitate the transfer of technical expertise and resources, thereby boosting the competitiveness of the Nigerian MRO sector.

The NCAA supervises Nigeria's aviation industry, including the airworthiness and certification of AMOs. An increase in the number of aircraft maintenance licences issued by the NCAA is expected to attract more investment to the region's MRO sector. A key priority for the NCAA is ensuring strict adherence to international safety standards and improving Nigeria's ratings under the International Civil Aviation Organisation (ICAO) standards. Part 6 of the Nigerian Civil Aviation Regulations (NCARs) sets out the regulatory framework for Approved Maintenance Organisations (AMOs) in Nigeria. These regulations specify the comprehensive requirements for obtaining and maintaining an AMO licence, including the application process, the development of maintenance procedure manuals, personnel qualifications and training, the adequacy of maintenance facilities and equipment, and the implementation of rigorous quality systems. They also specify the fees for initial certification and licence renewal. Compliance with these stringent regulations is compulsory for any organisation seeking to operate as an approved MRO facility within Nigeria.

The Nigerian government has demonstrated a firm commitment to advancing the local MRO industry through various policy measures and support mechanisms. This includes a dedicated focus on attracting both domestic and international investment to the aviation sector and on establishing innovative MRO facilities. The Aviation Sector Roadmap, a strategic document outlining the government's vision for the industry, emphasises the development of MRO capabilities as a key

component. The government is also considering the Public-Private Partnership (PPP) model as a practical approach for financing and developing large-scale MRO infrastructure projects nationwide. The Federal Executive Council (FEC) has already endorsed the creation of several MRO centres through PPP agreements, demonstrating strong governmental backing for the sector's growth.

Nigeria's MRO sector is growing, with each facility offering specialised services. Aero Contractors' MRO stands out as a leading centre in West and Central Africa, providing both line and heavy base maintenance for various aircraft, including Boeing 737 Classic and Next Generation models; Airbus A320 family, Bombardier CRJ and Dash 8 series, and Embraer E145 regional jets. The facility is expanding to increase its capacity and services. Located in Lagos, ExecuJet Aviation Nigeria is a well-known Fixed Base Operator (FBO) and MRO with approvals from several national aviation authorities. It delivers expert line and scheduled maintenance for various business and commercial aircraft brands, including Dassault, Gulfstream, Hawker, Embraer, and Bombardier, as well as avionics support, parts procurement, and component overhaul services.

7Star Global Hangar Limited, a privately operated AMO licensed by the NCAA, possesses significant aircraft maintenance capabilities in sub-Saharan Africa. They offer a comprehensive range of services, including MRO, component services, aircraft upholstery, Non-Destructive Testing, and maintenance for wheels, brakes, and batteries. Their offerings include aircraft from AgustaWestland, Sikorsky, Bell, Airbus Helicopters, Boeing, Hawker, Bombardier, and Embraer. In addition to their previous certifications for wheels and brakes, NDT, battery maintenance, and sheet metal repairs, Onedot Aviation (Lagos) has secured NCAA approval for base maintenance on Bombardier Challenger and CRJ series aircraft.

In Uyo, Ibom Air MRO, a government-owned facility, is a key maintenance centre for a broad range of aircraft, including Boeing 747s, Airbus A320S, and all CRJ variants. It collaborated with Airbus Consulting to develop a long-term MRO strategy encompassing comprehensive maintenance capabilities for Airbus A220 aircraft. At Abuja's Nnamdi Azikiwe International Airport, XEJet, a local

airline, established an MRO, flight support and engineering centre to deliver essential maintenance services for domestic carriers. In contrast, the capacity for wide-body aircraft maintenance is still under development. The Nigerian aircraft MRO market is poised to benefit from various emerging trends and opportunities in the upcoming years. The increasing adoption of advanced technologies and digitalisation within the global MRO sector presents a significant opportunity for Nigeria. This includes implementing predictive maintenance technologies, utilising data analytics, and artificial intelligence (AI) to forecast equipment failures, optimise maintenance schedules, and minimise aircraft downtime. Incorporating digital tools such as augmented reality (AR) and digital twins can further enhance maintenance processes, improve technician training, and increase operational efficiency. Public-Private Partnerships (PPPs) remain a key trend in the development of Nigeria's MRO infrastructure. The government's ongoing emphasis on PPPs for constructing and upgrading major aviation facilities, including MRO centres, offers a viable means of attracting private-sector investment, expertise, and technology (Adediran, 2019). The proposed MRO facility, approved by the Federal Executive Council (FEC) in collaboration with the AJW Consortium, exemplifies this trend.

Overcoming several key challenges will unlock the growth potential of Nigeria's aircraft MRO market. Addressing skill shortages and infrastructure gaps is essential (Habib and Turkoglu, 2020). This requires collective investments in specialised training institutions and programmes to develop a skilled workforce of aviation maintenance technicians and engineers. The government can play a vital role by supporting infrastructure development, including land allocation, and offering funding or incentives to establish and expand MRO facilities (Lin, 2016). Promoting collaboration between the Nigerian MRO sector and established international companies can facilitate knowledge transfer, the dissemination of best practices, and the adoption of advanced technologies, thereby strengthening their capacity. Improving regulatory efficiency and creating a more conducive business environment are also crucial for sustainable growth (Orikpete, Gungura, Ehimare and Ewim, 2023).

Attracting both domestic and international investment is crucial to building a strong, competitive MRO market in Nigeria (Adediran, 2019). The government should consider offering targeted incentives, such as tax reductions and subsidies, to companies willing to establish or expand MRO facilities within the country. Facilitating collaborations and joint ventures between Nigerian and international MRO firms can also be beneficial, enabling the sharing of expertise and resources, and providing access to broader markets (Olaganathan *et al*, 2020).

In conclusion, the Nigerian aircraft MRO market exhibits significant growth potential and is undergoing a transition that extends beyond incremental improvement toward comprehensive sector transformation. While factors such as rising air travel, fleet expansion, and government support continue to drive market growth, there is a clear shift as ongoing private and public-sector initiatives increasingly target systemic barriers. The development of robust local MRO capabilities is not only essential for reducing capital outflows from overseas maintenance but also forms the cornerstone of repositioning Nigeria as a major aviation hub in Africa. Strategic recommendations must therefore prioritise sector transformation through targeted investments, comprehensive policy reforms, and collaborative partnerships to strengthen human capital and infrastructure. Implementing these measures can catalyse the evolution of Nigeria's MRO sector from a regionally constrained industry to a competitive, self-sustaining pillar of economic growth, job creation, and enhanced aviation safety and efficiency.

2.21 Case Study of Major Global Players

2.21.1. Emirates Airways MRO

With its extensive network across six continents, Emirates Airlines has established itself as an award-winning global airline. The airline boasts the world's largest fleet of Boeing 777s and Airbus A380S. Maintaining, repairing, and overhauling its aircraft fleet are vital functions for an airline of this size, as they significantly influence safety, reliability, and operational efficiency. Effective MRO reduces

disruptions and maximises aircraft availability for service, thereby ensuring airworthiness. Emirates Engineering is the airline's in-house MRO division, playing a key role in managing the technical maintenance of its fleet. This report analyses Emirates' MRO operations, including internal capabilities, strategic partnerships, technological advancements in maintenance, substantial investments, and its current and future market position.

Emirates Engineering ranks among the world's most technologically advanced aircraft maintenance facilities. With GCAA CAR V approval, it meets strict regulatory standards. In addition to supporting its parent airline's extensive fleet, Emirates Engineering also provides maintenance services to more than thirty other airlines under third-party contracts. A skilled team manages all aspects of maintenance, engineering, quality control, planning, and coordination within the organisation. The main infrastructure supporting these activities includes a large facility at Dubai International Airport (DXB). Emirates Engineering provides a comprehensive range of aircraft maintenance services. Line Maintenance offers 24/7 technical support for aircraft and engines, as well as cabin maintenance and refurbishment, from its Dubai base and a network of outstations. Base Maintenance performs all routine, scheduled maintenance tasks, as well as any unscheduled major repairs, replacements, and modifications to the Emirates fleet. Highly trained staff in the Overhaul Workshops conduct testing, repair, modification, and overhauling of various aircraft components.

Beyond maintenance services, Emirates Engineering is also committed to developing talent through a wide range of technical training courses delivered at its world-class facilities. Emirates Airlines partners with Emirates Aviation University, which offers an Applied Bachelor's degree in Aircraft Maintenance Engineering programme that provides students with hands-on maintenance experience facilitated by the airline.

Emirates has established several key strategic partnerships to enhance its MRO capabilities and ensure optimal fleet performance.

Emirates has signed a 10-year, multimillion-pound services agreement with GE Aerospace for the electrical load management system on its Boeing 777 fleet, comprising 143 aircraft. This agreement improves the operational reliability, aircraft availability, efficiency, and safety of Emirates' Boeing 777 fleet. The deal covers repairs, stockholding, inventory management, programme management, configuration control, engineering change management, technical documentation, obsolescence management, and reliability trend analysis. As part of this partnership, GE Aerospace's inventory in Dubai will be integrated with Emirates' inventory at its facility, a strategic move to improve stock availability and reduce lead times, thereby enhancing service levels. Emirates is exploring and implementing Virtual and Augmented Reality (VR/AR) technologies for various maintenance tasks. Emirates' proactive adoption of these technological advancements reflects a strategic approach aligned with the ongoing digital transformation within the MRO industry.

The Emirates Group has shown robust financial performance in the 2024-25 fiscal year, achieving record results across key economic indicators.

The airline's significant investments in digitalisation and automation, including the adoption of predictive maintenance technologies, drone-assisted inspections, and VR/AR tools, align with the industry-wide shift towards digital solutions to enhance efficiency, improve accuracy, and reduce operational costs. Recognising the critical issue of workforce development and talent shortages in the MRO sector, Emirates' focus on engineering training programmes and its collaboration with educational institutions, such as Emirates Aviation University, are strategic measures to build a pipeline of qualified engineers and technicians and address this industry-wide challenge (Emirates, 2023).

By proactively addressing these industry trends and challenges through strategic initiatives, Emirates positions its MRO operations for long-term success and sustainability. The focus on technology and workforce development indicates a forward-looking approach for ongoing growth and efficiency in this key area of its business.

2.21.2 Ethiopian Airlines MRO

Ethiopian Airlines has established itself as a leading aviation group in Africa, demonstrating consistent growth and an innovative approach to adopting new aviation technologies, including MRO services. MRO services are vital in the aviation sector, serving as the backbone of ensuring aircraft fleet airworthiness, safety, and optimal operational efficiency. The airline's MRO is no longer merely a support function for its parent airline; instead, it has become a substantial business unit that enhances the group's overall success and strengthens its reputation as one of the most reliable and safest airlines. By exploring its history, infrastructure, service offerings, strategic initiatives, and competitive advantages, this analysis provides a detailed understanding of Ethiopian MRO's role and its impact on the aviation landscape of Africa and the Middle East.

The establishment of Ethiopian MRO in 1957 marked the beginning of its role as a key division of Ethiopian Airlines. This occurred early in the airline's history, which began operations in 1946, reflecting a long-term strategic vision for self-reliance in aircraft maintenance. Initially, the MRO division's primary objective was to provide essential maintenance services for Ethiopian Airlines' growing fleet. Over the following decades, Ethiopian MRO has undergone a significant transformation, gradually expanding its capabilities to serve a diverse range of third-party clients across Africa and the Middle East. This expansion demonstrates a strategic decision to utilise its accumulated expertise and infrastructure to serve the broader regional aviation market. Ethiopian Airlines, including its MRO division, is wholly owned by the Ethiopian government. While government ownership in industries can sometimes raise concerns about potential bureaucratic hurdles, the sustained success and growth of Ethiopian MRO suggest dedicated support from the Ethiopian government. This backing has been crucial in providing long-term financial stability and strategic direction needed to develop a leading MRO provider in a capital-intensive sector such as aviation.

The headquarters of Ethiopian MRO is at Bole International Airport in Addis Ababa, Ethiopia, establishing it as a central hub for African aviation. It has firmly positioned itself as the largest MRO service provider in Africa and the Middle East, a claim highlighted in its official communications. A substantial infrastructure supports this leading position, including six main hangars dedicated to airframe maintenance. These hangars offer significant capacity and versatility, accommodating a wide range of aircraft. Ethiopian MRO maintains comprehensive engine and component maintenance workshops equipped with the machinery and tools required to repair and overhaul aircraft, engines, and components. The operational logistics infrastructure comprises two extensive warehouses that store more than 100,000 line items. The initial warehouse focuses on aircraft components, whereas the second facility houses commercial goods and bulk materials. Ethiopian MRO has achieved full certification from key aviation regulatory bodies, including the Ethiopian Civil Aviation Authority (ETCAA), the Federal Aviation Administration (FAA), and the European Union Aviation Safety Agency (EASA). This indicates that its facilities and processes comply with stringent safety and quality standards set by the relevant authorities, enabling it to serve a range of international airlines. Other Middle Eastern and African Civil Aviation Authorities also certified the facility, broadening its regulatory compliance within its primary service region. Ethiopian MRO provides a comprehensive range of airframe maintenance services, including both base and line maintenance. Base maintenance involves thorough inspections and significant repairs to ensure the aircraft remains safe, structurally sound, and airworthy. Line maintenance involves routine inspections and servicing required between flights to ensure the safe operation of aircraft. Its capabilities extend to heavy maintenance for a diverse fleet of aircraft. This reduces airlines' reliance on Africa and the Middle East within the MRO market, leading to significant savings in both time and costs.

Ethiopian MRO boasts extensive component maintenance facilities with over 1,000 FAA and EASA-approved capabilities, underscoring the breadth of its services in this vital sector. These specialised workshops provide a range of aircraft components, including hydraulics, landing gear, APU's, wheels,

brakes, avionics, in-flight entertainment, mechanical systems, emergency equipment, interiors, and water/waste systems. Ethiopian MRO is Africa's sole Dowty-approved repair and overhaul center for the propeller blades, hubs, and spinners of De Havilland Canada DHC-8 Q-series aircraft. Because both the FAA and EASA certify many component maintenance functions, airlines can handle most aircraft maintenance in-house. This streamlines operations, lowers turnaround times, and reduces expenses by minimising reliance on external specialised MRO providers. As the only Dowty-approved facility in Africa for specific DHC-8 Q-series components, it holds a distinct market position and a competitive advantage when servicing operators of these aircraft in the region. This specialisation demonstrates a higher level of expertise and collaboration with original equipment manufacturers (OEMs), thereby attracting a specific clientele.

Ethiopian Airlines Group recently strengthened its longstanding relationship with GE Aerospace by signing a significant agreement to power its expanding fleet of wide-body aircraft with GE engines. These achievements enhance their reputation and attract airlines operating aircraft powered by these modern engine types, thereby reducing the need for regional airlines to seek specialised services overseas. Ethiopian MRO is the largest MRO service provider in Africa and the Middle East, which is a significant advantage in a market where scale often means a broader range of services and greater capacity. Being part of Ethiopian Airlines, one of Africa's leading and most successful airlines, offers a solid foundation and a steady stream of maintenance work. Founded in 1957, Ethiopian MRO has extensive expertise in aviation maintenance. Its workforce comprises over 3,000 skilled, safety-conscious, and resolute technical staff, representing substantial expertise. In Ethiopia, the company benefits from low labour costs, enabling competitive pricing. Ethiopian MRO has established a reputation for delivering high-quality, reliable services, which are crucial in the safety-critical aviation industry. Its access to an extensive spare parts inventory, with over 100,000 line items in stock, ensures efficient maintenance and minimises delays.

Addis Ababa's strategic location makes it an accessible hub for airlines across Africa and the Middle East. The company emphasises a convenient environment, positive hospitality, and a strong working culture, all of which enhance its operational efficiency. Its main competitive strength lies in its "one-stop shopping" approach, offering a full selection of in-house maintenance services for airframe, engine, APU, and landing gear, all backed by a certified training centre. This integrated approach simplifies the maintenance process for airlines. Ethiopian MRO's core values focus on delivering high quality, achieving short turnaround times, offering competitive prices, and providing excellent customer service.

By combining these factors, including being supported by a successful airline, having a large and experienced workforce, boasting an array of in-house capabilities, and benefiting from a strategic location, Ethiopian MRO develops a strong competitive advantage in its primary markets. The emphasis on low labour costs offers a potential price benefit, while the "one-stop shopping" model provides significant convenience and efficiency for airlines.

2.22 Business Opportunities in the Nigerian MRO Sector

The challenges facing Nigeria's aviation MRO sector are not obstacles but rather significant business opportunities. By addressing these challenges, Nigeria can unlock substantial economic potential, enhance aviation safety, and establish itself as a regional aviation leader. Nigeria's aviation MRO sector is vital; existing challenges can be transformed into promising business prospects. The robust growth in air traffic, coupled with the substantial capital outflow for overseas maintenance, underscores the clear economic need for localised MRO capabilities.

Challenge	Corresponding Business Opportunity	Impact
High Cost and Capital Flight from Overseas MRO	Establish Comprehensive Domestic MRO Facilities	Saves billions in foreign exchange, reduces aircraft downtime, creates local jobs, and enhances operational efficiency.
Inadequate Local MRO Infrastructure/Capacity	Invest in State-of-the-Art MRO Facilities (incl. heavy checks)	Reduces reliance on foreign MROs, attracts regional business, builds national self-reliance, and improves aircraft availability.
Operational Inefficiencies and Aircraft Grounding	Develop Localised Component and Engine Overhaul Capabilities	Minimises flight delays/cancellations, increases airline revenue, improves fleet utilisation, and enhances safety.
Skilled Labour Shortage and Workforce Gaps	Invest in Human Capital Development and Specialised Training	Creates a skilled workforce pipeline, supports MRO expansion, fosters technology transfer, and boosts safety culture.
Regulatory and Policy Environment (historical issues)	Strengthen Regulatory Framework and Promote FDI through Policy Reform	Attracts foreign investment, facilitates aircraft leasing, reduces operational risks, and enhances global confidence.
Lack of Regional MRO Hub in West/Central Africa	Position Nigeria as the Regional MRO Hub	Captures significant regional MRO spend, establishes a competitive advantage, diversifies the local economy, and enhances the national image.

Table 3: Nigeria MRO Challenges and Business Opportunities

Developing local MRO capabilities offers two main benefits. First, it reduces the billions of pounds spent on overseas maintenance, keeping more money within Nigeria. Second, it accelerates aircraft turnaround times, thereby reducing daily revenue loss from aircraft grounding. This sector presents a substantial opportunity for specialised investment. Moving from outsourcing MRO, which entails inflated costs and capital requirements, to building strong local capabilities transforms the industry into a potential revenue stream. This approach not only saves billions in foreign exchange but also creates additional income streams by servicing regional airlines, turning the MRO sector from a liability into a strategic economic asset. By investing in and expanding domestic MRO facilities, Nigeria can reduce this expenditure and retain foreign exchange within the country.

The large MRO facility in Akwa Ibom aims to become one of Africa's leading maintenance centres, comparable to those in Ethiopia, South Africa, and Egypt. It can accommodate several large aircraft, such as two Boeing 747-8s or eight Airbus A220S, thereby decreasing capital flight and creating jobs. The facility plans to offer third-party commercial maintenance services upon NCAA certification. Aero Contractors, on the other hand, is expanding its Lagos facility to become a one-stop maintenance centre for Western and Central Africa, enhancing its heavy maintenance capabilities. The expansion involves significant infrastructure upgrades and investment in advanced tools. Air Peace, in collaboration with Embraer, is establishing an innovative MRO facility in Nigeria to serve both Nigerian and international fleets. This partnership, which involves a long-term services agreement for Air Peace's E195-E2 and ERJ 145 fleets, offers component exchanges, repair services, and the Ahead-Pro diagnostic system for predictive maintenance. Meanwhile, United Nigeria Airlines and Cronos Aviation have joined forces to establish an MRO. The partnership aims to reduce operational costs and enhance the global competitiveness of Nigerian airlines. XEJet is creating a new USD 10 million flight

support and engineering centre at Abuja's Nnamdi Azikiwe International Airport. Lagos remains the leading aviation centre in West Africa, with a committed investment of USD 250 million under its Aviation Roadmap. This aims to establish Lagos as the aviation hub of West Africa and to address the critical shortage of skilled labour, both of which are essential for the sustainable growth of Nigeria's MRO sector. Boeing predicts a significant demand for aviation personnel in Africa by 2041, including 20,000 pilots, 21,000 technicians, and 26,000 cabin crew. This forecast highlights a key opportunity to develop specialised training programmes tailored for aircraft maintenance engineers and technicians within Nigeria. Ongoing investment in workforce development is vital not only for building a skilled labour pool but also for ensuring operational safety and emergency preparedness in the aviation industry. Existing institutions, such as NCAT in Zaria, already play a vital role in training these professionals. Historical collaborations, such as Bristow Helicopters' continuous sponsorship of students at NCAT since 1986, serve as a proven model for successful industry-academia partnerships. Building on this, new training, and knowledge-exchange initiatives, such as the Memorandum of Understanding (MoU) between Aero Contractors and the Nigerian Safety Investigation Bureau (NSIB), can further enhance safety training, foster technical collaboration, and develop human capital in the sector. These partnerships are integral to establishing a resilient and self-sustaining MRO ecosystem.

Adopting advanced technologies such as predictive maintenance, AI-driven diagnostics, digital twin modelling, and real-time safety monitoring can enhance efficiency, minimise downtime, and improve safety outcomes within the MRO sector. Partnerships for technology transfer are essential. The strategic partnership between the Nigerian government and Boeing, signed in 2024, includes technology transfer, capacity building, and the development of local aircraft maintenance facilities, which is expected to save Nigeria millions of pounds. Using Embraer's Ahead-Pro diagnostic system for Air Peace's E-Jet fleet demonstrates the adoption of innovative maintenance diagnostic tools. Honeywell Aerospace's partnership with ExecuJet Nigeria for avionics and engine installations offers

regional support, easier access to parts, and opportunities for local skill development in advanced systems.

Strategic Partnerships and Foreign Direct Investment (FDI). The significant market potential makes a compelling case for attracting the global MRO market, Original Equipment Manufacturers (OEMs), and aviation infrastructure developers. The Nigerian government has introduced incentives for foreign investment, including tax holidays and duty waivers on imported aircraft and spare parts. Public-Private Partnerships (PPPs) are the preferred approach for establishing MRO facilities, as demonstrated by the approval of the MRO centre through a PPP with Messrs. AJW Consortium.

Nigeria's adherence to the Cape Town Convention has increased, evidenced by the signing of the Irrevocable Deregistration and Export Request Authorisation in October 2024. This rise is attributed to the signing of the Irrevocable Deregistration and Export Request Authorisation (IDERA) in October 2024 and the subsequent clarification of regulations for its implementation. Traditionally, Nigerian airlines had resorted to the costly option of "wet leasing" due to perceived legal uncertainty. Compliance with the Convention promotes more affordable "dry leasing" arrangements, leading to:

Reduced Aircraft Acquisition Costs: Frees capital for MRO investments.

Fleet modernisation and expansion plans. Demand for local MRO services is increasing, as evidenced by the Nigerian government's dry leasing arrangements with Boeing.

Increased Demand for Local MRO: A larger, newer fleet naturally drives domestic maintenance activities.

Enhanced investor confidence signals a more stable and predictable operating environment.

The Convention is more than a legal formality; it serves as a strategic economic facilitator for MRO growth, aligning with stakeholder demands for local MRO facilities to reduce foreign-exchange costs

and create jobs. However, implementation challenges persist, including legal ambiguities and insufficient judicial capacity, which can still delay repossession efforts.

The increasing engagement of major OEMs, such as Embraer with Air Peace and Boeing (with the Nigerian government), in local MRO development is a significant trend. This signals a move toward direct technology transfer, access to genuine parts, and specialised training, which are crucial to maintaining modern aircraft and building sustainable, high-quality MRO capabilities in Nigeria. Modern aircraft are technologically advanced and require specialised maintenance, proprietary tools, and authentic parts, often supplied or controlled by OEMs. Direct collaborations with OEMs ensure the quality and reliability of local MRO services, promote the transfer of vital aerospace technology and expertise, and help develop indigenous capacity while reducing long-term dependence on foreign MRO providers.

2.23 Research Model and Hypotheses

2.23.1 Research Conceptual Model

The data analysis method in this dissertation follows a systematic, multi-phase process that combines quantitative and qualitative techniques to provide a comprehensive understanding of Nigeria's aviation MRO sector.

The process began with data preparation and organisation, which involved gathering primary data from 205 completed Google Forms surveys and compiling secondary data from the literature review, case studies, and external market research reports. The quantitative data were then cleaned and coded to ensure accuracy, consistent formatting, and proper encoding of categorical variables, supporting statistical analysis.

The second phase focuses on quantitative data analysis using JASP and Microsoft Excel. This stage involves applying descriptive statistics to summarise respondent demographics and initial insights into MRO sector issues, including deficiencies, currency fluctuations, opportunities, and prospects.

The Chi-Square Test of Independence is used to evaluate the relationship between professional experience and perceived regulatory hurdles. Pearson's r is a statistical measure used in correlational analysis to quantify the linear relationship between two or more variables. Multiple linear regression models forecast the MRO sector's outlook based on factors such as collaboration, government support, and investment in training and research. The third phase involves qualitative data analysis, applying thematic analysis to open-ended survey responses and relevant textual content from the dissertation's literature and case studies. This systematic process includes familiarisation with the data, generating initial codes, identifying overarching themes, reviewing and refining them, and finally defining and naming them to gain deeper insights into the sector's complexities, challenges, and proposed solutions. The final phase, Triangulation, combines findings from quantitative and qualitative analyses to interpret and synthesise data.

This comprehensive approach facilitates the validation of conclusions and provides a holistic understanding of the Research Questions. The synthesised insights serve as the foundation for deriving overarching findings and discussing their implications for stakeholders, contributing actionable knowledge to the strategic development of Nigeria's aviation MRO industry. The data analysis in this dissertation directly addresses the Research Questions and the hypotheses (H0 and H1), providing a comprehensive understanding of Nigeria's aviation MRO sector.

Research Question 1 and 2: Inherent Complexities: The interpretation of inherent complexities depends on descriptive statistics from survey questions about respondent demographics (primary role, years of experience, organisation size) to provide contextual understanding. A descriptive analysis of the primary impact of Nigeria's lack of advanced MRO facilities quantifies the most pressing issues. Chi-Square tests were used to assess whether these complexities were perceived differently across stakeholder groups; this is essential for developing targeted management strategies. Thematic analysis, where relevant, and open-ended responses that address complexities, add depth to this interpretation with qualitative insight.

Descriptive statistics from questions about the significance of foreign exchange (forex) fluctuations and the characterisation of collaboration between airline operators and MRO providers in Nigeria provided insights into key challenges. Pearson's

Correlation analysis is then used to examine relationships between these challenges and other factors, including potential interactions between high forex impact and low collaboration. Chi-Square tests also help identify whether specific demographic groups perceive challenges differently. Thematic analysis of open-ended responses is crucial here, as it extracts detailed qualitative accounts and proposed solutions related to operational inefficiencies, supply chain vulnerabilities, and regulatory burdens, thereby providing rich context for the quantitative measures.

Research Question 3: Potential Business Opportunities: The interpretation of potential business opportunities involves findings from descriptive statistics, correlational analysis, and multiple linear regression. A descriptive study examines the opportunities created by the expansion of domestic airlines, including crucial business aspects, suitable financial instruments, and the most effective government incentives, to outline perceived opportunities and preferred funding and support mechanisms. Correlational analysis helps identify relationships between perceived opportunities and the factors that enable them. Multiple Linear Regression forecasts the outlook for Nigeria's MRO sector, using independent variables such as collaboration, government support, and investment in training and Research and Development. The regression results highlight the most impactful opportunities for strategic investment and policy intervention. Thematic analysis offers qualitative insights into the feasibility and subtleties of these opportunities, including innovative ideas and stakeholder recommendations.

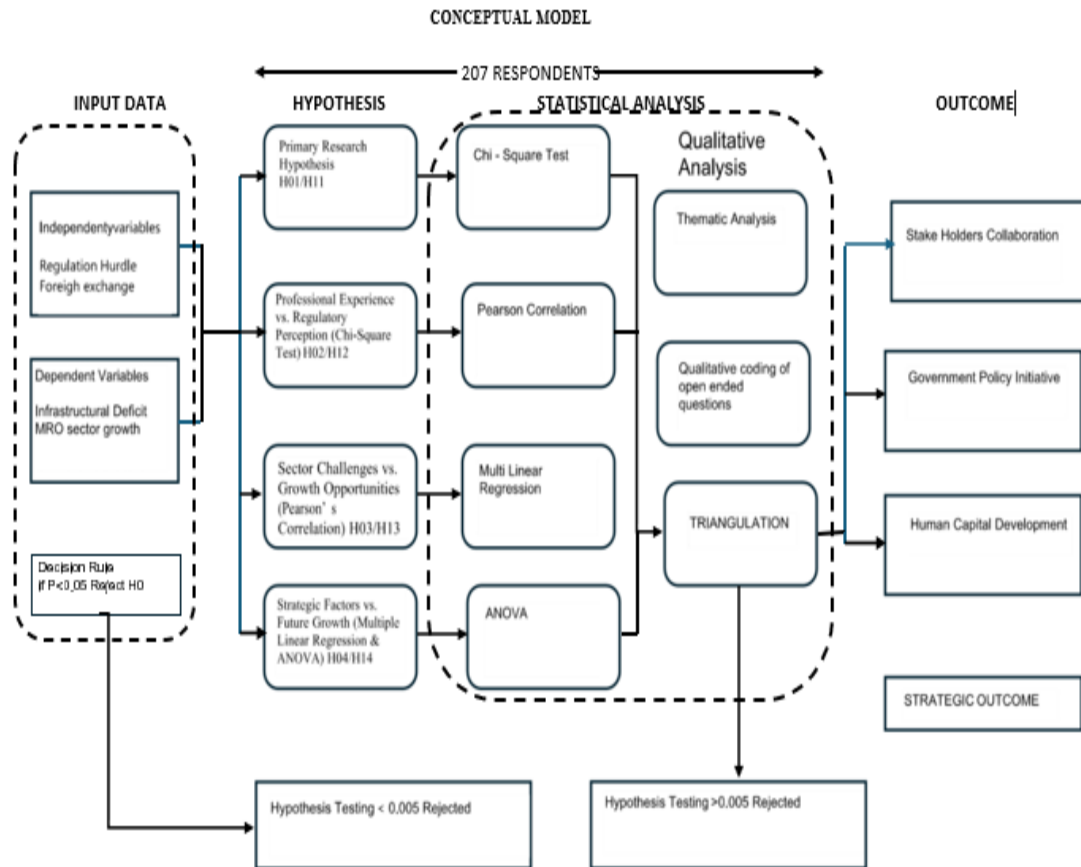


Figure 3: Conceptual Model

2.23.2 Hypothesis Development

The data analysis process is designed to evaluate the proposed hypotheses directly; the hypotheses, however, are developed to validate assumed perceptions, analyse, and identify key problems, and propose practical solutions. The main hypothesis is presented below:

Null Hypothesis (H0): The challenges in Nigeria's MRO sector do not constitute a business opportunity.

Alternative Hypothesis (H1): The challenges in Nigeria's MRO sector constitute a business opportunity.

Quantitative findings (descriptive statistics, correlations, and regression) demonstrate the perceived impact of challenges and the ways specific opportunities contribute to the sector's growth. For instance,

if respondents identify "Higher operational disruptions and longer aircraft downtime" as a significant impact (a challenge) and simultaneously identify "Establishing new MRO facilities" as a key business opportunity, this quantitative evidence directly supports the idea that challenges do constitute opportunities. The linear regression model, by predicting the outlook from factors derived from addressing challenges (collaboration and training), further supports H1 if these factors significantly influence a positive outlook.

Qualitative insights from thematic analysis offer narrative depth by explaining how specific challenges are perceived as opportunities, such as the economic necessity to minimise foreign exchange drain, leading to the need for local MROs. These qualitative elaborations support or challenge the hypothesis by providing contextual evidence and real-world examples, thereby strengthening the argument's validity.

Ultimately, triangulating these diverse data streams during the interpretation phase enables the dissertation to draw a clear conclusion on whether the challenges faced by Nigeria's MRO sector can be transformed into viable business opportunities, thereby directly addressing H0 and H1.

Statistical Tool	Null Hypothesis	Alternative Hypothesis
Primary Research Hypothesis	(H01)The challenges and complexities inherent in Nigeria’s MRO sector do not constitute significant business opportunities for sector growth and indigenous market investment.	H11)The challenges and complexities inherent in Nigeria’s MRO sector constitute significant and quantifiable business opportunities for sector growth and indigenous market investment.
Professional Experience vs Regulatory Perception (Chi-square test)	(H02): There is no significant correlation between an individual's years of professional experience in the Nigerian aviation sector and their perception of the primary regulatory obstacles.	(H12): An individual's years of professional experience in the Nigerian aviation sector significantly influence their perception of the primary regulatory obstacles.
Sector Challenges vs Growth Opportunities (Pearson’s Correlation)	(H03): There is no significant linear relationship between identified sector challenges (such as market friction) and potential investment or growth opportunities.	(H13): A significant linear correlation exists between identified sector challenges and potential investment or growth opportunities.
Strategic Factors vs Future Growth (Multiple Linear Regression and ANOVA)	(H04): Strategic factors, such as policy backing and stakeholder cooperation, do not significantly estimate or shape the industry's future economic prospects and growth trajectory.	(H14): Strategic factors, including policy backing and stakeholder cooperation, significantly estimate and shape the industry's future economic prospects and growth trajectory.

Table 4: List of Hypotheses

It will subsequently be supported by sub-hypotheses designed to evaluate specific variables, which will be developed and tested.

The null hypothesis (H01) posits that challenges in Nigeria’s MRO sector do not present significant business opportunities, underscoring the need to test this assumption to gain sector insights.

Alternative Hypothesis (H11): The challenges and complexities inherent in Nigeria’s MRO sector present significant, quantifiable business opportunities for growth and indigenous market investment.

Inferential statistical testing will evaluate the developed hypotheses. The study employs several statistical tools, including Chi-square tests, Pearson's correlation, and multiple linear regression, each chosen for its specific analytical strengths.

The Chi-Square Test of Independence will assess whether years of experience vary across perceptions of regulatory issues.

Null Hypothesis (H02): There is no significant correlation between an individual's years of professional experience in the Nigerian aviation sector and their perception of the primary regulatory obstacles facing the market.

Alternative Hypothesis (H12): There is a significant correlation between an individual's years of professional experience in the Nigerian aviation sector and their perception of the primary regulatory obstacles facing the market.

While Pearson's Product-Moment Correlation (r) (Relationship). This analysis examines sector challenges and potential market solutions.

Null Hypothesis (H03): There is no significant linear relationship or correlation between the identified sector challenges and the perceived business opportunities within the Nigerian MRO landscape.

Alternative Hypothesis (H13): There is a significant linear relationship and a positive correlation between the identified sector challenges and the perceived business opportunities within the Nigerian MRO landscape.

Similarly, the Multiple Linear Regression and ANOVA measure how much strategy changes affect the sector's future. ANOVA checks how well this model fits the data.

Null Hypothesis (H04): Strategic drivers, including government policy support, stakeholder collaboration, and investment in training, do not significantly predict the future economic outlook or growth trajectory of the Nigerian MRO sector.

Alternative Hypothesis (H14): Strategic drivers, including government policy support, stakeholder collaboration, and investment in training, are statistically significant predictors of the Nigerian MRO sector's future economic outlook and growth trajectory.

Finally, triangulation, which converges and concludes the study, also uses descriptive statistics to set benchmarks, validate methods, and draw conclusions. It offers a thorough, multi-layered approach to tackling the major challenges within Nigeria's MRO sector. By integrating the core hypothesis, the study moves beyond simple observation to provide both accurate predictions and meaningful insights. Various perspectives on the topic will be considered, utilising a range of statistical methods:

Perceptual Validation: This study employs the Chi-Square Test to evaluate whether market obstacles are objective facts that are consistently perceived by individuals regardless of their level of experience, thereby examining the objectivity of reported market barriers.

Relational Validation: Utilising Pearson's correlation coefficient, the research quantifies the relationship between identified sector challenges and growth opportunities, assessing whether a significant linear correlation exists between market friction and potential investment.

Predictive Validation: Both Multiple Linear Regression and Analysis of Variance (ANOVA) are employed to estimate how strategic factors, such as policy support and stakeholder cooperation, may influence the industry's future economic prospects and growth trajectory.

Verification and Synthesis: The final triangulation of all inferential results involves cross-verifying these methods to eliminate mono-method bias and draw a cohesive, comprehensive conclusion.

Therefore, the empirical structure shows that the complexities inherent in Nigeria's aviation landscape are not just barriers; they also foster innovation. When examined more thoroughly, these challenges prove to be substantial, measurable drivers of local market investment and sustained sector growth.

2.24. Research Gaps

While general reports and market analyses exist for the broader African MRO market, such as those by Mordor Intelligence and the Insight Partners, both of which mention Nigeria as a component, there is a notable lack of in-depth, localised academic research that offers a comprehensive, integrated analysis of the MRO landscape in Nigeria(Habib and Turkoglu, 2020). Existing discussions often highlight individual challenges or general opportunities (Orikpete *et al*, 2023). However, they rarely link these aspects in a systematic study of the MRO ecosystem.

This research investigates operational complexities, focusing on the technical and logistical challenges faced by existing MRO facilities in Nigeria. This includes examining their equipment, certifications, processes, parts supply chain management, and compliance with international safety standards, including NCAA, EASA, and FAA requirements. A comprehensive assessment is conducted of the maintenance services (line, base, heavy checks, component repair, engine overhauls) that Nigerian MROs can perform, compared with actual demand from the Nigerian and regional aviation markets.

Regulatory Effectiveness: This detailed analysis assesses the Nigerian Civil Aviation Authority (NCAA)'s regulatory enforcement, its impact on MRO operations, and opportunities to improve support for growth and ensure compliance. While government statements and industry reports frequently mention "business opportunities" in the Nigerian MRO sector (Adetiloye, 2015), there is a significant lack of thorough, research-backed identification and analysis of specific, actionable business opportunities (Ichou and Veress, 2024; Hallensleben *et al*, 2025). Vague claims about "investment potential" fail to offer the detailed information needed for effective strategic planning or well-informed investment decisions.

Market Niches: Identifying specific types of MRO services with high demand but limited local supply, from Nigerian airlines and potentially other West African carriers. This involves analysing fleet types, maintenance schedules, and outsourcing patterns.

Feasibility of New MRO Segments: Assessing the viability of establishing new MRO capabilities based on available infrastructure, human resources, and

financial conditions. This may include conducting mini-feasibility studies for different MRO segments. The research analyses Nigeria's strategic geographic position and its potential to become a regional MRO centre for West and Central Africa, considering the current MRO landscape in neighbouring countries and competitive advantages. Innovative Business Models: The research explores alternative models for MRO facilities, such as Public-Private Partnerships (PPPs), joint ventures with international MRO giants, or specialised MRO service providers focusing on specific aircraft components or types. Investment Case: The research develops a data-driven rationale for potential investors by outlining the return on investment (ROI) opportunities for various MRO initiatives, including cost savings from reduced overseas maintenance, job creation, and broader economic benefits. By focusing on these areas, the research aims to move beyond broad recognition of challenges and opportunities to deliver a specific, actionable, and academically rigorous understanding of the Nigerian MRO sector.

Chapter 3: Methodology

3.1 Research Philosophy

This study adopts a pragmatic philosophical approach, recognising that the multifaceted nature of Nigeria's aviation Maintenance, Repair, and Overhaul (MRO) sector requires a flexible, adaptable research design. Pragmatically, diverse methodologies, including both quantitative and qualitative approaches, are promoted to achieve a comprehensive understanding of complex phenomena. Research questions and objectives are prioritised according to this philosophy, which guides the selection of the most effective methods to address them rather than rigid adherence to a single paradigm. The complexity of challenges and opportunities in the MRO sector requires a pragmatic, thorough approach that combines objective data with stakeholder perspectives. To gain a deeper understanding

The research design employed a mixed-methods approach, combining quantitative and qualitative methods. This method enables the collection of numerical data (through a structured survey) and

detailed textual data (via document analysis and qualitative interviews or case studies from the original dissertation). A concurrent triangulation strategy was employed, where both data types were collected and compared during interpretation. This process aimed to provide a more comprehensive and validated understanding of the research problem. The quantitative component identified patterns, statistical relationships, and the prevalence of specific challenges and opportunities within Nigeria's MRO sector. In contrast, the qualitative component sought to offer rich, detailed insights into the complexities, challenges, and opportunities, adding depth and context to support the quantitative findings.

3.2 Mixed-Methodology Design

This dissertation employed a mixed-methods research design that combined quantitative and qualitative approaches. This decision was motivated by a pragmatic philosophical stance that asserts that research questions should determine the methods employed rather than rigid adherence to a single paradigm. The complex, multifaceted nature of the Nigerian aviation MRO sector necessitated a comprehensive investigation to identify both broad patterns and subtle insights.

Neither a purely quantitative nor a strictly qualitative approach can provide a complete understanding of the research problem. Quantitative methods (surveys) are well-suited to identifying prevalence, patterns, and statistical relationships across larger samples, thereby enabling quantification of perceptions of complexity, challenges, and opportunities ("What is the main impact?" and "How significantly does forex fluctuate?"). Qualitative methods (thematic analysis of open-ended responses and literature review/case studies) are vital for providing in-depth context, exploring underlying reasons, and capturing the richness and nuance of human experiences and proposed solutions that numerical data cannot communicate (such as "Why are regulatory hurdles perceived as such?" and "What innovative solutions are suggested?").

The study used a concurrent triangulation strategy, collecting quantitative and qualitative data simultaneously and integrating them during interpretation. This approach allows corroboration of findings, enhancing the credibility and validity of the conclusions. Qualitative comments on the economic imperative of reducing aircraft downtime reinforced the quantitative data, highlighting a significant impact of "Higher operational disruptions". Each method contributed distinct pieces of the puzzle, yielding a more comprehensive and robust understanding than either method could achieve on its own. Quantitative data may reveal what is happening, whereas qualitative data explain why and how.

The research questions inherently required both types of data:

Research Question 1 (Complexities) and Research Question 2 (Challenges): Quantitative data revealed the most significant complexities and challenges, while qualitative data offered detailed explanations and contextual factors.

Research Question 3 (Opportunities): Quantitative data assessed the perceived importance of numerous opportunities, while qualitative data offered insights into their feasibility, strategic implementation, and innovative elements. The mixed-methods approach was a deliberate and strategic choice to harness the strengths of both quantitative and qualitative methods, thereby enabling a comprehensive, valid, and relevant investigation of the complex dynamics of the MRO sector.

3.3 Sampling Technique

This is a non-probability sampling method that combines convenience and snowball sampling techniques. The specialised nature of the target population and the challenge of compiling a comprehensive list of all stakeholders in the Nigerian aviation sector led us to adopt this approach.

The target population comprised a diverse group of stakeholders, such as

1. Flight and maintenance personnel.

2. Airline operators and management
3. Maintenance, Repair, and Overhaul (MRO) is provided.
4. Regulatory body officials
5. Academic researchers and aviation consultants

The process began with convenience sampling, where the research team initially contacted readily accessible key industry individuals. The snowball sampling method was used, where initial participants were asked to distribute the survey to other relevant professionals in their networks.

This combined approach proved effective in collecting data from a targeted, knowledgeable group, yielding 205 complete responses that served as the basis for the quantitative analysis.

3.4 Data Collection

Primary data for this study were collected via a structured survey distributed via Google Forms. The survey targeted a wide range of stakeholders in the Nigerian aviation sector and related fields, including flight and maintenance personnel, airline management, MRO providers, regulatory authorities, academic researchers, non-pilots, and aviation enthusiasts.

The primary data collection tool used for this research was a questionnaire, detailed in Appendix A of the original dissertation. This questionnaire, created and distributed via Google Forms, included both closed-ended questions (such as multiple-choice and Likert-scale items) designed to collect quantitative data and open-ended questions intended to gather qualitative responses, allowing participants to elaborate on their views.

The survey aimed to gather insights about:

1. Inherent complexities within the Nigerian MRO sector.

2. Key challenges impeding operational efficiency and growth.
3. Potential business opportunities for establishment and expansion.

Perceptions of regulatory obstacles, the impact of foreign exchange rate fluctuations, and collaborative initiatives. Effective strategies for adaptation, resilience within the supply chain, and sustainable development. The identification of suitable financial instruments and key considerations for investors. Participant recruitment utilised a non-probability sampling approach, specifically convenience and snowball sampling. This methodology was chosen due to the specialised nature of the target population and the practical challenges associated with obtaining a comprehensive sampling frame within the Nigerian aviation sector. Initial contacts were established with key industry stakeholders, who facilitated the dissemination of the survey to other pertinent parties. A total of 205 complete responses were obtained for quantitative analysis.

Secondary data were extensively extracted from a comprehensive literature review and case studies (including Nigeria Airways, Aero Contractors, Bristow Helicopters Aviation, Emirates Airways MRO, and Ethiopian Airways MRO), which informed the qualitative analysis and enriched the interpretation of the survey findings. They also provided initial descriptive statistics for the survey, which are further elaborated in this methodology section. Historically, the Nigerian aviation MRO sector has faced numerous challenges, including inadequate infrastructure, a shortage of skilled workers, and a heavy reliance on foreign MRO services (Umezurike and Ganiyu, 2020; Orikpete *et al*, 2023). Periods of economic instability and policy inconsistencies have often hampered early efforts to develop indigenous MRO capabilities, as exemplified by Nigeria Airways (Orikpete *et al*, 2023). Recent initiatives, such as privatisation and liberalisation, have spurred renewed interest and investment in building a strong domestic MRO industry (Oluwakoya and Ajayi, 2022; Nwaogbe, 2023).

The secondary data were also drawn from a comprehensive collection of research sources, including reputable market research reports and pertinent academic publications. Key sources utilised for market size and growth forecasts include:

1. Oliver Wyman
2. Research Nester
3. Precedence Research
4. Mordor Intelligence
5. Strategic Market Research
6. Grand View Research
7. Stratview Research
8. The Insight Partners
9. Verified Market Research

There are discrepancies across levels in forecasts of the Nigerian MRO market, highlighting data opacity in emerging markets(Habib and Turkoglu, 2020). Although these discrepancies may be due to numerous factors, they all share a similar pattern of growth. Mordor Intelligence, for instance, estimates the 2024 market at \$329.92 million, projecting a 2.66% CAGR to \$386.48 million by 2030 (Mordor Intelligence, 2024). Conversely, Verified Market Research valued it at \$815.2 million in 2023, with an expected worth of \$1,750 million by 2031, showing a 10.02% CAGR from 2024. As a result, precise quantification remains challenging due to investor uncertainty(Ososuakpor, 2021b, 2021a). The focus should be on consensus on growth and on the identified qualitative drivers, such as increased air travel, fleet expansion, and government support. Government initiatives, such as the \$250 million allocated for MRO facilities under the Aviation Roadmap, further support this growth trend (Adediran, 2019). These discrepancies emphasise the need for improved data collection and standardisation within the Nigerian aviation sector.

Complementary information and detailed case studies were collected from various industry reports and company-specific publications cited throughout the dissertation, such as those from:

1. Air Transport Action Group (ATAG)
2. International Air Transport Association (IATA)

3. Federal Airports Authority of Nigeria (FAAN)
4. Nigerian Civil Aviation Authority (NCAA)
5. Company-specific reports and announcements from entities like Air Peace, Embraer, British Airways, and Air France.

3.5 Questionnaire Design

The questionnaire is designed to address the research's core questions and objectives by reviewing the Research Questions and Objectives highlighted in Chapter 1, ensuring that each survey question directly contributes to their resolution. This alignment is essential for maintaining the data's validity and relevance. The next step involves identifying the specific individuals or groups with insights into aviation research and how to contact them; this includes defining the target population as diverse aviation stakeholders in Nigeria, such as flight and maintenance personnel, airline operators, MRO providers, regulatory bodies, and academic researchers. Given the specialised nature of this population, a non-probability sampling approach, such as convenience or snowball sampling, is used.

This next step focuses on structuring the data collection method to align with the research approach. A mixed-methods design is used with a question format that supports both quantitative and qualitative analysis. Closed-ended questions are well-suited to collecting structured data, such as demographic details, Likert-scale responses, and multiple-choice options. These formats facilitate data quantification and statistical analysis.

Open-ended questions, such as requests for "Additional comments", promote detailed, qualitative elaboration, providing nuanced insights and uncovering unforeseen viewpoints that fixed options might not capture. Researchers placed demographic questions at the beginning to provide context for responses and to enable subgroup analysis. The core research questions were then formulated to directly address the complexities, challenges, and opportunities identified in the research objectives. Each question also focuses on a single concept to prevent confusion. For multiple-choice questions,

response options are comprehensive and mutually exclusive (Gottlieb, Bailitz, Shappell, and Wagner, 2023).

The questionnaire included an introduction that set the tone by explaining the purpose of the study, obtaining informed consent, ensuring anonymity and confidentiality, and finally outlining the method for distributing the questionnaire.

The accessibility, user-friendliness, and automated data-collection features of Google Forms often lead researchers to choose it for online surveys, thereby simplifying data management

Although not explicitly detailed in some accounts, pilot testing is a crucial, often implicit step in questionnaire design. It involves administering the draft questionnaire to a small, representative group from the target population. The aim is to identify any ambiguities, technical issues, or areas for improvement in clarity, length, flow, and terminology before full-scale deployment. Feedback from the pilot test refines the questionnaire, enhancing its effectiveness and reliability. The final stage involves preparing the instrument for broad distribution, including making any final revisions based on pilot-test feedback, and then sharing the questionnaire link with the identified stakeholder network.

3.6 Data Analysis

JASP statistical software and Microsoft Excel were the primary tools for data analysis. The quantitative data collected from the survey were analysed using JASP, and Excel was also used for initial data organisation, cleaning, and preliminary calculations.

The following statistical techniques were applied:

Descriptive statistics tools, such as frequencies, percentages, means, medians, and standard deviations, were used to summarise the demographic characteristics of the respondents (such as primary job function, years of experience, and organisation size) and responses to individual survey questions. This

helped describe the central tendency and variability in the data, thereby providing initial insights into perceived complexities, challenges, and opportunities.

Mean ($\bar{x}$): $\bar{x} = \frac{\sum x}{n}$

Median: The central value in a numerically ordered dataset.

Mode: The value appearing with the highest frequency in a dataset.

Standard Deviation (s): $s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$

Application to Research Questions: Descriptive statistics played a vital role in exploring Research Question 1 (inherent complexities), Research Question 2 (principal obstacles), and Research Question 3 (potential business opportunities). For instance, the frequency distributions and percentages obtained from survey questions such as the first question ("What is your primary role in the aviation industry or an allied industry?"), Question 2 ("How many years of experience do you have in the Nigerian aviation sector?"), Question 3 ("What is the size of your organisation?") provided essential demographic context for the respondent pool, offering insights into the profile of individuals facing the complexities and challenges. Quantifying perceived effects from responses to Question 4 ("What is the main impact of Nigeria's lack of advanced MRO facilities? ") contributed to identifying the most significant complexities and challenges (Research Questions 1 and 2).

These insights are vital for understanding baseline challenges in the MRO sector and for identifying priority areas for stakeholder intervention, which inform the problem statement and potential solutions for this DBA thesis. Responses improve the understanding of current operational efficiency and the factors affecting it (Research Question 2), including the sixth question: "How would you characterise the collaboration between airline operators and the MRO market in Nigeria?" Furthermore, Question 7 asks: "How significantly does foreign exchange (forex) fluctuation impact MRO costs and spare parts sourcing?" Descriptive statistics from questions such as Question 10: "Which are the five most crucial viable business opportunities in Nigeria's MRO landscape?" captured and summarised the most

common business opportunities and sector outlook (Research Question 3). Questions 11 and 14 inquire: "What financial instrument is suitable for funding Nigeria's MRO and aviation infrastructure?" and "What is the outlook for Nigeria's MRO sector in the next 10–15 years?" respectively.

Chi-Square (χ^2) Test of Independence: This test was used to examine the association between two categorical variables, determining whether a meaningful relationship exists between them.

$$\text{Formula: } \chi^2 = \sum E_i (O_i - E_i)^2$$

Where O_i represents the observed frequency, and E_i represents the expected frequency under the assumption of independence (Rahman, Noraidi, Hj Khalid, Mohamad-Adam, Zahari, 2025).

Application to Research Questions: Chi-square tests were used to examine Research Question 1 (complexities) and Research Question 2 (challenges) by assessing whether perceptions of these constructs varied across respondent demographics, including job title, tenure, and company size. For instance, analysing the relationship between Question 1 ("What is your primary role in the aviation industry or an allied industry?") and Question 5 ("What is the main regulatory hurdle for the MRO market, operators, and investors?") could reveal if regulatory personnel perceive regulatory hurdles differently from MRO market participants or airline operators. This clarifies the nuanced nature of challenges from different stakeholder perspectives, highlighting specific areas for targeted management actions or policy.

Pearson's r was used to assess the strength and direction of linear relationships between two continuous variables (or, when appropriately treated, ordinal variables).

$$\text{Formula: } r = \frac{[n \sum x^2 - (\sum x)^2] [n \sum y^2 - (\sum y)^2] - n \sum x - (\sum x)(\sum y)}{[n \sum x^2 - (\sum x)^2] [n \sum y^2 - (\sum y)^2]}$$

A correlational analysis examined Research Questions 2 (challenges) and 3 (opportunities) by examining relationships among numerous factors affecting the MRO sector's operational environment

and growth prospects. For example, the correlation between respondents' perceptions from Question 7 ("How significantly does foreign exchange (forex) fluctuation impact MRO costs and spare parts sourcing?") and their views on Question 10 ("To what extent does increasing domestic airlines present an opportunity for local MRO?") enabled an investigation of how a key challenge (forex fluctuation) might inversely relate to or be mitigated by a notable opportunity (growth of domestic airlines).

Multiple Linear Regression was used to model the relationship between a single dependent variable and two or more independent variables, assessing the independent variables' predictive power on the dependent variable(Allen, 2017).

Formula: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \epsilon$ (Knights and Prchkovska, 2024).

Where Y represents the dependent variable, X_1 , X_2 , and X_t represent the independent variables, β_0 is the y-intercept, β_1 , β_2 , ..., β_n are the regression coefficients, and ϵ is the error term (Knights and Prchkovska, 2024).

Multiple linear regression played a crucial role in identifying the main drivers of the sector's outlook, thereby helping to answer Research Question 3 - potential business opportunities, and providing an overall understanding of the sector's trajectory. Specifically, this method was used to forecast Question 14 ("What is the outlook for Nigeria's Maintenance, Repair, and Overhaul (MRO) sector in the next 10-15 years?"), The dependent variable, representing perceived future opportunities, is derived from a combination of independent variables from other survey questions. These included perceptions from Question 6 ("How would you characterise the collaboration between airline operators and the MRO market in Nigeria?"), Question 13, which asked about the most effective government support to promote MRO business expansion, and adaptation strategies such as "Investing in specialised training and encouraging research and development" from Question 8 ("How can the Nigerian Maintenance, Repair, and Overhaul (MRO) sector adapt to developing trends?"). This analysis sheds light on the

specific factors that had the greatest predictive influence on the perceived growth and success of the Nigerian MRO sector.

The qualitative data, obtained from the survey's open-ended questions and the dissertation's rich textual content (including the literature review and case studies), were analysed thematically. Specifically, for Question 20 of the survey, an open-ended item designed to elicit detailed textual responses, thematic analysis was systematically used to identify, analyse, and report patterns (themes) within the data. Themes or patterns are described as the outcomes of data analysis in the TA approach (Braun and Clarke, 2006).

The systematic steps involved in this process were:

Familiarisation with the Data: This initial stage involved repeated reading of the qualitative responses and extensive engagement with the dissertation content to gain a comprehensive and immersive understanding of the data.

Generating Initial Codes: Relevant segments of the data were assigned initial codes to capture features pertinent to the research questions.

Searching for Themes: Similar codes were subsequently grouped to form potential overarching themes and more granular sub-themes.

Reviewing Themes: A rigorous review process was undertaken to ensure that the identified themes accurately reflected the coded data and were coherent and distinct within the overall dataset.

Defining and naming themes: Each theme was thoroughly analysed to identify its essence and its relevance to the core Research Questions. Subsequently, concise and descriptive names were assigned to each theme.

Producing the Report: The developed themes were woven together into a coherent narrative, substantiated by illustrative quotes drawn from the qualitative data and cross-referenced with insights gleaned from the detailed case studies and literature review presented in the dissertation.

Thematic analysis aimed to explore underlying perceptions, lived experiences, and proposed solutions related to the complexities, challenges, and business opportunities in Nigeria's MRO sector, supplementing the quantitative findings with detailed qualitative insights. The data analysis process for this dissertation used a systematic, multi-phase approach that integrated quantitative and qualitative methods to provide a comprehensive understanding of Nigeria's aviation MRO sector.

The initial phase focused on data preparation and organisation. This involved collecting primary data from 205 completed Google Forms surveys and compiling secondary data from the literature review, case studies, and external market research reports presented in the dissertation. After collection, the quantitative data was carefully cleaned and coded to ensure completeness, consistent formatting, and appropriate numeric coding for categorical variables, supporting statistical analysis.

In the second phase, quantitative data analysis, we used JASP statistical software and Microsoft Excel. Descriptive statistics were calculated to summarise respondent demographics and provide initial insights into key aspects of the MRO sector, including the impact of MRO deficiencies, foreign exchange fluctuations, perceived opportunities, and the outlook. A chi-squared test of independence was performed to explore the relationship between professional experience and perceived regulatory hurdles. Pearson's r correlation coefficient was used to evaluate relationships among variables. Finally, multiple linear regression models were developed to predict the outlook of the MRO sector based on factors such as collaboration, government support, and investment in training and research.

The third phase, qualitative data analysis, involved applying thematic analysis to open-ended survey responses and to relevant textual content from the dissertation's literature and case studies. This systematic process included familiarisation with the data, generating initial codes, searching for

overarching themes, reviewing, and refining these themes, and finally defining and naming them to extract in-depth insights into complexities, challenges, and proposed solutions within the sector. This comprehensive approach enables the corroboration of results and provides a holistic understanding of the research questions.

3.7 Data Analysis Flow Model

This image illustrates a clear, systematic framework for a research study within the aviation or industrial sector, focusing on MRO operations. The depicted structure follows a traditional research methodology that logically flows from a broad problem to specific, actionable outcomes. The research process begins with the Problem Statement, which identifies the core issue or knowledge gap that the study aims to address. This is followed by the formulation of specific Research Questions that narrow the focus and guide the entire investigation.

Following the review of existing literature, the study presents its findings based on empirical evidence. The framework emphasises this stage, leading to the last step: conclusions and recommendations. This concluding section interprets the findings in response to the initial research questions. It presents challenges as business opportunities and advocates a commercially focused, solution-oriented approach to Nigeria's MRO industry.

Problem Statement: This marks the first stage of the research and clearly defines the central issue the study aims to address. In this dissertation, the problem statement highlights Nigeria's heavy reliance on foreign MRO services, emphasising the high financial costs, extended aircraft downtime, and foreign exchange pressures associated with this dependency. It underscores the urgent need for domestically developed MRO capabilities.

Research Questions: Derived directly from the problem statement, these questions narrow the investigation's focus. They guide the entire research process by clarifying the study's aims. For this dissertation, the Research Questions examine the inherent complexities of the Nigerian aviation MRO

sector, the significant challenges hindering its growth and operational efficiency, and the potential business opportunities for its development and expansion.

Literature Review: This essential stage involves a thorough examination of existing academic work, industry reports, and case studies. It aims to provide a comprehensive understanding of the existing literature by outlining the current state of knowledge, presenting a global and a Nigerian MRO context, and identifying research gaps that the dissertation addresses. A review of successful MRO models and historical issues lays the foundation for understanding sector dynamics.

Findings summarise: the empirical evidence collected in the study, highlighting key insights into the complexities, challenges, and opportunities of Nigeria's MRO sector and directly addressing the research questions.

Conclusions and Recommendations: The final stage of the process synthesises all findings and interprets them to draw overarching conclusions about the Nigerian MRO sector. It aims to foster optimism by reinterpreting challenges as valuable business opportunities. It then presents strategic growth imperatives, along with actionable recommendations to inform future development.

3.8 Model Assessment

3.8.1 Assessment of Questionnaire

The primary data collection method in this study is a structured questionnaire administered via Google Forms; the assessment focuses on its design, benefits, and limitations in effectively collecting the required data. It includes a combination of closed-ended questions (multiple-choice and Likert-scale items) and open-ended questions. This combined format was chosen to align with the study's mixed-methods approach, aiming to collect both quantitative and qualitative data.

Closed-ended questions were designed to collect and quantify perceptions, identify prevalence, and establish statistical relationships, such as primary role, years of experience, organisation size, main

impact of MRO lack, regulatory hurdles, foreign exchange impact, adaptation strategies, supply chain resilience, domestic airline opportunities, business prospects, financial instruments, investor considerations, steps for sustainable growth, and outlook.

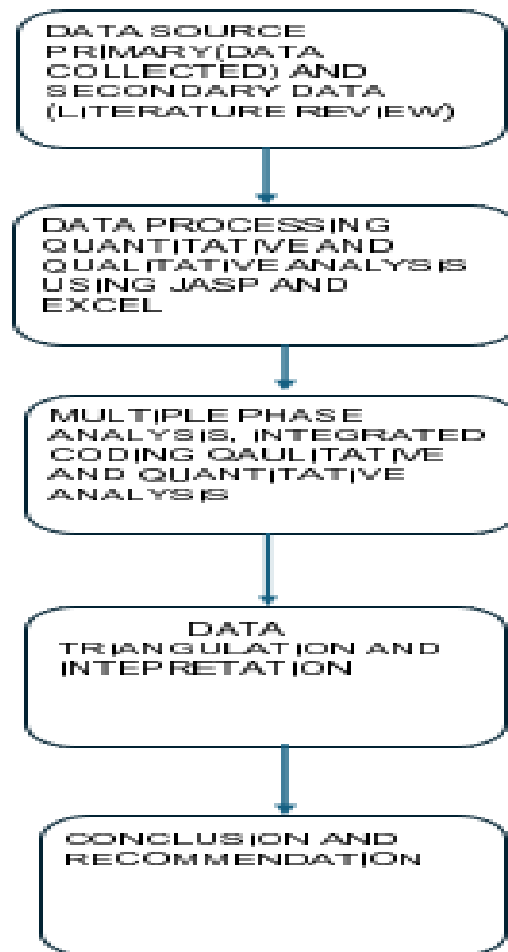


Figure 1: Data Analysis Flow Model

3.8.2 Data Validity

This research was carefully planned, and the questionnaire was designed to align with the research questions. It employs a combination of closed-ended questions to collect quantitative data and open-ended questions to elicit qualitative insights. The literature review references and cites various sources, including academic journals, industry reports, and analyses from firms such as Oliver Wyman and

Mordor Intelligence. This approach minimises reliance on a single perspective and enriches the study's contextual background. The research adopts a mixed-methods approach, a dependable method for increasing validity, combining quantitative data from a survey of 205 respondents with qualitative insights from open-ended questions and detailed case studies. The findings are supported across different data types. For example, qualitative comments on the economic imperative reinforce the quantitative finding that "Higher operational disruptions and longer aircraft downtime" significantly affect reliance on foreign MRO services.

3.8.3 Bias Analysis

The dissertation identifies several potential sources of bias and explores their implications, primarily in the Limitations of methodology section.

Sampling Bias: The study used nonprobability sampling methods (convenience and snowball sampling). This was a practical choice for reaching a specialised population, but it may mean the sample does not represent all stakeholders in the Nigerian aviation sector.

The research explicitly notes that technical and operational personnel comprised the largest share of the survey sample (67.1% of respondents). This may lead to an overemphasis on operational challenges such as training and equipment, and an underemphasis on strategic, financial, or high-level policy issues that senior management or investors might prioritise. The findings rely on self-reported data from the questionnaire, which can be influenced by biases such as Social Desirability Bias, in which respondents may give answers they believe are more professionally acceptable. **Subjective Interpretation:** Different respondents might interpret questions differently. A respondent's memory may affect the accuracy of their responses.

3.8.4 Ethical Considerations

All research procedures were followed to ensure the highest level of protection and privacy for participants. Informed consent was obtained from all survey respondents, with a clear explanation of

the study's purpose, how their data would be used, and an emphasis on the voluntary and anonymous nature of their participation. Confidentiality was maintained by keeping responses anonymous and ensuring that no identifiable information was collected or reported. Finally, all data collected was stored securely to prevent unauthorised access.

3.8.5 Limitations of Methodology

Although the mixed-methods approach used in this study provided a thorough analytical framework and employed a non-probability sampling method combining convenience and snowball sampling, it was practical for reaching a specialised, often hard-to-access population within the Nigerian aviation sector; however, it may not fully represent all stakeholder groups. As a result, the generalisability of the quantitative results to the entire population of aviation professionals in Nigeria is limited.

Flight or maintenance personnel accounted for 74.1% of respondents. This may have led to a "frontline" bias, whereby operational challenges are highlighted more than strategic, financial, or policy-related concerns that may be more common among underrepresented groups, such as senior management, financiers, and policymakers.

The findings are based on self-reported data and are subject to some level of bias.

Social Desirability Bias: Respondents might have given answers they believed were more socially acceptable or professionally favourable, rather than truly reflecting their opinions or experiences.

Subjective Interpretation: Different respondents might have understood questions in varying ways, causing response differences that do not reflect actual differences in viewpoint.

Recall Bias: Respondents' ability to accurately recall past events or feelings may affect the accuracy of their responses.

The research also uses a cross-sectional design, gathering data at a single point in time. This snapshot method helps describe the current state of the MRO sector. However, it does not enable causal

inferences or trend analysis. Although the open-ended survey questions provide valuable qualitative context, this approach naturally limits the depth of insights compared to more immersive qualitative methods, such as in-depth, semi-structured interviews or focus groups. Despite these limitations, including a lack of probing questions, the methodology was employed, offering a solid and valuable foundation for understanding the complexities of Nigeria's MRO sector. The findings provide credible insights for stakeholders and outline a clear direction for future research.

3.9 Data Presentation

The researchers collected and analysed 205 responses. The participants' demographic and professional backgrounds provide context for their perspectives on the industry. The main obstacles identified are regulatory and financial, while the most promising opportunities lie in strategic partnerships and human capital development. Despite these challenges, the overall outlook for the sector over the next 10-15 years remains cautiously optimistic.

What is your primary role in the aviation industry or an allied industry?

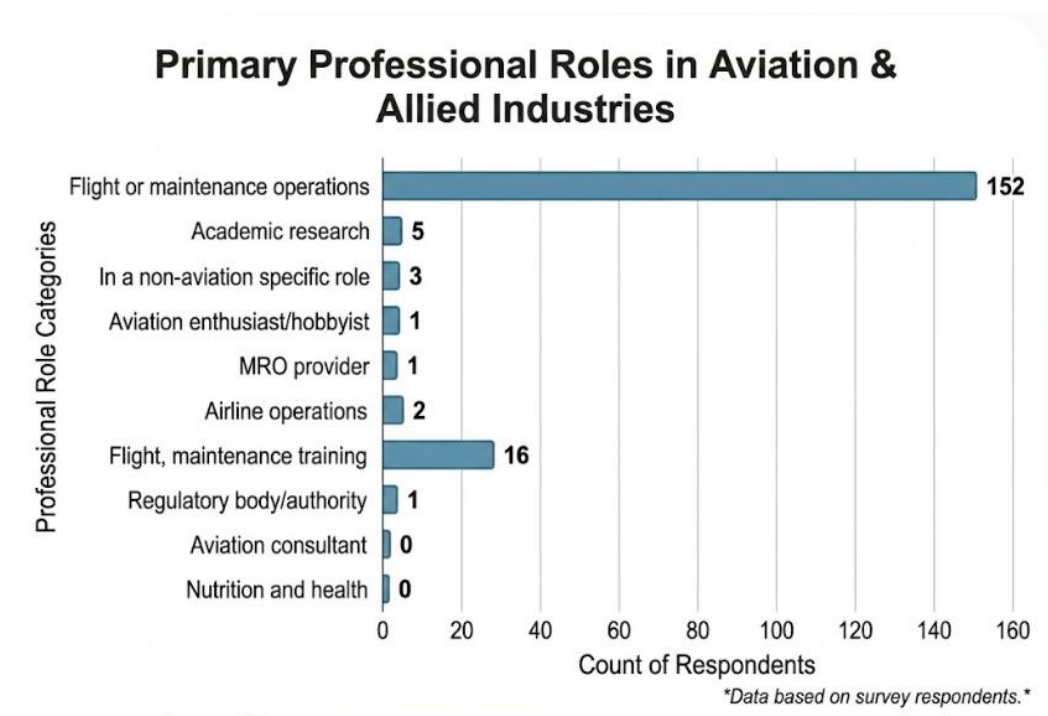


Chart 1: What is your primary role in the aviation or an allied industry?

The survey revealed that the most significant proportion (152 respondents) is from the operational side of the industry, with remaining roles including flight, maintenance and ground support personnel (74%); non-aviation fields (6.8%), airline operator/management (5.4%), academic researchers (2.4%), MRO sector (1.5%), regulatory bodies (1.5%), and other allied industries. This implies that MRO solutions must be efficient and address daily operational challenges, making engagement from these groups in strategic planning crucial. Future research should specifically target the perspectives of underrepresented groups, including those from MRO, regulatory bodies, and investors, to achieve a more comprehensive understanding.

How many years of experience do you have in the Nigerian aviation sector?

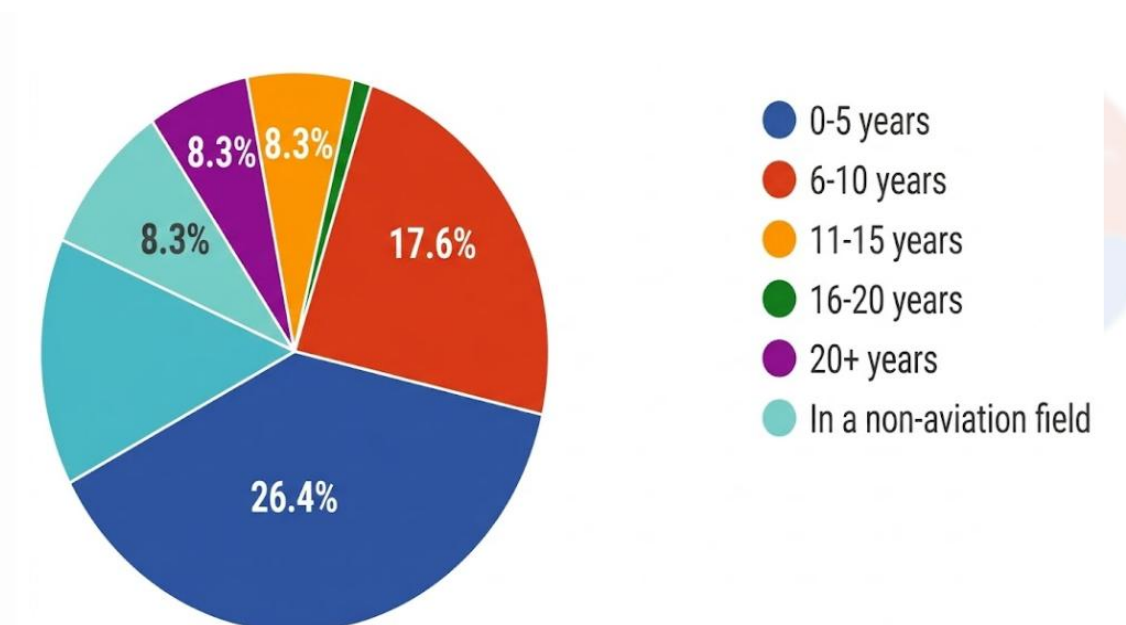


Chart 2: How many years of experience do you have in the Nigerian aviation sector?

Most respondents (26.8%) have mid-level experience, with "6-10 years" being the most common (55 respondents) in the Nigerian aviation sector, with other experience levels including 0-5 years (22.4%), 11-15 years (17.6%), 16-20 years (8.3%), and over 20 years (6.8%), with 18% from non-aviation fields.

This indicates that the workforce is established but may require advanced training and mentorship programmes to address complex industry-specific challenges. Further research could examine how distinct experience levels shape perceptions of MRO challenges and opportunities.

What is the size of your organisation?

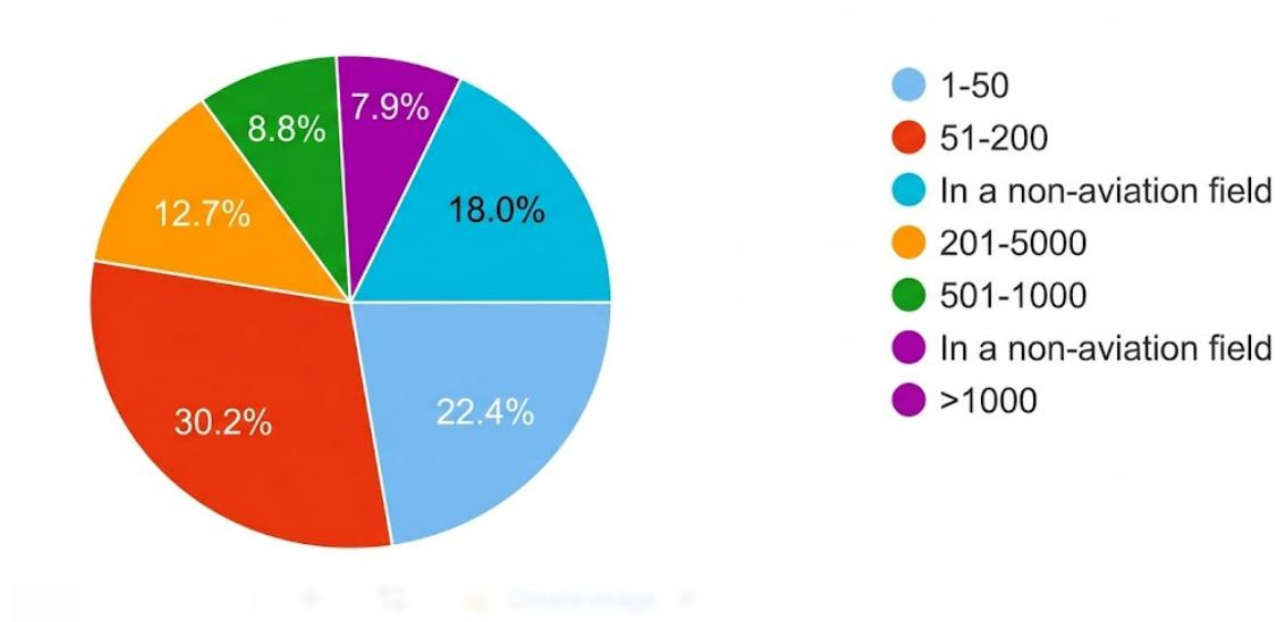


Chart 3: What is the size of your organisation? (Number of employees)

The largest group of respondents (30.2%) is from medium-sized organisations with "51-200" employees (62 respondents). Employee counts across other organisations include 1-50 (22.4%), 201-500 (12.7%), 501-1000 (8.8%), and over 1000 (7.8%). Additionally, 18% are from non-aviation fields. This suggests that policy and support initiatives should address the needs of these medium-sized entities. Tailored programmes for scaling up could have a significant impact. Future studies might examine whether perceived MRO challenges and opportunities vary by organisational size.

What is the main impact of Nigeria's lack of advanced maintenance, repair, and overhaul (MRO) facilities?

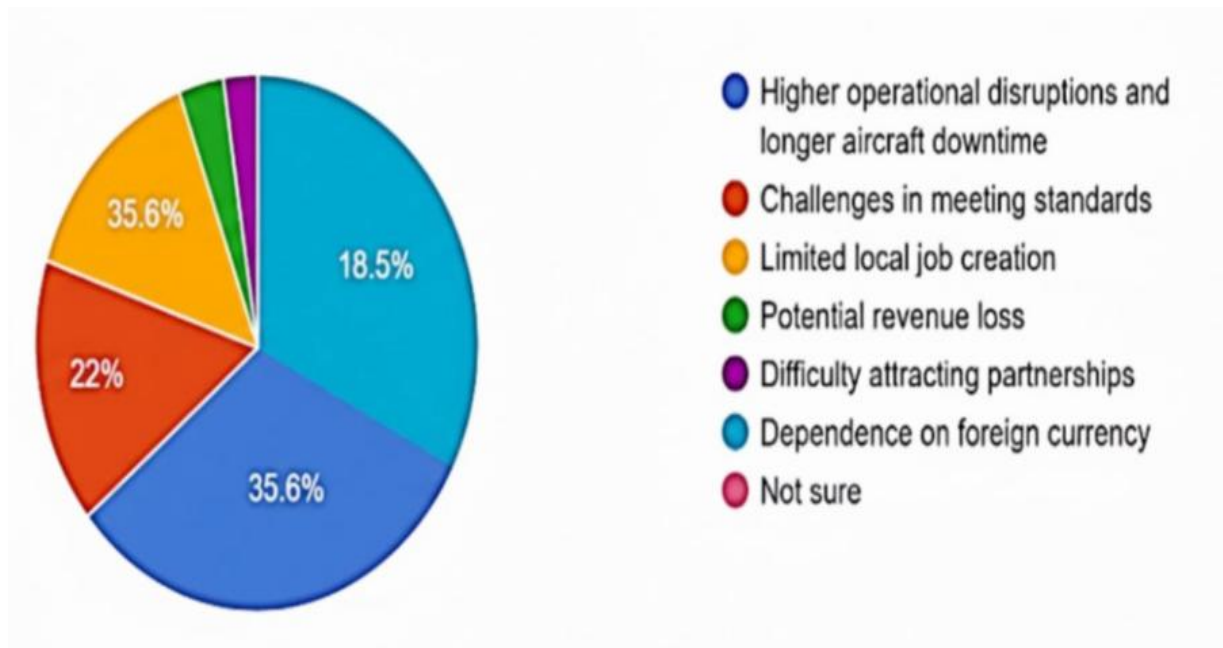


Chart 4: What is the main impact of Nigeria's lack of advanced Maintenance, Repair, and Overhaul (MRO) facilities?

The most significant identified impact, "Higher operational disruptions and longer aircraft downtime" (35.6%), is also the most common among respondents (73). Other effects include challenges in meeting standards (22%); reliance on foreign currency (18.5%); limited local job creation (10.7%); and difficulty attracting partnerships (9.3%). This emphasises the crucial need to prioritise investment in advanced facilities to directly address operational bottlenecks. Improving aircraft availability can lead to substantial cost savings and increased airline efficiency (Khan, Nasim, and Rasheed, 2024; Alomar and Nikita, 2025). Further research could measure the economic impact of "higher operational disruptions and longer aircraft downtime" to provide more valuable data for investment cases.

What is the main regulatory hurdle for the maintenance, repair, and overhaul (MRO) market, operators, and investors?

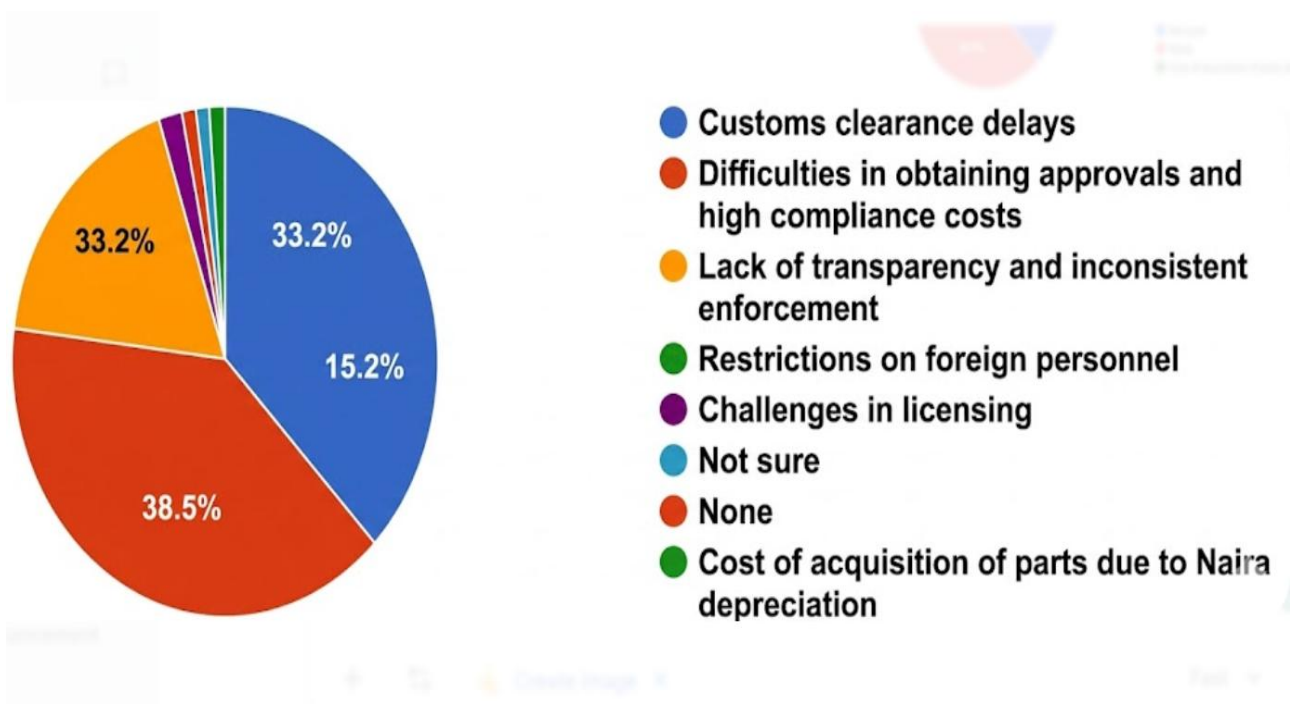


Chart 5: What is the main regulatory hurdle for Maintenance, Repair, and Overhaul (MRO) providers, operators, and investors?

Questionnaire question: "Difficulties in obtaining approvals and high compliance costs" (38.5%) was identified as the primary regulatory barrier and is the most common issue (79 respondents), with "Lack of transparency and inconsistent enforcement" (33.2%) and "Customs clearance delays" (15.1%) also being significant concerns.

How would you characterise the collaboration between airline operators and the maintenance, repair, and overhaul (MRO) market in Nigeria?

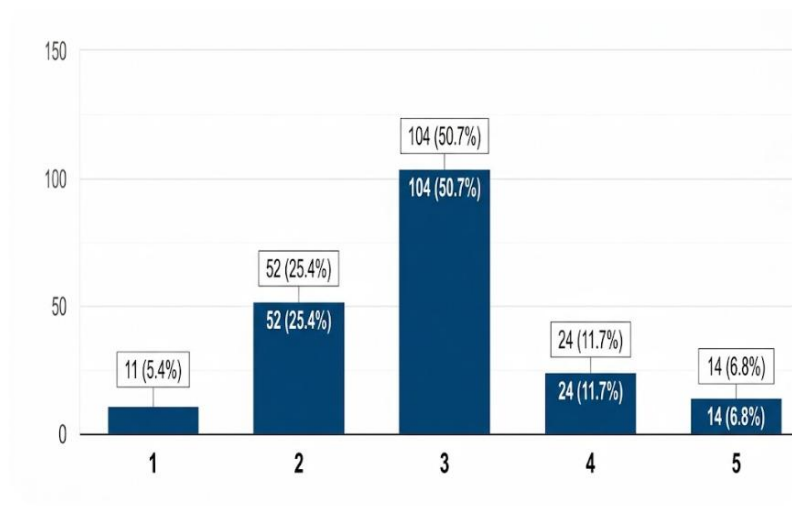


Chart 6: How would you characterise the collaboration between airline operators and Maintenance, Repair, and Overhaul (MRO) providers in Nigeria?

Questionnaire question: Collaboration is rated as neutral or moderate (50.7% selecting '3', which is also the median and mode), with 104 respondents on a 1-5 scale, yielding a mean of 2.698. Additionally, 25.4% rated it as '2' (limited), 11.7% as '4' (better), and only small proportions showed exceptionally low ('1' at 5.4%) or extremely high ('5' at 6.8%) levels of collaboration. This suggests there is significant room for improvement. Industry stakeholders should facilitate platforms for better dialogue, joint ventures, and information sharing to leverage domestic capabilities. Underlying factors and actionable strategies for stronger partnerships could be uncovered through qualitative research methods, such as case studies.

How significantly does foreign exchange (forex) fluctuation impact maintenance, repair, and overhaul (MRO) costs and spare parts sourcing?

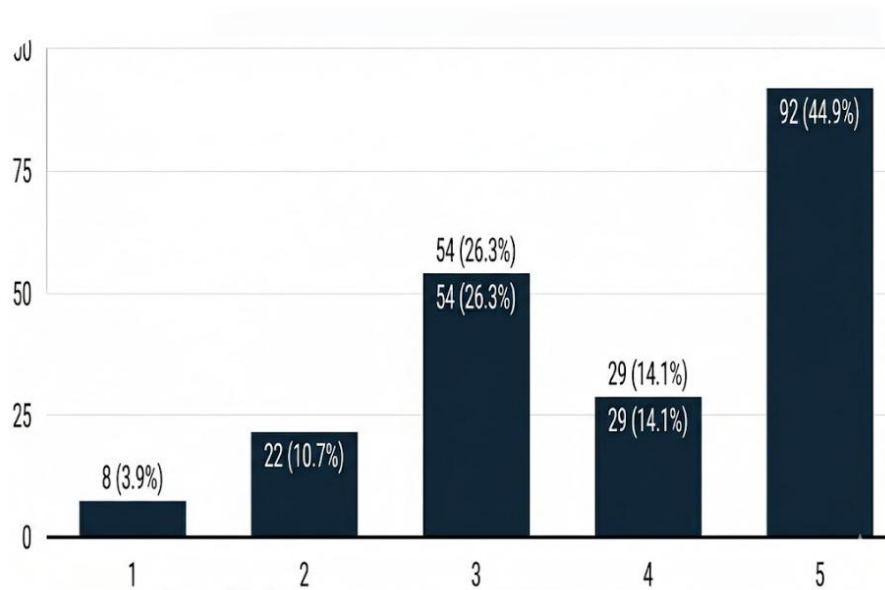


Chart 7: How significantly does foreign exchange fluctuation impact maintenance, repair, and overhaul (MRO) costs and spare parts sourcing?

Questionnaire question: Economic modelling and research into alternative financing mechanisms could help with foreign exchange exposure.

How can the Nigerian Maintenance, repair, and overhaul (MRO) sector adapt to developing trends?



Chart 8: How can the Nigerian Maintenance, Repair, and Overhaul (MRO) sector adapt to developing trends?

Questionnaire question: "Investing in specialised training and encouraging research and development" (46.3%), which is also the mode (95 respondents), is seen as the most essential adaptation strategy, highlighting human capital and innovation. Other key adaptation suggestions include upgrading facilities and equipment (21%), forming partnerships for technology transfer (15.6%), adapting regulatory frameworks (3.9%), and implementing digital maintenance logs and AI (8.8%). This result suggests that MRO companies should invest in workforce upskilling and Research and Development to remain competitive and adopt modern technologies, with support from the government and educational institutions. Detailed studies on specific training needs and effective models for technology transfer are needed.

9. What is the most crucial strategy that the Maintenance, Repair, and Overhaul (MRO) market in Nigeria can employ to ensure the resilience of its supply chains for spare parts and components in the face of global disruptions?

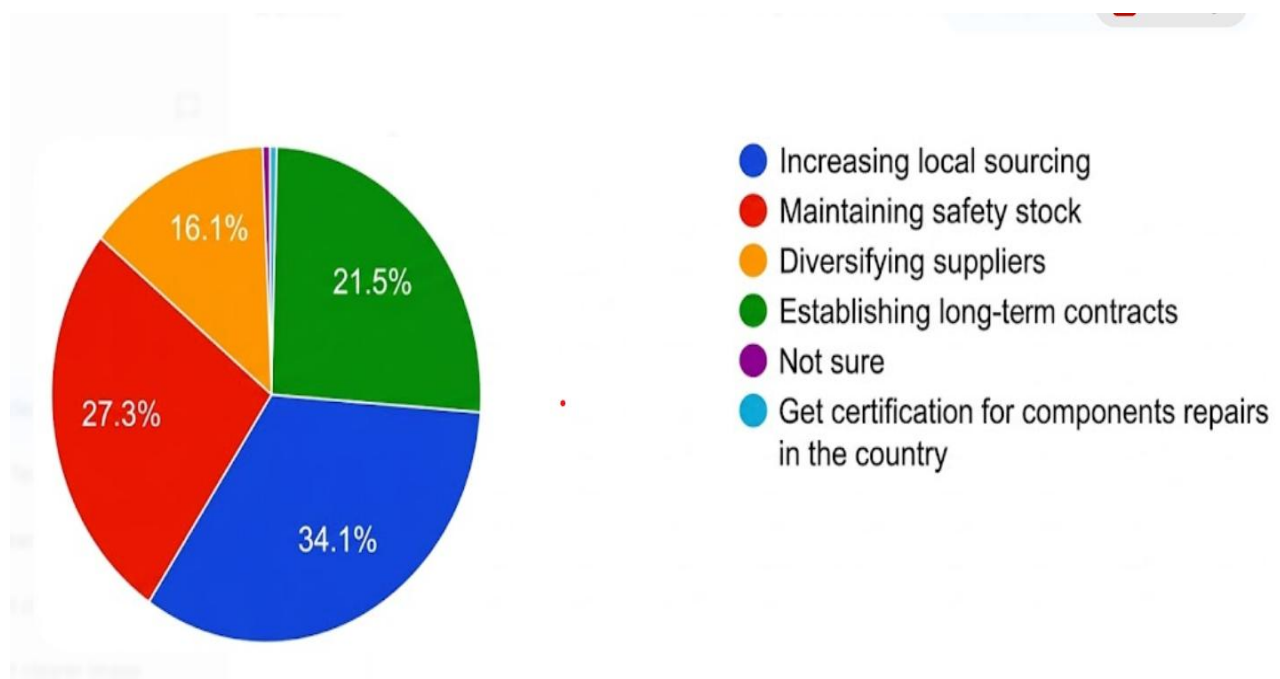


Chart 9: What is the most crucial strategy MRO provides in Nigeria that can be employed to ensure resilience against global disruptions?

What is the most crucial strategy that the Maintenance, Repair, and Overhaul (MRO) market in Nigeria can employ to ensure the resilience of its supply chains for spare parts and components in the face of global disruptions?

Research Question No. 9, "Increasing local sourcing" (34.1%), the most popular choice (70 respondents), is regarded as the most critical strategy for supply chain resilience. It indicates a preference for reducing reliance on external sources, with "Maintaining safety stock" (27.3%) and "Establishing long-term contracts" (21.5%) also identified as key strategies. This suggests that, where feasible, building strong local spare parts supply chains is a crucial step towards minimising vulnerability to global disruptions. It requires investment in local manufacturing capabilities and quality assurance. Conversely, conducting a feasibility study of local manufacturing, alongside analysis of economic benefits and exploration of advanced inventory management, would be advantageous.

To what extent do the increasing number of domestic airlines present an opportunity for local Maintenance, Repair, and Overhaul (MRO)?

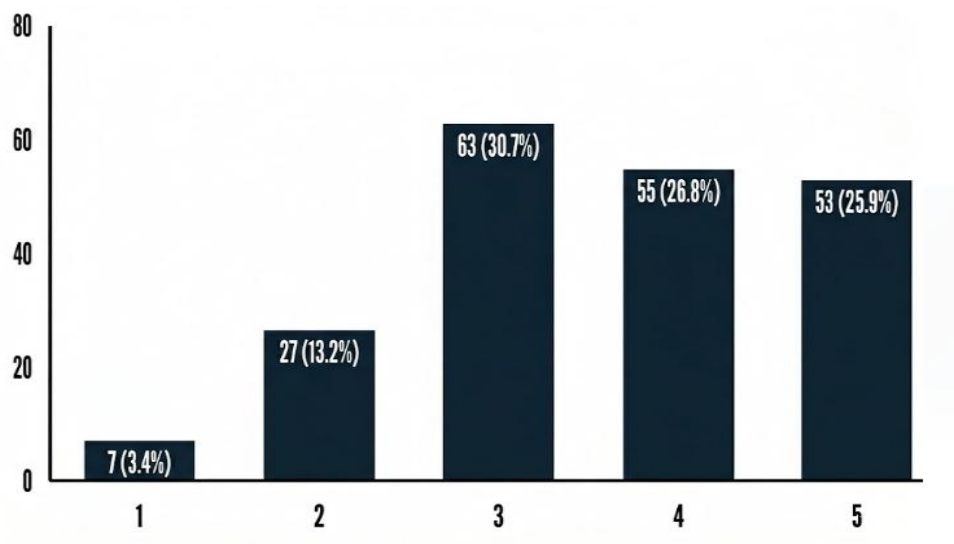


Chart 10: To what extent do increasing domestic airlines present an opportunity for local Maintenance, Repair, and Overhaul (MRO)?

The survey asked stakeholders to rate the extent to which the growth of domestic airlines presents an opportunity for local MRO on a 1-5 scale.

The most frequent response (the mode) was:

'3' (neutral), which was selected by sixty-three respondents (30.7%).

While 'neutral' was the single most common answer, a combined majority of stakeholders view the growth of domestic airlines as a significant opportunity:

26.8% (55 respondents) rated the opportunity as a '4'.

25.9% (53 respondents) rated it as a '5' (very significant).

Overall, more than half of respondents (52.7%) rated the opportunity as 4 or 5, indicating a strong positive perception of this market driver. Lower ratings were less common: 13.2% selected '2' and 3.4% selected '1'.

11. Which are the five most crucial viable business opportunities in Nigeria's MRO landscape?

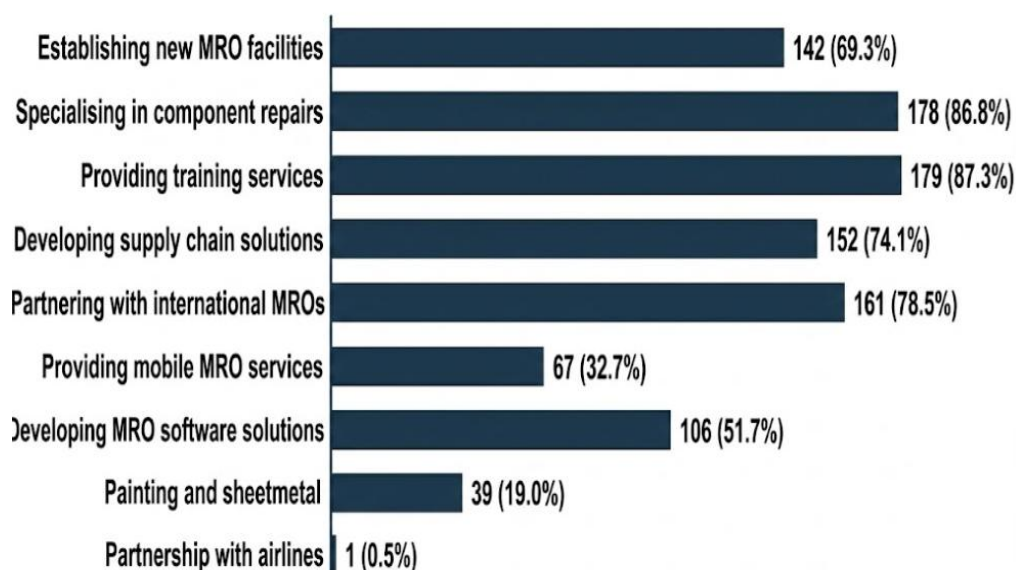


Chart 11: Which are the five most crucial viable business opportunities in Nigeria's MRO landscape?

The increase in domestic airlines is seen as a "very significant business opportunity" (32.7% selecting '5', which is also the mode among sixty-seven respondents, on a 1-5 scale with a mean of 3.785 and a median of 4.000), reinforcing the potential for local market growth. Additionally, 28.8% rated this opportunity as '3' (neutral), 26.8% as '4', and only a small percentage (2%) viewed it as an insignificant opportunity. This suggests that the growth of domestic airlines provides a strong driver of local MRO development. Markets should strategically focus on serving this expanding local sector through customised service offerings and competitive pricing. Market research to forecast fleet growth and specific MRO needs would support strategic planning.

Opportunity	Count	Percentage
Providing training services	179	87.3%
Specialising in component repair and overhaul	178	86.8%
Partnering with international MRO providers	161	78.5%
Developing supply chain solutions	152	74.1%

Establishing new MRO facilities	142	69.3%
Developing MRO software solutions	106	51.7%
Providing mobile MRO services	67	32.7%
Painting and Sheetmetal	39	19.0%
Partnership with airlines	1	0.5%

Table 5: Which are the five most crucial viable business opportunities in Nigeria's MRO landscape?

12. What financial instruments are suitable for funding Nigeria's maintenance, repair, and overhaul (MRO) and aviation infrastructure?

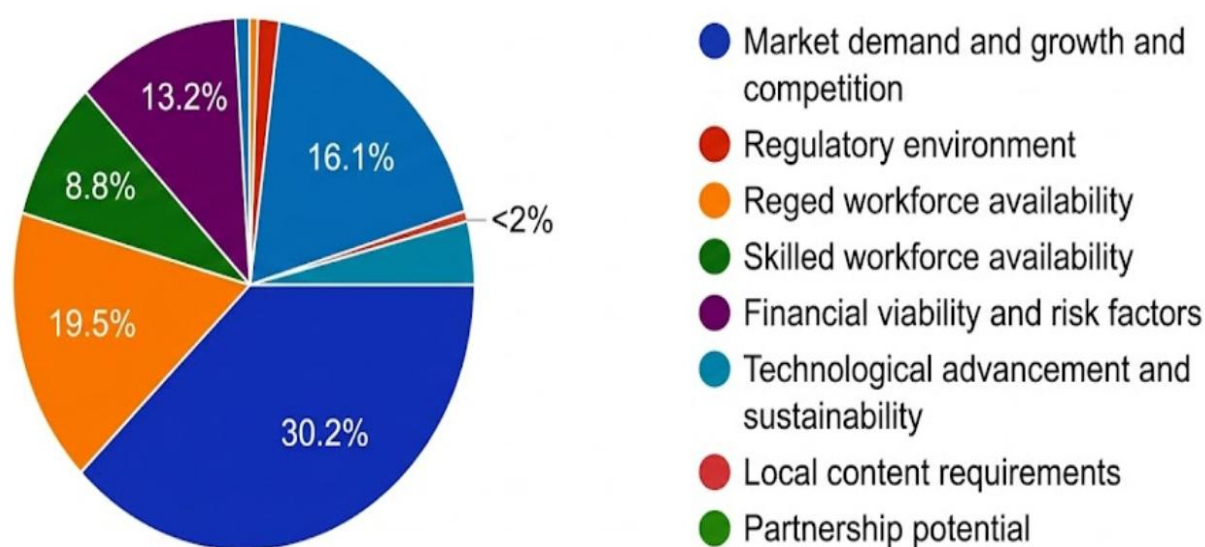


Chart 12. What financial instruments are suitable for funding Nigeria's maintenance, repair, and overhaul (MRO) and aviation infrastructure?

Public-private partnerships (PPPs) (47.3%), the most frequently preferred option (97 respondents), emerge as the most suitable financial instrument, indicating a preference for collaborative funding

models. "Government grants" (24.4%) are also favoured, followed by private equity (13.2%), commercial bank loans, and sovereign wealth fund investments (each 5.85%), as well as diaspora bonds and venture capital (2.93%). This suggests that MRO projects should explore PPP models, utilising both government support and private-sector efficiency. Additionally, advocacy for increased government grants and simplified access to private equity is essential. Conversely, conducting a comprehensive study of successful PPP models and examining the factors that make MRO projects attractive to private equity and sovereign wealth funds would be beneficial.

What are the key factors investors should consider in Nigeria's maintenance, repair, and overhaul (MRO) business sector?

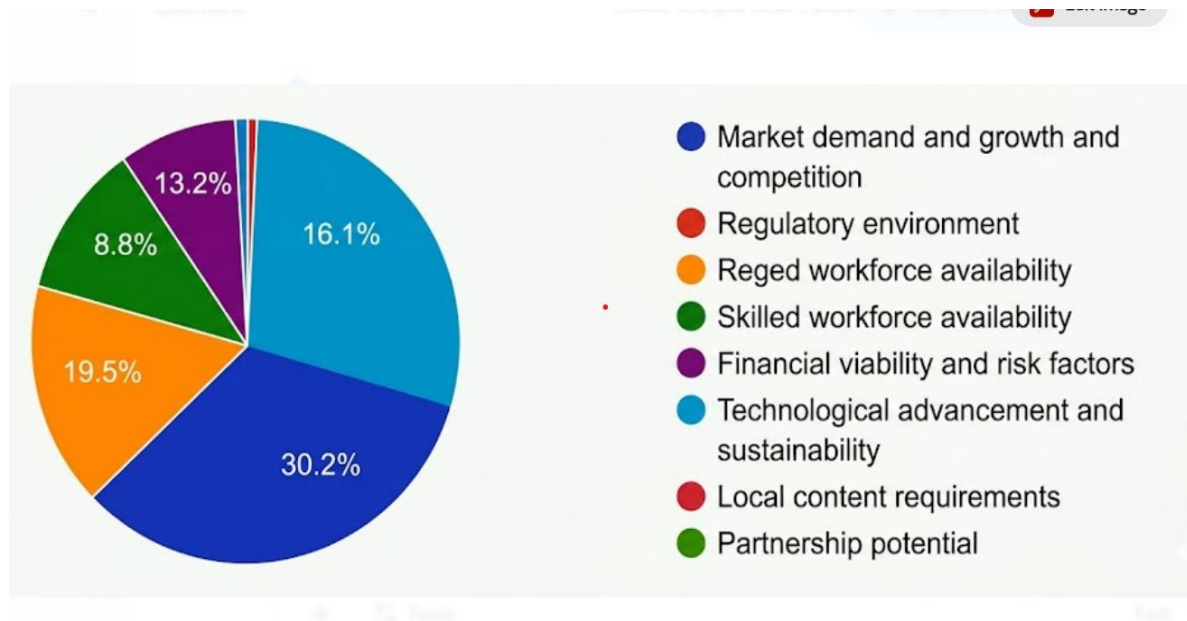


Chart 13: What are the key factors investors should consider in Nigeria's maintenance, repair, and overhaul (MRO) business sector?

Research Question 13: "Market demand and growth and competition" (30.2%), which is also the most frequent response (62 respondents), is the most critical factor for investors. It highlights a focus on market viability, with other key factors including: the availability of a skilled workforce (19.5%), technological advancement and sustainability (16.1%), financial viability, and risk factors (13.2%);

infrastructure and facilities (8.8%); and the regulatory environment (6.83%). This suggests that to attract investors, MRO businesses should clearly communicate market demand and demonstrate strategies for maintaining a competitive edge. Investing in workforce development and sustainable technologies can also enhance investor appeal. Additionally, conducting detailed market analyses of specific MRO segments and researching risk mitigation strategies tailored to the Nigerian MRO context would be advantageous.

14. What is the most crucial step to ensure the sustainable growth of Nigeria's maintenance, repair, and overhaul (MRO) industry?

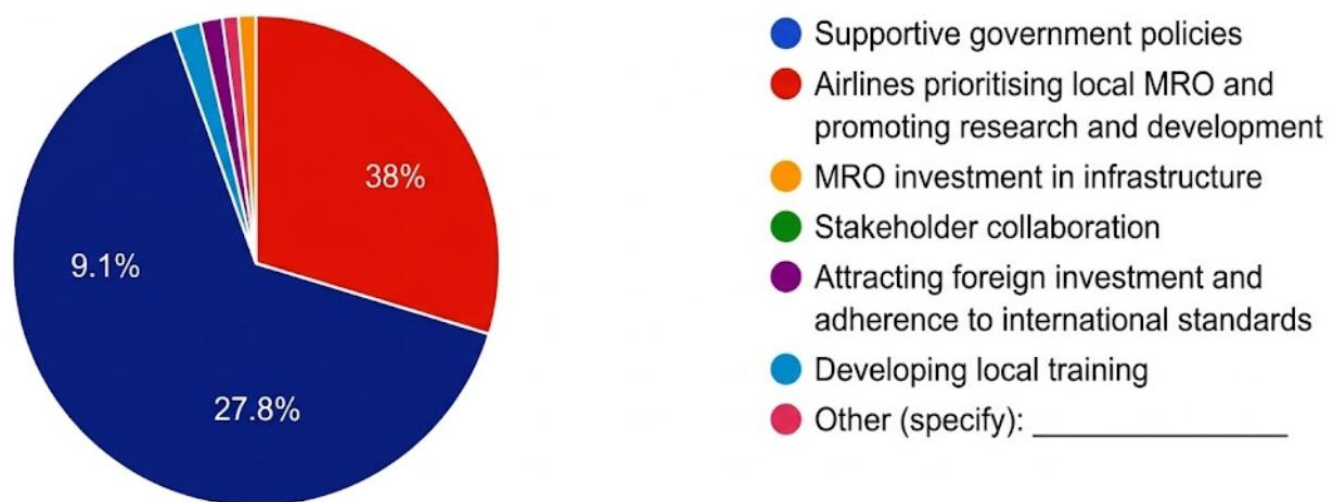


Chart 14: What is the most crucial step to ensure the sustainable growth of Nigeria's Maintenance, Repair, and Overhaul (MRO) industry?

Airlines prioritising local MRO and promoting research and development" (38%), which is also the mode (78 respondents), is seen as the single most crucial step, highlighting the role of domestic demand and innovation. Other vital steps include supportive government policies (27.8%), attracting foreign investment and adherence to international standards (17.1%), MRO investment in infrastructure

(7.3%), stakeholder collaboration (5.4%), and developing local training (3.9%), implying that airlines should be encouraged through incentives or mandates to use local MRO services where capabilities exist, and collaborative Research and Development efforts between airlines and MRO market are crucial. Studies on successful incentive programs and research on building trust and long-term partnerships would be relevant.

15. What government incentive would best foster maintenance, repair, and overhaul (MRO) business growth?

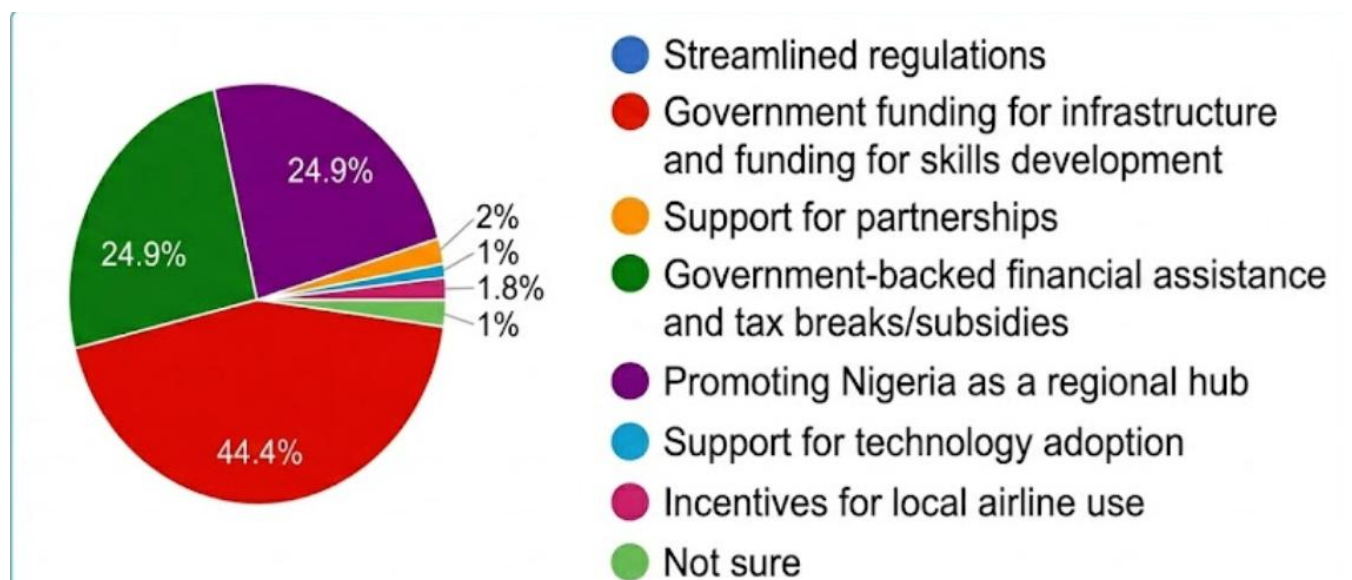


Chart 15: What government incentive would best foster maintenance, repair, and overhaul (MRO) business growth?

Questionnaire question 15: "Government funding for infrastructure and skills development" (44.4%), which is also the most common (91 respondents), is regarded as the most effective government incentive, highlighting the importance of investing in fundamental elements. Other recognised incentives include government-backed financial assistance and tax breaks/subsidies (24.9%),

promoting Nigeria as a regional hub (10.7%), support for partnerships (8.8%), support for technology adoption (4.9%), streamlined regulations (3.4%), and incentives for local airline use (2.4%). This suggests that advocacy groups should focus on securing government funding for MRO infrastructure and skills development programmes. Additionally, utilising government-backed financial assistance and tax breaks could increase investment. Conversely, conducting a cost-benefit analysis of various government incentive schemes and researching ways to promote Nigeria as a regional hub would be relevant.

Questionnaire question 16: What is the outlook for Nigeria's Maintenance, Repair, and Overhaul (MRO) sector in the next 10-15 years?

The outlook for Nigeria's Maintenance, Repair, and Overhaul (MRO) sector over the next 10 to 15 years is one of cautious optimism, with many stakeholders showing a neutral stance. To statistically confirm this outlook, we used Linear Regression and ANOVA (Analysis of Variance).

Statistical Significance

Linear regression examines the relationship between several factors and the overall outlook for the MRO sector. The results in Table 5 demonstrate a statistically significant relationship. Model M₁ indicates that the predictor variable accounts for 18.9% of the variance in the outcome ($R^2 = 0.189$), which is statistically significant ($p < .001$). Adding a variable to Model M₂ increases the explanatory power to 24.5% ($R^2 = 0.245$), with strong statistical significance ($p < .001$).

ANOVA was used to evaluate the significance of the regression models. As shown in Table 6, both models are statistically significant ($p < .001$). For Model M₁, the F-statistic of 47.433 indicates that the model is a key predictor of the MRO outlook. Similarly, for Model M₂, the F-statistic of 32.749 confirms its statistical significance.

The analysis shows that a "neutral" sentiment is the most common, accounting for 44.4% of respondents (91 individuals). This cautious stance is emphasised by being the median and mode of the responses, with a mean score of 3.483. A detailed breakdown of the outlook is:

1. Very Positive (5): 17.1%
2. Positive (4): 26.3%
3. Neutral (3): 44.4%
4. Negative (2): 11.2%
5. Very Negative (1): 1%

This distribution indicates that, although there is some optimism, significant strategic efforts are needed to build greater confidence in Nigeria's MRO sector's future. Consistent application of the proposed solutions is key to transforming the current neutral view into a clearly positive one.

Model	R	R ²	Adjusted R ²	RMSE	R ² Change	df1	df2	p
M ₀	0.000	0.000	0.000	0.937	0.000	0	204	
M ₁	0.435	0.189	0.185	0.846	0.189	1	203	< .001
M ₂	0.495	0.245	0.238	0.818	0.055	1	202	< .001

Table 6: Linear Regression

Model		Sum of Sq	df	Mean Sq	F	p
M ₁	Regression	33.923	1	33.923	47.433	< .001
	Residual	145.180	203	0.715		
	Total	179.102	204			
M ₂	Regression	43.854	2	21.927	32.749	< .001
	Residual	135.248	202	0.670		
	Total	179.102	204			

Table 7: ANOVA Outlook for Nigeria MRO

3.10 Data Interpretation

The interpretation phase involved synthesising findings from quantitative and qualitative analyses to provide a comprehensive understanding of the research problem. Guided by a pragmatic philosophical approach, the integration of collected data enabled a deeper exploration of the complexities, challenges, and opportunities within the Nigerian aviation MRO sector.

3.10.1 Interpretation for Research Question 1 (Inherent Complexities)

Interpreting inherent complexities relied on descriptive statistics applied to survey questions such as Question 1 ("What is your primary role in the aviation industry or an allied industry?"), Question 2 ("How many years of experience do you have in the Nigerian aviation sector?"), Question 3 ("What is the size of your organisation?"). These provided fundamental insights into respondent demographics, offering a contextual understanding of who experiences and reports these complexities. The descriptive analysis of Question 4 ("What is the main impact of Nigeria's lack of advanced Maintenance, Repair, and Overhaul (MRO) facilities?") informs the primary complexities, providing a quantitative understanding of the most pressing issues. Chi-square tests of independence between demographic variables and perceptions of impacts or regulatory hurdles, such as Question 5: "What is the main

regulatory hurdle for Maintenance, Repair, and Overhaul (MRO) market, operators and investors?")

Indicate whether complexities are perceived differently across various stakeholder groups. This differentiated understanding is crucial for developing targeted management strategies to navigate the sector's intricate landscape. Thematic analysis of relevant open-ended responses to Question 20 (where they addressed complexities) further enriched this interpretation by providing qualitative depth and context for the quantitative findings.

3.10.2 Interpretation for Research Question 2 (Key Challenges)

Descriptive statistics applied to questions such as Question 7 ("How significantly does foreign exchange (forex) fluctuation impact Maintenance, Repair, and Overhaul (MRO) costs and spare parts sourcing?") yielded interpretations of key challenges. Question 6 ("How would you characterise the collaboration between airline operators and the Maintenance, Repair, and Overhaul (MRO) market in Nigeria?") also provided valuable insights. These responses provided quantitative measures of the severity and nature of identified challenges, such as the extent of foreign exchange impact and the level of existing collaboration, which are essential for prioritising resource allocation in business planning. To explore the relationships between these challenges and other factors, Pearson's r correlation analysis was then utilised. For instance, a correlation between high foreign exchange (forex) impact and low collaboration could indicate interconnected challenges, highlighting the need for multi-faceted strategic interventions. Chi-Square Tests of Independence further contributed by identifying whether specific demographic groups perceived challenges differently, allowing for a more nuanced approach to addressing workforce and regulatory concerns. The thematic analysis of Question 20 played a crucial role here, extracting detailed qualitative accounts and proposed solutions related to operational inefficiencies and supply chain vulnerabilities (as reflected in Question 8: "What is the most crucial strategy that Maintenance, Repair, and Overhaul (MRO) market in Nigeria can employ to ensure the resilience of their supply chains for spare parts and components in the face of global

disruptions?"). Regulatory burdens also provide a rich context for quantifying these challenges and for informing actionable recommendations for operational improvements.

3.10.3 Interpretation for Research Question 3 (Potential Business Opportunities)

Interpreting potential business opportunities involves analysing findings from descriptive statistics, correlational analysis, and multiple linear regression. Descriptive analysis of questions like Question 9 ("To what extent does increasing domestic airlines present an opportunity for local Maintenance, Repair, and Overhaul (MRO)?"), Question 10 ("Which are the five most crucial viable business opportunities in Nigeria's MRO landscape?"), Question 11 ("What financial instrument is suitable for funding Nigeria's Maintenance, Repair, and Overhaul (MRO) and aviation infrastructure?"), Question 13 ("What government incentive would best foster Maintenance, Repair, and Overhaul (MRO) business growth?") outlined perceived opportunities, funding mechanisms, and government support preferences, providing a roadmap for strategic investment. Correlational Analysis helped elucidate relationships among perceived opportunities and facilitating factors, such as the correlation between government incentives and investor attractiveness. Multiple linear regression was employed to predict Question 14 ("What is the outlook for Nigeria's Maintenance, Repair, and Overhaul (MRO) sector in the next 10–15 years?"). This model utilised independent variables such as Question 6 ("How would you characterise the collaboration between airline operators and Maintenance, Repair, and Overhaul (MRO) market in Nigeria?"), Question 13 ("What government incentive would best foster Maintenance, Repair, and Overhaul (MRO) business growth?"), Adaptation strategies include "Investing in specialised training and encouraging research and development" (from Question 8: "How can the Nigerian Maintenance, Repair, and Overhaul (MRO) sector adapt to developing trends?").

The regression results highlight which factors most strongly predicted a positive outlook, emphasising key opportunities for strategic investment and policy intervention, while providing data-driven insights to inform decision-making aimed at fostering sector growth. Thematic analysis of Question 20

provided qualitative insights into the feasibility and nuances of these opportunities, including innovative ideas and stakeholder recommendations not captured by the closed-ended questions, thereby enriching strategic planning.

Triangulating data sources enhanced the validity and richness of the conclusions, enabling a more robust and actionable interpretation of Nigeria's MRO landscape's current state and prospects.

Although the employed mixed-methods approach provides a comprehensive view, some methodological limitations must be recognised.

The survey sample's significant representation (74.1%), consisting of 'Flight or maintenance personnel' as discussed in the 'Methodological Challenges' section of the dissertation, may have introduced bias by reflecting a frontline perspective.

Surveys in this study featured a substantial proportion of flight or maintenance personnel (74.1%), resulting in a pronounced "frontline" bias. This demographic emphasis led to a predominant focus on operational challenges and solutions, such as prioritising specialised training and encouraging research and development. However, this representation may have led to an underestimation of the strategic and financial hurdles the sector faces. Recognising this limitation, the analysis acknowledges that the findings primarily reflect the perspectives and priorities of frontline staff. To enhance the representativeness of future research, it will be important to include a broader cross-section of stakeholders, such as senior management, financiers, regulatory officials, and policy makers, to provide a more balanced understanding of the complex issues affecting Nigeria's MRO sector. Despite these acknowledged limitations, the selected methodology provided a robust framework for exploring Nigeria's complex aviation MRO sector and yielded valuable insights for stakeholders and future research.

Stakeholder Profile	Frequencies (Most Common Response)	Median	Std. Dev.	Percentage	Number of Responses (out of 205)
Primary Role in the Aviation Industry	Flight, maintenance, and ground support personnel	N/A	N/A	74%	152
Professional Experience in the Nigerian Aviation Sector	6-10 years	N/A	N/A	26.80%	55
Organisation Size (Number of Employees)	51-200	N/A	N/A	30.20%	62
Identified Operational Headwinds					
Main Impact of Insufficient Domestic MRO Facilities	Higher operational disruptions and longer aircraft downtime	N/A	N/A	35.60%	73
Main Regulatory Hurdle for MRO Development	Difficulties in obtaining approvals and high compliance costs	N/A	N/A	38.50%	79
Characterisation of Airline Operator and MRO Provider Collaboration	Neutral (3 out of 5)	3	0.923	50.70%	104
Impact of Forex Fluctuation on Costs and Sourcing	Significant (5 out of 5)	4	1.216	44.90%	92
Most Important Strategy for Supply Chain Resilience	Increasing local sourcing	N/A	N/A	34.10%	70
Identified Market Opportunities and Strategic Levers					
Perceived Opportunity from Increasing Domestic Airlines	Significant (5 out of 5)	4	1.068	32.70%	67
Most Viable Business Opportunity in the MRO Landscape	Providing training services	N/A	N/A	87.30%	179
Most Suitable Financial Instrument for MRO Infrastructure	Public-private partnerships (PPPs)	N/A	N/A	47.30%	97
Key Factor for Investor Consideration	Market demand, growth, and competition	N/A	N/A	30.20%	62
Most Crucial Step for Sustainable Growth	Airlines prioritising local MRO and promoting Research and Development	N/A	N/A	38%	78
Most Effective Government Incentive for MRO Growth	Government funding for infrastructure and skills development	N/A	N/A	44.40%	91
Outlook					
Outlook for Nigeria's MRO Sector in the Next 10-15 Years	Neutral (3 out of 5)	3	0.937	44.40%	91
Key Themes for Future Development (from qualitative analysis)	Human Capital, Government's Pivotal Role, Strategic Infrastructure, and the Need for Collaboration, Specialisation, and Quality.	N/A	N/A	N/A	38

Table 8: Contingency Table of Years of Experience vs Main Regulatory Hurdle (Observed Counts)

3.10.4 Complex Analysis

This analysis investigates the outlook of Nigeria's MRO sector over the next 10-15 years. We utilise linear regression models to identify key factors that predict this outlook and combine these quantitative findings with qualitative insights from aviation stakeholders to provide a comprehensive evaluation.

Model Fit and Significance (ANOVA F-statistic and p-values)

The linear regression analysis involved two models, M1 and M2, designed to forecast the outlook for Nigeria's MRO sector. The ANOVA table shows that both models are significant, indicating that the independent variables collectively reliably predict the outlook of the MRO sector.

Model M1: Showed an F-statistic of 47.433 with a p-value of less than 0.001 ($p < .001$). This strong statistical significance indicates that the relationship identified by the model is unlikely to be due to random chance.

Model M2: Also showed strong statistical significance, with an F-statistic of 32.749 and a p-value of less than 0.001 ($p < .001$).

The significant p-values for both models provide compelling evidence for the identified relationships, indicating that the selected independent variables account for a meaningful portion of the variance in the perceived MRO sector outlook. Model M2, with an Adjusted R^2 of 0.238, accounts for 23.7% of the variance in the MRO sector's outlook, marking a notable improvement over Model M1's Adjusted R^2 of 0.185. This suggests that the additional independent variable(s) in M2 help explain the factors that affect the future of the MRO sector.

The independent variables affecting this outlook include collaboration between airlines and the MRO market, the type of government support for business growth, and investment in specialised training, research, and development.

This dissertation provides a critically integrated analysis of Nigeria's aviation MRO sector, not

Not only identifying its inherent complexities and principal growth barriers, but also evaluating how these very challenges yield substantive business opportunities for sectoral transformation. Through a rigorous mixed-methods approach drawing on quantitative survey data from 205 aviation stakeholders, alongside qualitative insights and a broad literature base featuring global and African MRO case studies the work synthesises diverse sources of evidence. This synthesis not only highlights the multi-layered nature of the obstacles facing the sector but also interrogates their interplay to uncover actionable strategies for sustainable sectoral advancement. The study moves beyond mere documentation of issues, offering a nuanced, evidence-driven foundation for actionable policy and investment recommendations. To transform the current capital flight into a self-reliant, vibrant aviation ecosystem, a collaborative approach is crucial. This involves prioritising robust human capital, resilient infrastructure, the adoption of advanced technology, and the maintenance of consistent policy. Failure to address these foundational elements risks limiting the sector's potential, perpetuating reliance on foreign services, and hindering Nigeria's ambition to become a leading regional MRO hub in Africa. Strategic decisions and stakeholder cooperation will shape the future of Nigeria's MRO sector.

This presents a key statistical analysis by interpreting Chi-Square test results to assess whether there is a significant relationship between aviation professionals' years of experience and their perceptions of the main regulatory challenges in Nigeria's MRO sector.

3.10.5 Variables Under Examination

The research identifies key variables linking industry challenges to business opportunities in Nigeria's MRO sector, categorising them as predictors, outcomes, and categories within a comprehensive framework. It assesses infrastructure gaps and projects the sector's long-term economic outlook. The study uses standard methodologies, analysing sample characteristics to test hypotheses. Independent variables include strategic drivers such as global MRO trends, Nigerian

risks, government policies, stakeholder collaboration, specialised training, and the adoption of new technologies. The dependent variable is the sector's future economic outlook, with categorical variables measuring industry barriers. Findings show experience doesn't alter views on regulatory issues, with high compliance costs being structural. The study highlights economic and relational variables responding to sectoral issues. A multiple linear regression model predicts success based on these variables, with strategic drivers accounting for 24% of the variance in projected success, supporting targeted policies and investments. Predictive analysis grounds the proposed roadmap in empirical relationships between challenges and growth.

3.10.6 Chi-Square Test Results

The Chi-Square test results, taken from the "Chi-Square Tests" section of the provided data, are summarised below. These statistics are essential for assessing the statistical significance of the observed relationship between the two categorical variables.

Statistic	Value	df	Asymptotic Significance (2-sided)
Chi-Square	24.128	20	0.239
Likelihood Ratio	29.569	20	0.076
N of Valid Cases	194		

Table 9: Chi-Square Test Results

The Chi-Square test of independence for the relationship between "Years of Experience" and "Main Regulatory Hurdle" yielded a Pearson Chi-Square statistic of 24.128 with 20 degrees of freedom (df). The Asymptotic Significance (2-sided) or p-value is 0.239. Since the p-value of 0.239 exceeds the traditional alpha level of 0.05 ($p > 0.05$), the null hypothesis of independence cannot be rejected. This indicates no significant association between an individual's years of experience in the Nigerian aviation sector and their perception of the primary regulatory obstacle facing the MRO market, operators, and investors.

Although the Chi-Square test indicates no significant association, it is still valuable to examine the descriptive patterns in the contingency table. Across all experience levels, two regulatory challenges stand out as the most frequently mentioned: "Difficulties in obtaining approvals and high compliance costs" (38.5% overall) and "Lack of transparency and inconsistent enforcement" (33.2% overall). The counts for these two issues are markedly higher across all experience groups compared to other hurdles. This consistent pattern, although not statistically significant, suggests that these two regulatory problems are common and recognised difficulties throughout the Nigerian aviation sector.

Recent developments in the Nigerian aviation MRO sector, as of June 2025, indicate ongoing efforts to address key issues. The enactment of the Civil Aviation Act 2022 and the Nigerian Civil Aviation Regulations (NCARs) 2023, along with the domestication and implementation of the Cape Town Convention, aim to create a more compliant and investor-friendly regulatory environment by easing aircraft financing and streamlining aircraft registration and deregistration. Despite these positive regulatory and infrastructural changes, challenges such as skilled labour shortages, foreign exchange volatility affecting parts procurement, and the need for technological upgrades persist. The ongoing global aircraft supply crisis and ageing fleets underscore the urgent need for robust, efficient MRO capabilities in Nigeria, highlighting the recurring issues of "difficulties in obtaining approvals and high compliance costs" and "lack of transparency and inconsistent enforcement" as a critical focus for continuous improvement, regardless of professional experience levels.

3.10.7 Thematic Analysis

Question 20 requires a thematic analysis to gather additional comments or perspectives on the future of Nigeria's Maintenance, Repair, and Overhaul (MRO) sector. Your input is vital for gaining a clearer understanding of this developing industry and current business opportunities.

The Future Prospects of Nigeria's MRO Sector

A strong, multi-faceted understanding is provided by combining these qualitative insights with quantitative data from the earlier structured survey.

Theme 1: Bridging the Human Capital and Skills Gap: The Foundational Imperative

Respondents highlight a critical shortage of skilled workers and the urgent need to improve human capital development. Two comments illustrate this perceived bottleneck: "No organisation can thrive with the wrong set of skilled personnel," and "If more people are trained to be skilled workers, Nigeria's MRO sector will improve." This qualitative emphasis supports the quantitative findings from Question 8, where 46.3% of respondents identified "Investing in specialised training and encouraging research and development" as the most crucial strategy for the Nigerian MRO sector to adapt to changing trends. Additionally, among the factors considered most vital by investors (19.5% in Question 12) were the need for a skilled workforce, underlining its importance across stakeholder groups. The current workforce profile, with a mode of 26.8% having 6-10 years of experience, indicates an established but under-equipped talent pool that requires advanced training and mentorship to address industry-specific challenges.

Theme 2: Government's Pivotal Role: Policy Consistency and Enabling Environment

Respondents emphasised the crucial role of the Nigerian government in fostering an enabling environment through targeted policies, financial incentives, and simplified regulations. Frequent calls were made for "A deliberate government policy to support local MRO" and "Full Government Intervention Packages." Specific suggestions included exempting aviation equipment and spare parts from taxation, implementing tax waivers for most aviation-related spares, and establishing partnerships to develop MRO facilities. This aligns with data from Question 13, in which "Government funding for infrastructure and skills development" was identified as the top government incentive, selected by 44.4% of respondents. "Supportive government policies" also ranked second most important for sustainable growth in Question 14, with 27.8% reflecting prospects for Nigeria's MRO sector.

Theme 3: Strategic Infrastructure and Operational Efficiency: Reducing External Reliance

The need for robust domestic MRO infrastructure and enhanced operational efficiency to reduce reliance on foreign services was a recurring concern. Phrases like "Establishing an MRO will be a good idea to reduce the need to always travel for checks, as well as to reduce the need for foreign exchange during this period of scarcity" highlight the economic significance. Quantitative data from Question 4 supported this, with "Higher operational disruptions and longer aircraft downtime" identified by 35.6% of respondents as the main impact of Nigeria's lack of advanced MRO facilities. "Increasing local sourcing" was seen as the most vital strategy for supply chain resilience by 34.1% of respondents in Question 9, demonstrating a desire to develop indigenous capabilities. The qualitative data indicate that "MRO operators should take advantage of the liberalised Forex environment in Nigeria and move towards advancement", suggesting an opportunity for domestic facilities to alleviate foreign exchange pressures.

Theme 4: Collaboration, Specialisation, and Quality: A Path to Regional Leadership

Respondents emphasised the importance of collaboration, specialisation, and adherence to ambitious standards to bolster Nigeria's MRO sector. This is exemplified by the statement that "the growth of Nigeria's MRO must go through international partnerships, local development in training and infrastructure." Qualitative feedback raised concerns about local MROs "aiming for profit and contracts first but forgetting to develop long-term stability and promote quality and high standards," highlighting the need for a long-term vision. This aligns with the quantitative findings in Question 10, where "Specialising in component repair and overhaul" (86.8%) and "Partnering with international MRO market" (78.5%) were identified as the two most vital business opportunities. The ambition to become a "leading MRO hub in Africa" reflects a shared goal, with commitments to "uphold Nigeria's aviation industry up to the international standard" and to obtain "certification for component repairs in the country." The perceived "neutral" collaboration between airline operators and the MRO market, as

indicated by 50.7% of respondents in Question 6, highlights significant potential to improve these essential partnerships.

The reconciliation emphasises that, while the Nigerian MRO sector possesses significant, recognised opportunities driven by inherent market demand, its cautious current outlook suggests these opportunities are not self-fulfilling. Their realisation depends entirely on a sustained, coordinated, and multifaceted effort to address systemic challenges. These include regulatory consistency and financial stability (Orikpete, Gungura, Ehimare and Ewim, 2023).

The outlook for Nigeria's MRO sector depends on strategic investment in human capital and infrastructure, sustained government policy support, improved operational efficiency, and a collective effort to establish collaborative partnerships.

Chapter 4: Findings and Discussions

4.1 Preamble

Earlier chapters examined Nigeria's MRO sector, outlining its complexities, main challenges, and business opportunities. The aim is to provide a clear overview of this vital sector, which is crucial to Nigeria's economic growth and its ambition to become a major aviation hub in Africa. The closing chapter summarises key findings, using both quantitative and qualitative data to review Nigeria's MRO industry and its prospects. The study employed a rigorous mixed-methods approach, combining quantitative survey data from 205 aviation stakeholders with qualitative insights and an extensive literature review, including global and African MRO case studies.

Survey data empirically confirm these complexities, with "Higher operational disruptions and longer aircraft downtime" identified as the most significant impact by 35.6% of respondents. This indicates that a larger number of stakeholders view the immediate operational disruption and revenue loss from grounded aircraft as the most severe consequences, surpassing reliance on foreign currency (18.5%). The concept of "complexity" in this study encompasses interconnected factors, including regulatory

hurdles, infrastructure gaps, technological limitations, skill shortages, and financial constraints, all of which exacerbate one another.

The dissertation details a range of challenges that impede the efficient growth of Nigeria's MRO sector.

Regulatory Hurdles and Bureaucratic Processes: The main regulatory challenges identified include "Difficulties in obtaining approvals and high compliance costs" (38.5%) and "Lack of transparency and inconsistent enforcement" (33.2%). A chi-squared test was conducted to examine the relationship between an individual's years of experience in the Nigerian aviation sector and their perception of the primary regulatory issue. The test resulted in a p-value of 0.239. Since this p-value exceeds the typical alpha level of 0.05, there is no significant correlation between years of experience and perceptions of regulatory barriers.

Financial Constraints and Foreign Exchange Volatility: Foreign exchange (forex) fluctuations are considered "very significant" in their impact on MRO costs and sourcing spare parts by 44.9% of respondents. The persistent depreciation of the Nigerian Naira against major international currencies increases the local-currency equivalent of maintenance costs, thereby intensifying capital flight and financial pressures.

Human Capital Deficits and Skills Gaps: A significant shortage of skilled labour, including aircraft maintenance technicians and engineers, hampers industry growth. "46.3% of participants identified investing in specialised training and encouraging research and development as the most crucial adaptation strategy." Qualitative feedback reinforced this, emphasising that "No organisation can thrive with the wrong set of skilled personnel."

Nigeria's MRO facilities, currently underdeveloped, with outdated technologies and insufficient infrastructure, present an opportunity for strategic investment and modernisation, encouraging stakeholders to view infrastructural limitations as a chance for growth and innovation.

Supply Chain Vulnerabilities: Ongoing disruptions in the supply chain affect the availability of spare parts, leading to longer turnaround times. "Increasing local sourcing" is viewed as the most essential strategy for supply chain resilience by 34.1% of respondents.

Since spare parts cannot be stored in enormous quantities due to their high value, accurate forecasting is crucial for maintaining the profitability of the MRO service provider. Irregular patterns in spare parts demand, discussed in the next section, weaken the effectiveness of traditional time-series and statistical forecasting methods for MRO industry applications.

50.7% of respondents described collaboration between Nigerian airline operators and the MRO market as mainly "neutral" or moderate, indicating significant potential for developing stronger, more integrated relationships.

Business opportunities for MRO establishment and expansion persist despite challenges. The Nigerian aviation sector offers substantial and promising such opportunities.

Nigeria's MRO market is expected to grow from USD 815.2 million in 2023 to USD 1,750 million by 2031, reflecting a compound annual growth rate of 10.02%. This increase primarily stems from the expansion of domestic airlines, which 32.7% of survey respondents highlight as an essential driver.

Aviation infrastructure.

The most effective government incentive, recognised by 44.4% of respondents, is the improved compliance with the Cape Town Convention, which is projected to reach 75.5% in 2025. This policy acts as a strategic economic enabler, facilitating more affordable dry leasing, reducing aircraft acquisition costs, increasing demand for local MRO services, and boosting investor confidence, thereby presenting a compelling opportunity for industry growth.

Nigeria's strategic position and large aviation market create a significant opportunity to establish it as a regional MRO hub, especially since West and Central Africa currently lack major, functional MRO

facilities capable of heavy maintenance. This gap presents a strategic advantage for Nigeria in attracting regional and international clients, thereby fostering industry expansion.

4.2 Hypothesis Testing

This dissertation rigorously evaluates the hypothesis through a comprehensive methodological framework outlined in this study. A clear decision rule determined whether to accept the null hypothesis (H_0) or the alternative hypothesis (H_1). The rule below provides an objective basis for interpreting statistical results from the integration of quantitative survey data and qualitative insights, thereby guiding conclusions about business opportunities in Nigeria's MRO sector.

4.2.1 The Decision Rule: Choosing Between H_0 and H_1

The decision to support either the null hypothesis (H_0) or the alternative hypothesis (H_1) is based on a strict statistical rule that compares the calculated p-value with a predetermined significance level (α), usually set at 0.05. If the p-value is less than 0.05, the result is deemed statistically significant. In this case, the null hypothesis (H_0) is rejected, thereby supporting the alternative hypothesis (H_1). If the p-value exceeds 0.05, the result is not considered statistically significant. The null hypothesis (H_0) is not rejected, indicating there is sufficient evidence to support the alternative hypothesis (H_1).

The validity of the study's statistical tests depends on several essential methodological assumptions. For Multiple Linear Regression, key conditions include a linear relationship among variables, independent errors, constant error variance (homoscedasticity), normality of errors, and the absence of severe multicollinearity among predictors. For the Chi-Square Test of Independence, the necessary conditions are that both variables are categorical, observations are independent, and the expected frequency in most cells is at least five.

4.2.2 Hypothesis Statement

The core research premise submitted to empirical validation was:

Null Hypothesis (H0): The challenges in Nigeria's MRO sector do not constitute a business opportunity.

Alternative Hypothesis (H1): The challenges in Nigeria's MRO sector constitute a business opportunity.

4.2.3 Flowchart of the Hypothesis Testing Process

The flowchart below illustrates the empirical validation process of this study, which combines quantitative and qualitative methods, showing the systematic approach to data collection, analysis, and synthesis, culminating in testing the research hypothesis.

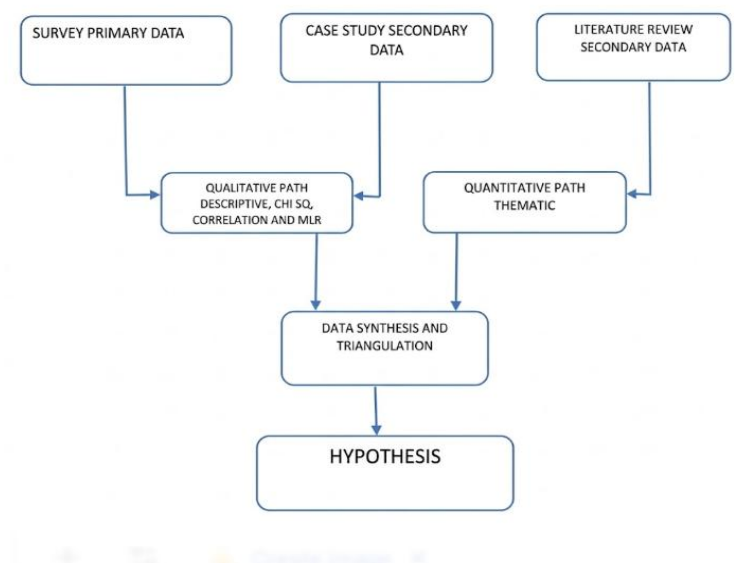


Figure 2: Flowchart of the Hypothesis Testing Process

Phase 1: Converting Operational Inefficiencies into a Quantifiable Market Opportunity

The descriptive analysis clearly shows that the most significant operational challenges for Nigerian airlines are the most profitable market gaps for MRO investors.

The analysis of 205 stakeholder responses showed that the main adverse impact of the MRO deficit is "Higher operational disruptions and longer aircraft downtime," cited by 35.6% of respondents; this operational issue results in significant financial losses, including capital flight for overseas maintenance checks, which cost more than \$1.5 million per aircraft. In response to this issue, stakeholders highlight the top business opportunities as "Providing training services" (87.3%), "Specialising in component repair and overhaul" (86.8%), and "Establishing new MRO facilities" (69.3%). Additionally, they identified partnering with international MRO providers as a key business opportunity (78.5%).

Interpretation of Findings: This statistical association provides compelling evidence. It confirms that an investment in local MRO infrastructure is not speculative but a direct response to an urgent market demand. The Challenges are not merely problems but quantifiable market requirements that remain unmet.

Model		Sum of Squares	df	Mean Sq	F	P
M2	Regression	43.854	2	21.927	32.749	<.001
	Residual	135.248	202	0.670		
	Total	179.102	204			

Table 10: Analysis of Variance: Mean Square Regression (MSR) to the Mean Square Error (MSE)

Table 10: Chi-Square test of independence was performed on "Years of Experience" vs. "Main Regulatory Hurdle" for 194 valid cases

Part 2: Quantifying the Levers for De-Risking Investment and Driving Growth

The multiple linear regression analysis identifies and quantifies the strategic factors that predict future success, providing a data-driven roadmap.

The final regression model (M2) used survey data to predict the MRO sector's outlook. The ANOVA table below outlines the key results from the dissertation's statistical analysis.

Multiple linear regression analysis examines the relationship between a single dependent variable and two or more independent variables. One-way ANOVA (analysis of variance) is a statistical test employed to compare the means of three or more groups to ascertain whether significant differences exist among them. It evaluates within-group and between-group variation to determine if the group means differ significantly. This method is applicable when there is a single independent variable with multiple levels and one dependent variable.

Table 10: Analysis of Variance: Mean Square Regression (MSR) to the Mean Square Error (MSE).

The F-statistic, which tests the model's overall significance, is computed as the ratio of the Mean Square Regression (MSR) to the Mean Square Error (MSE).

Formula:

$$F = \text{MSR}/\text{MSE}.$$

Calculation:

$F = 21.927/0.670$ approximately 32.749. Mean Square Regression (MSR) from the ANOVA table: $\text{MSR} = 21.927$.

Mean Square Error (MSE) from the ANOVA table: $\text{MSE} = 0.670$.

Divide MSR by MSE: $21.927/0.670$ approximately 32.7268.

Round to the reported F-statistic: 32.749.

Adjusted R^2 : This metric provides a more accurate measure of the model's explanatory power by accounting for the number of predictors.

Formula: The adjusted R-squared formula is: $1 - [(1 - R\text{-squared}) * (n - 1) / (n - K - 1)]$,

where R-squared is the original coefficient of determination, n is the number of data points, and k is the number of independent variables (regressors) in the model.

Inputs: $R^2=0.245$, n (sample size) = 205, p (number of predictors) = 2.

Calculation: Adjusted $R^2 = 1 - [(1 - 0.245) * (205 - 1) / (205 - 2 - 1)] \approx 0.238$.

R^2 from the regression output: $R^2 = 0.245$.

sample size (n): n = 205.

Number of predictors (p): p = 2.

Calculate (1-R²): $1 - 0.245 = 0.755$.

(n-1): $205 - 1 = 204$.

(n-p-1): $205 - 2 - 1 = 202$.

Substitute values into the formula: $1 - [1 / (0.755) (204) 202]$.

Multiplication in the numerator: $0.755 * 204 = 154.02$.

Division: $154.02 / 202 \approx 0.762475$.

Subtract from 1: $1 - 0.762475$, approximately 0.238.

Round to the reported Adjusted R^2 : 0.238.

Result: The calculated F-statistic of 32.749 yielded a p-value of $<.001$. This indicates that the model is highly significant. The final adjusted R^2 of 0.238 signifies that 23.7% of the sector's future success depends on three manageable levers: stakeholder collaboration, government policy, and human capital development. This finding transforms abstract challenges into measurable factors, enabling strategic action to foster a positive outlook.

Phase 3: Diagnosing Systemic Regulatory Risk.

The Chi-Square test assesses the nature of regulatory challenges, providing crucial insights for market-entry strategy.

Input Data: The calculation was based on the observed frequencies from the contingency table (Table 8) for 194 valid cases.

Chi-Square Test Results

Formula:

$\chi^2 = \sum (O_i - E_i)^2 / E_i$, where O_i = observed value (actual value) and E_i = expected value.

The chi-square test is a statistical test used to compare two or more data sets and assess data in which variables are distributed across categories.

Process: This formula applies to all cells in the contingency table (Table 8). The sum of these calculated values equals the final statistic of 24.128.

Since the calculated p-value (0.239) exceeds the conventional significance level of 0.05, we do not reject the null hypothesis. This indicates that, based on the survey data, years of experience do not significantly influence individuals' perceptions of the main regulatory hurdles in Nigeria's MRO sector. The identified regulatory issues, such as "Difficulties in obtaining approvals and high compliance costs" and "Lack of transparency and inconsistent enforcement," are shared across all experience levels.

This indicates that there is no statistically significant association between a professional's years of experience in the Nigerian aviation sector and their perception of the primary regulatory obstacle.

The most frequently cited barriers, "Difficulties in obtaining approvals and high compliance costs" (38.5%) and "Lack of transparency and inconsistent enforcement" (33.2%), require comprehensive, top-down reform.

4.2.3 Correlation Analysis: Illustrating Interdependencies of Challenges and Opportunities

Pearson's r correlation coefficient was used to assess the strength and direction of linear relationships between two continuous variables (or, when appropriately handled, ordinal variables)(Schober, Boer and Schwarte, 2018). This analysis addressed Research Question 2 (challenges) and Research Question 3 (opportunities) by examining the interconnections among several factors shaping the MRO sector's operational landscape and growth prospects.

$$\text{Formula: } r = [n * \Sigma (XY) - (\Sigma X * \Sigma Y)] / \sqrt{[(n * \Sigma X^2 - (\Sigma X)^2) * (n * \Sigma Y^2 - (\Sigma Y)^2)]}$$

Where:

n = number of pairs of scores.

ΣXY = the sum of the product of paired scores.

Sum x = sum of X scores.

Sum y = sum of Y scores.

ΣX^2 = sum of squared X scores.

ΣY^2 = sum of squared Y scores.

Illustration with Survey Data:

Impact of Forex Fluctuation vs. Opportunity from Domestic Airlines: the correlation between respondents' perceptions from Question 7 ("How significantly does foreign exchange (forex) fluctuation impact Maintenance, Repair, and Overhaul (MRO) costs and spare parts sourcing?") and their views on Question 9 ("To what extent does the increase in domestic airlines present a business opportunity for local Maintenance, Repair, and Overhaul (MRO)?") was examined. This analysis involved the respondents' perceptions.

Hypothetical Interpretation: Although the raw data and the calculated 'r' value for this specific pairing are not explicitly given in the text, a hypothetical strong negative correlation would imply that as foreign exchange impact increases (posing a challenge), the perceived business opportunity for

expanding domestic airlines might decrease, or vice versa. This indicates a complex relationship in which economic hurdles can dampen optimism even toward perceived opportunities. Conversely, a positive correlation would suggest that, despite foreign exchange challenges, the growth of domestic airlines consistently presents an opportunity, driven by the need to counter external financial pressures.

Government Incentives vs Investor Attractiveness: Another illustrative application involves the correlation between "What government incentive would best foster Maintenance, Repair, and Overhaul (MRO) business growth?" (Question 18) and "What are the key factors investors should consider in Nigeria's Maintenance, Repair, and Overhaul (MRO) business sector?" (Question 13).

A positive correlation here would indicate that stakeholders perceive government incentives as evidence that government action can attract investors to the sector. This analysis provided insights into co-varying factors relevant to the sector's dynamics. This facilitates the development of integrated strategies that account for these interdependencies, a core aspect of strategic business administration. The correlations help quantify the relationships between problems and proposed solutions or opportunities, thereby enriching the strategic narrative.

4.2.4 Triangulation of Key Strategic Findings

This research employs a concurrent triangulation approach that combines quantitative statistical data, qualitative thematic data, and secondary sources. It also systematically integrates findings to interpret the data and confirm the research conclusions. By integrating quantitative data from 205 stakeholders with qualitative insights from open-ended survey responses and case studies, the research cross-verified findings to mitigate mono-method bias. Subsequently, the outcomes were triangulated to emphasise the interrelations among inherent complexities, operational challenges, and business opportunities, culminating in a data-informed roadmap for investors.

Additionally, the data analysis presented directly pertains to the three principal research questions and assesses both the primary and subsidiary hypotheses. The statistical validation of the primary

hypothesis H1 and Research Questions 1 and 2, which pertain to the Challenge-Opportunity, scrutinises the inherent complexities and key challenges, including regulatory obstacles, infrastructure deficiencies, and financial limitations, which intensify these issues, as shown in the tabled summary below:

Research Component	Statistical Tool	Research Objective
Questions 1 and 2: Problems and Challenges	Descriptive Statistics and Chi-Square	Measuring the impact of poor infrastructure and regulations.
Question 3: Business Opportunities	Descriptive Statistics and Regression	Finding profitable areas and growth drivers.
Hypothesis 1: Challenge-Opportunity Nexus	Inferential Statistical Testing	Reinterpreting market friction as quantifiable investment gaps.
Hypothesis 2: Regulatory Perceptions	Chi-Square Test	Assessing the objectivity of systemic barriers across experience levels.
Hypothesis 3: Relational Interdependence	Pearson's Correlation	Examining the linear relationship between challenges and opportunities.
Hypothesis 4: Future Growth Prediction	Statistical Tool Used	Modelling strategic drivers to predict long-term sector success.

Table 11: Synthesising key strategic findings by triangulating quantitative evidence, qualitative evidence, and corroborating secondary data.

Hypothesis 1 (H1) also posits that these complexities constitute significant, quantifiable business opportunities rather than mere barriers to entry. The lack of advanced local MRO facilities has established a quantifiable operational void. Survey data identifies the following primary impacts:

1. 1. High Maintenance Costs (Overseas Checks): Cited by 49.3% of respondents, indicating a substantial burden on foreign exchange reserves.
2. 2. Operational Disruptions and Downtime: Reported by 35.6% of stakeholders as the most significant impact, directly leading to revenue loss due to grounded aircraft.

3. 3. Reduced Fleet Availability: Identified by 31.2% of participants.

Triangulating this with secondary data indicates that 79 out of 123 aircraft in Nigeria, approximately 64%, are presently grounded, thereby establishing a substantial captive market for local heavy maintenance service providers. These challenges underscore the immediate market demands.

Chi-Square Analysis: Diagnosing Systemic Regulatory Risk (H2) Hypothesis 2 assessed whether professional tenure influenced the perception of regulatory hurdles (H02/H12) or if these barriers were perceived as objective systemic features. It was also performed on "Years of Experience" vs "Main Regulatory Hurdle" for 194 valid cases.

Statistic	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	24.128	20	0.239

Table 12: Chi-Square test of independence was performed on "Years of Experience" vs. "Main Regulatory Hurdle" for 194 valid cases

The resulting p-value of 0.239 ($p > 0.05$) indicates no significant association between experience level and regulatory perception. Across all stakeholder groups, regardless of role or tenure, two challenges were consistently identified:

1. Difficulties in obtaining approvals and high compliance costs (38.5%).
2. Lack of transparency and inconsistent enforcement (33.2%).

This absence of statistically significant differences affirms that regulatory obstacles are objective and systemic characteristics inherent to the Nigerian market, rather than subjective interpretations. They embody tangible institutional voids that necessitate top-down policy measures to mitigate investment risks.

Research Question 3 and Hypothesis 3 employ relational validation to assess the viability of indigenous solutions. Pearson's correlation coefficient was utilised to quantify the relationship between economic pressures, such as foreign exchange (forex) volatility, and perceived opportunities. Quantitative data indicate that 44.9% of stakeholders regard forex fluctuation as "highly significant" in its impact on maintenance costs. Qualitative thematic insights corroborate this, with respondents observing that the "inability to perform C-checks locally is a drain on foreign exchange." This establishes a positive relational interdependence: as the cost of foreign maintenance increases due to Naira depreciation, the valuation and strategic importance of domestic sourcing (endorsed by 34.1% of respondents) significantly escalate.

Empirical findings identify two primary high-margin niches for immediate investment:

1. Training Services: Rated as a viable opportunity by 87.3% of participants.
2. Component Repair: Rated as a viable opportunity by 86.8% of participants.

These segments offer better margins than commoditised line maintenance and address the 27% global technician shortage predicted by 2027.

Predictive Modelling of Sectoral Outlook: Multiple Linear Regression (H4) Hypothesis 4 represents the study's predictive core, modelling how strategic factors shape the sector's 10- to 15-year outlook.

The multiple linear regression analysis (Model M²) yielded a highly significant result ($p < .001$) with an F-statistic of 32.749.

Metric	Value
Adjusted R ²	0.238
Significance	<.001

Table 13: Predictive Modelling of Sectoral Outlook

The adjusted R² value of 0.238 indicates that 23.8% of the variance in the sector's outlook is accounted for by three key determinants: government policy support, stakeholder collaboration, and investment in specialised training. These factors translate abstract sectoral concerns into quantifiable predictors, thereby affirming that future growth is contingent upon deliberate strategic alignment in these domains.

Integrated Table of Key Findings

The subsequent table consolidates quantitative data, qualitative narratives, and secondary sources to offer a comprehensive overview of the sector's strategic imperatives.

Strategic Dimension	Quantitative Evidence	Qualitative Insights	Corroborating Secondary Data
Infrastructure	49.3% cite high maintenance costs.	C-check inability to strain foreign exchange reserves.	Trends favour specialised heavy maintenance hubs.
Regulatory	41.5% identify duties/taxes as a hurdle.	Compliance/taxes discourage investment.	Success in the UAE/Ethiopia is linked to tax-free zones.
Market Potential	87.3% see growth in training services.	Massive market in component repair.	African demand is projected to grow at a 5.4% CAGR through 2030.

	44.9% favour strategic OEM partnerships.	OEM collaboration is non-negotiable.	OEM-led models are the industry standard.
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Table 14: Integrated Table of Key Findings

Triangulation of findings confirms that the Nigerian MRO sector is at a critical point, with systemic challenges evolving into quantifiable market drivers.

4.2.5 Analysis Conclusion

The comprehensive analysis, which triangulates quantitative and qualitative data, provides precise results for the hypothesis test. In conclusion, the rejection of the null hypotheses for H1, H3, and H4 provides empirical evidence that the sector's current weaknesses, specifically, high costs, foreign dependency, and infrastructure gaps, are the primary challenges whose resolution will drive its future economic strength. By addressing the identified strategic levers, Nigeria can halt capital flight, enhance fleet utilisation, and establish a resilient, self-sufficient aviation ecosystem for the West African sub-region.

Strategic Growth Imperatives:

1. For Government: Implement full tax waivers for aircraft spares and digitise the NCAA approval processes to standardise approval processes.
2. For Investors: Target specialised "workshops" for component repair (86.8% viability) and establish FAA/EASA-certified training canters to capture the regional workforce gap.
3. For Airlines: Transition from "neutral" collaboration to active maintenance pools to reduce the 35.6% impact of operational disruptions.

Chapter 5: Conclusion

5.1. Research Contribution and Implication

This dissertation contributes significantly to the understanding of the African aviation industry by providing one of the first comprehensive, data-driven analyses of Nigeria's MRO sector.

This research offers the following contributions:

Fills a knowledge gap: It moves beyond general statements about challenges and opportunities to provide specific, empirical evidence from a mixed-methods approach.

Integrated Analysis: It consistently links the sector's challenges directly to feasible business opportunities, framing problems as catalysts for growth. For instance, it links capital flight from overseas maintenance directly to the business opportunity to establish comprehensive domestic MRO facilities.

Stakeholder-Centric View: By capturing the perspectives of a broad range of industry stakeholders, this study provides a comprehensive, ground-level assessment of the sector's critical needs and viable solutions. The inclusion of such a diverse array of voices strengthens the validity of the policy recommendations, ensuring they are responsive to operational challenges and better positioned to inform targeted, evidence-based interventions by policymakers. **For policymakers:** The research clearly calls for action, emphasising the need for stable policies, simplified regulations (especially relating to approvals and customs), and direct government support for infrastructure and skills development through mechanisms such as Public-Private Partnerships (PPPs).

For Investors: The study highlights the most promising areas for investment, such as specialised component repair, training services, and partnerships with international MROs. It also emphasises that market demand and a skilled workforce are key considerations.

For Airlines and MROs: The findings highlight the urgent need for increased collaboration to develop a self-sufficient ecosystem. It encourages airlines to focus on local MROs and for MROs to invest in quality, specialisation, and international standards to secure domestic and regional market share. Overall, the dissertation serves as a strategic roadmap to transform Nigeria's MRO sector from a state of dependency and capital drain into a self-sufficient, competitive, and profitable industry that can serve as a hub for West and Central Africa.

This dissertation also offers a foundational analysis of Nigeria's MRO sector; however, due to the typical resource and time constraints of doctoral research, several areas require further exploration. Future research should extend this study's cross-sectional "snapshot" by conducting a multi-year longitudinal study to monitor the actual impact of policy and investment changes. There is a need for more immersive qualitative research, such as in-depth interviews and focus groups, targeting senior management, financiers, and policymakers whose perspectives were underrepresented in this study's survey-based approach. To gain a more detailed understanding of local operational realities, future research should also incorporate primary data case studies of Nigerian MRO facilities.

Finally, to bridge the gap between recognising opportunities and securing investment, research focused on creating detailed financial models and data-driven investment cases is essential to help turn this study's findings into bankable projects.

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5.3 List of Abbreviations

AD Airworthiness Directives

AI Artificial Intelligence

AIB Accident Investigation Bureau

AMO Approved Maintenance Organisation

AR Augmented Reality

ATA Air Transport Association of America

ATAG Air Transport Action Group

BASA Bilateral Air Service Agreements

BATS BGI Aviation Technical Services

CAGR Compound Annual Growth Rate

CAMO Continuing Airworthiness Management Organisation

CAMP Continuous Airworthiness Maintenance Program

CARs Civil Aviation Regulations

CASS Continuing Analysis and Surveillance System

CFM International

CHC Canadian Helicopters Corporation

CMM Component Maintenance Manual

CM Condition-Monitoring

CMR Certification Maintenance Requirements

COBU Central Operating Business Unit

DFDR Digital Flight Data Recorder

DSRAM Directorate of Safety Regulation and Monitoring

DWC Dubai World Central

DXB Dubai International Airport

EASA European Union Aviation Safety Agency

EEMC Engine Maintenance Centre

EPS Earnings Per Share

ETS Engine Technical Services

ETCAA Ethiopian Civil Aviation Authority

FAA Federal Aviation Administration

FAAN Federal Airports Authority of Nigeria

FARs Federal Aviation Regulations

FCAA Federal Civil Aviation Authority

FEC Federal Executive Council

FDI Foreign Direct Investment

FX Foreign Exchange

GDP Gross Domestic Product

GE General Electric

GENx General Electric Next Generation

GII Grand View Research (inferred from tables)

GSE Ground Support Equipment

HT Hard Time

IATA International Air Transport Association

IASA International Aviation Safety Assessment

ICAO International Civil Aviation Organisation

IFE In-Flight Entertainment

IMF International Monetary Fund

IOCC Integrated Operations Control Center

IoT Internet of Things

LCCs Low-Cost Carriers

LHT Lufthansa Technik

LLPs Life Limited Parts

LRUs Line Replaceable Units

MEA Middle East and Africa

MEL Minimum Equipment Lists

ML Machine Learning

MMIA Murtala Muhammed International Airport

MoU Memorandum of Understanding

MRO Maintenance, Repair, and Overhaul

MRB Maintenance Review Board

MSG Maintenance Steering Group

NAMA Nigerian Airspace Management Agency

NAPIMS National Petroleum Investment Management Services

NCAT Nigerian Aviation College of Technology

NCAR's Nigerian Civil Aviation Regulations

NCDMB Nigerian Content Development and Monitoring Board

NCAA Nigerian Civil Aviation Authority

NDT Non-Destructive Testing

NSIB Nigerian Safety Investigation Bureau

OC On-Condition

OEMs Original Equipment Manufacturers

OHM Overhaul Manual

PPP Public-Private Partnership

PPandL Propulsion Planning and Logistics

RAF Royal Air Force

SAR Search and Rescue

SAE Safran Aero Engines

SAF Sustainable Aviation Fuel

SBs Service Bulletins

SFP Skywise Fleet Performance

SIAEC SIA Engineering Company

SLAs Service Level Agreements

MRO Maintenance, Repair and Overhaul

SOPs Standard Operating Procedures

SSA Sub-Saharan Africa

TAP Total Assurance Program

VMR Verified Market Research

VR Virtual Reality

WAAC West Africa Airways Corporation

5.4 Appendices

5.4.1 Appendix A: Questionnaire

5.4.2 Appendix B: questionnaire response Excel sheet

5.4.3 Appendix C: Questionnaire Response Chart