



Assessing the Role of Human Error in Aviation Accidents and Incidents in Nigeria: A Theoretical Perspective

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Abstract

Human error remains the dominant contributor to aviation accidents worldwide, accounting for an estimated 70–80% of incidents and Nigeria is no exception. This conceptual paper examines the role of human error in Nigerian aviation accidents and incidents by drawing on three theoretical perspectives: Human Factors Theory, the Swiss Cheese Model and Human Error Theory. It argues that errors should not be understood merely as the product of individual incompetence but as the outcome of systemic interactions among human, organizational and technological dimensions. The paper first categorizes human error into skill-based lapses, decision errors, perceptual errors and violations, situating these within the Nigerian context of strained regulatory capacity, resource constraints and fragile safety culture. It then identifies four key areas where human error manifests: communication breakdowns between flight crews and air traffic control, skill-based errors exacerbated by inadequate training and supervision, maintenance-related lapses linked to cost-cutting and weak oversight and human factors such as fatigue, time pressure and organizational stress. Using conceptual triangulation, the study demonstrates how each theoretical lens illuminates distinct, yet interconnected aspects of human error. The paper concludes that addressing aviation safety in Nigeria requires systemic reforms in training, engineering oversight and regulatory enforcement, alongside stronger organizational safety cultures. As a conceptual analysis, the study provides a foundation for empirical research and policy action to strengthen aviation safety and reduce error-related accidents.

Keywords: Human Error, Aviation Accident, Human Factors Theory, Swiss cheese Model, Nigerian Aviation.

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Original Research Articles

INTRODUCTION

The aviation industry has experienced remarkable growth over the past decades, becoming one of the most complex and interconnected sectors in the global economy (Rizzi & Rizzi, 2022). This growth is underpinned by advances in aviation business models, aeronautic engineering innovations and the professionalization of pilot training and operations. Modern aircraft systems combine sophisticated engineering with high levels of automation (Kabashkin et al., 2023), while airline businesses increasingly prioritize efficiency, safety and competitiveness in a globalized market (Sun et al., 2024). At the same time, pilots and crew are required to operate within dynamic environments that demand precision,

situational awareness and adaptability.

Despite technological progress, human error remains the leading cause of aviation accidents and incidents worldwide, accounting for an estimated 70-80% of occurrences (Howell, 2025). Errors may arise from pilots' decision-making lapses, engineers' maintenance oversights or organizational shortcomings in business management and regulatory enforcement. Such errors often occur in environments where the human, technological and organizational systems interact in unpredictable ways, highlighting the persistent role of the human element in aviation safety.

In Nigeria, the challenge of human error is particularly



significant. The country's aviation sector faces persistent issues related to regulation, infrastructure deficits, pilot and crew training standards as well as safety culture (Uhuegho et al., 2025). While agencies such as the Nigerian Civil Aviation Authority (NCAA) and the Federal Airports Authority of Nigeria (FAAN) provide oversight, gaps remain in the enforcement of safety regulations, investment in training programs and modernization of facilities (Salawu & Osho, 2025). These challenges, combined with systemic pressures within airline business operations, create conditions in which human error can have devastating consequences.

While extensive scholarship has examined aviation safety and the causes of accidents, much of the literature has tended to emphasize global or Western experiences, focusing on pilot fatigue, cockpit automation, organizational culture and technological reliability (Olaganathan et al., 2021; Sieberichs et al., 2024; Xin et al., 2025). Studies often document how human factors account for a significant proportion of aviation incidents (Kharoufah, 2016; Lázaro et al., 2024) and international bodies such as the International Civil Aviation Organization (ICAO) have developed safety frameworks to mitigate these risks (ICAO, 2025). Existing research on Nigeria has primarily concentrated on regulatory shortcomings and infrastructural deficits or isolated accident investigations (Oji & Abili, 2024; Sylva & Amah, 2021; Taiwo et al., 2024), often without a unifying theoretical lens. What remains underexplored is a holistic, theory-driven conceptualization of how human error manifests across the interrelated domains of aviation business practices, aeronautic engineering systems and pilot training in Nigeria.

The aim of this conceptual paper is therefore to assess the role of human error in aviation accidents and incidents in Nigeria through a theoretical perspective. Specifically, the study draws on human factors theory, Swiss cheese theory and human error theory to analyze the multifaceted factors that influence human performance in aviation. The paper seeks to answer the question: how do theoretical perspectives on human error and organizational safety explain the persistence of accidents in the aviation industry despite technological and regulatory advancements? This provides a deeper understanding of the causes of human error and to propose pathways for strengthening aviation safety in Nigerian. To achieve this aim, the following objectives are outlined: (1) to identify and categorize the most common types of human error contributing to aviation accidents and incidents in Nigeria; (2) to examine how pilot and crew training programs can be designed to reduce the occurrence of human error in Nigerian aviation; (3) to assess the role of regulatory oversight in minimizing human error-related aviation accidents and incidents in Nigeria; and (4) to examine how human factors principles can be systematically integrated into accident investigation and prevention strategies in Nigeria.

The novelty of this study lies in its effort to bridge that gap by systematically applying human factors theory, Swiss cheese

theory and human error theory to the Nigerian aviation experience. This integrated approach allows for a deeper examination of the structural, technical and human dimensions of error that extant literature has treated in fragments. The paper not only contributes to academic debates on aviation safety but also provides practical insights for regulators, airline operators and training institutions seeking to enhance safety culture within Nigeria's aviation industry.

CONCEPTUAL BACKGROUND OF HUMAN ERROR IN AVIATION

Understanding Human Error

Human error in aviation refers to unintended actions, flawed decisions or omissions by individuals that result in deviations from expected performance and compromise operational safety (Cheng, 2018). Decades of research have consistently highlighted that human error is the single largest contributor to aviation accidents and incidents (Lázaro et al., 2024). Unlike mechanical or technical failures that can often be traced to discrete faults in hardware or software, human error embodies the vulnerabilities of individuals operating within complex socio-technical systems. In such an environment, errors emerge not solely from individual failings but from the dynamic interplay between human performance, technological design and organizational conditions.

Rasmussen's (1982) taxonomy, widely applied in aviation, identifies four categories of error: skill-based errors, decision errors, perceptual errors, and violations (de Mattos et al., 2024). This framework identifies four broad categories of human error: skill-based errors, decision errors, perceptual errors and violations. Skill-based errors occur in routine tasks, such as a pilot forgetting to retract landing gear. The decision errors involve poor judgment despite adequate information, such as attempting to land in severe weather. Perceptual errors arise when sensory input is misinterpreted, leading to disorientation or loss of control; while violations differ by being intentional deviations from procedures, such as skipping pre-flight checks or ignoring weather advisories under pressure. These categories reveal that error often reflects organizational cultures and systemic influences as much as individual actions.

Aviation organization misconduct shapes how human error is addressed in aviation. A narrow focus on the individual risks fostering a "blame culture" that overlooks systemic origins, thereby placing the responsibility on frontline operators such as pilots or engineers (Mearns, 2020). In contrast, a systemic view rather highlights latent conditions such as poor training, weak oversight, flawed communication or designs that make errors more likely. Moving beyond punitive approaches requires building a "just culture" balancing accountability with teach (Snyder et al., 2025). Such culture accepts error as inevitable but mitigates consequences through resilience, safeguard and collaboration.

Key Areas of Human Error in Aviation Operations

Human error in aviation manifests in several domains that directly shape safety and reliability (Yilmaz, 2025). Understanding these areas is crucial for designing interventions that reduce accident risks. The four recurring domains illustrating how errors arise across different layers of aviation systems are communication breakdowns, skill-based errors, maintenance-related errors and human factors (Alharasees et al., 2023).

Communication breakdowns remain one of the most persistent threats in numerous accidents and incidents (Kaya, 2023). Effective exchanges between the cockpit crews and air traffic control are essential for situational awareness, yet miscommunication can occur through ambiguous phrasing, incomplete information or limited English proficiency. The reliance on advanced technologies introduces additional challenges when pilots misinterpret automated system prompts or controllers misjudge crew understanding (Kabashkin et al., 2023). These breakdowns can escalate quickly, leading to loss of situational awareness, delayed responses to hazards and in extreme cases, collisions or runway incursions.

Skill-based errors occur during routine tasks performed under conditions of fatigue, distraction, or insufficient supervision (Olaganathan, 2024). These lapses reflect the vulnerability of procedural memory under stress or high workload. Without effective oversight and reinforcement of standard operating procedures, small slips can go undetected until they cascade into serious incidents.

Maintenance-related errors are another critical concern. Aviation maintenance demands strict compliance with manuals and checklists, yet errors such as incorrect component installation or missed defects have repeatedly contributed to accidents (Nogueira et al., 2023). These failures often stem less from individual negligence than from systemic pressures like tight turnaround times, cost-cutting or inadequate training. Unlike operational errors, maintenance lapses are often latent, only emerging under stress in flight, making them especially dangerous.

Human factors including fatigue, stress, time pressure and insufficient qualifications, cut across all aspects of aviation (Lázaro et al, 2024). Fatigue slows reaction times and reduces vigilance, while organizational pressures to meet demanding schedules can push personnel to bypass safety protocols. Stress further impairs decision-making, and the presence of inadequately trained staff compounds risks by limiting the ability to recognize hazards or respond effectively.

These areas demonstrate that human error is not simply an individual failing, but the outcome of interactions between people, technology and organizational systems. Addressing them requires a dual approach, which is strengthening individual competences while reforming the cultural, procedural and systemic conditions that shape aviation performance.

Interconnections between Aviation Business, Engineering and Pilot Training

The safety of aviation operations is shaped not by individual actions alone but by the interconnectedness of organizational, technical and human dimensions. As such, aviation business practices, engineering design and maintenance and pilot training are deeply intertwined, collectively influencing how human error is expressed, managed or mitigated in the system (Kyrylenko et al., 2023). Safety therefore depends on how effectively business priorities, engineering integrity and pilot competence are aligned to prevent small lapses from escalating into major incidents.

Management decisions within aviation organizations decisively influence operational safety. Roth et al. (2021) insist that budget allocations, staffing policies and investment in training or safety technologies determine whether airlines build resilience or expose themselves to risks. Cost-cutting can reduce maintenance staff or shorten training cycles, creating conditions for procedural lapses, while strategic investments in fatigue management, oversight and safety systems strengthen defenses (Sprajcer et al., 2022). Thus, business imperatives set the upstream conditions under which errors are either amplified or contained.

Aircraft design, maintenance protocols and technological systems affect how reliably humans interact with machines. For example, a poorly designed cockpit interfaces may overload pilots or obscure critical warnings, while complex or unclear maintenance documentation increases the likelihood of procedural deviations (Habib & Turkoglu, 2020). The advent of automation has reduced certain categories of error but has also introduced challenges such as complacency and skill degradation (Alharasees et al., 2023). Effective engineering must therefore address not only mechanical reliability but also the cognitive and operational demands placed on humans.

Accordingly, pilot competence, situational awareness and crew coordination serve as frontline defenses against accidents. So, training that emphasizes both technical proficiency and non-technical skills (such as communication, teamwork and decision-making under stress) equips crews to manage unexpected challenges (Naji et al., 2021). Crew resource management has been also remained valuable in mitigating errors through collaborative decision-making (Mearns, 2020). Conversely, inadequate training leaves pilots ill-prepared for new technologies or complex operational environments (Nogueira et al., 2023). Therefore, pilot operations both reflect and amplify the combined effects of business and engineering decisions: by either mitigating risks through competence and coordination or exacerbate them when training gaps exist.

These domains show that human error is systemic, not isolated. Business imperatives shape resources allocation and engineering decisions while pilot training influences operational resilience. Alignment across these dimensions strengthens safety, while misalignment creates pathways for accidents.

Theoretical Foundations

Understanding aviation accidents requires grounding in robust theoretical models that explain the multifaceted nature of human error. This study draws on three established backgrounds to provide an integrated lens for analyzing the dynamics of aviation safety in Nigeria. The theories are human factors theory, the Swiss cheese model and human error theory. These theories have been widely applied in high-reliability industries to explain how individual, organizational and systemic failures converge to produce accidents. This paper advances a more holistic understanding of error pathways, offering perspectives that transcend single-cause explanations while highlighting the systemic interdependencies that shape aviation safety outcomes.

Human Factors Theory

The human factors theory mid-twentieth century as psychologists and engineers sought to explain why accidents occur in complex socio-technical systems (de Winter & Hancock, 2021). A key milestone of this theory is Elwyn Edwards' SHEL model (1972), which framed accident causation as mismatches between Software, Hardware, Environment, and Liveware (Perboli et al., 2021). Hawkins later refined it into the SHEL (L) model, emphasizing the operator at the center of these interactions (Iida et al., 2025). Early applications influenced cockpit design, workload management and crew resource management (CRM).

Debates focus on scope: while proponents value its practical ability to link psychology with engineering (Okine et al., 2025), critics argue it oversimplifies organizational and cultural influences (Poornikoo & Øvergård, 2024). Despite limitations, Human Factors Theory remains foundational, redirecting attention from individual blame to systemic interactions.

Swiss Cheese Theory (Reason's Model)

James Reason's Swiss cheese theory (1990) reframed accidents as organizational rather than individual failures (Wiegmann et al., 2022). It depicts multiple layers of defense, namely: technical, human and organizational, each with "holes" or weaknesses (Reason et al., 2006). When these align, hazards breach all defenses. According to Mortling (2025), this model gained traction in aviation for explaining accidents such as the Tenerife disaster (1977) and Concorde crash (2000). As a result, the framing also further informed the development of safety management systems (SMS) in aviation (Wong & Pawlicki, 2025).

Critics caution that the model suggests linearity in accidents, whereas real failures are nonlinear and emergent (Lazányi, 2025). Others argue that it highlights weaknesses but underrepresents system resilience. Even so, its value as a visual and conceptual tool makes it one of the most enduring models in aviation safety.

Human Error Theory

Human error theory builds on Rasmussen's SRK framework (1982, 1986), which distinguishes between skill-based, rule-based and knowledge-based behaviour. James Reason (1990) extended this taxonomy by including violations, deliberate deviations from procedures (He & Söffker, 2023). Reason's classification of slips, lapses, mistakes and violations became central to accident investigation, training and air traffic control analysis (Latorella & Prabhu, 2017).

The framework has drawn criticism for encouraging a blame-oriented mindset and for being more diagnostic than prescriptive (Ren et al., 2024). Yet, proponents emphasize its clarity and practical utility in providing investigators with a common language (Baartmans et al., 2022). It remains a cornerstone of aviation safety, informing CRM and integrating into resilience-based approaches that stress adaptation and systemic learning.

Applicability of Theories to Aviation Context

Collectively, human factors theory, Swiss cheese model and human error theory provide a layered framework for understanding aviation safety in both global and Nigerian contexts. Human factors theory highlights how mismatches between humans, machines and environments, such as poorly designed cockpits or fatigue-inducing schedules, which create error-prone conditions. The Swiss cheese model extends this to the organizational level, showing how weak regulatory oversight, resource shortages or inadequate safety cultures in Nigerian airlines allow latent hazards to align into accidents. Accordingly, human error theory adds diagnostic clarity by categorizing slips, lapses, mistakes and violations, guiding investigators and trainers in addressing both unintentional and deliberate deviations. Therefore, these theories move analysis beyond blaming pilots or engineers, emphasizing how errors emerge from systemic pressures, design flaws and organizational gaps. Their integration remains essential for shaping training, engineering oversight and regulatory reforms aimed at reducing accident recurrence in Nigeria's aviation sector.

METHODOLOGY

This study adopts a conceptual theory-driven design, synthesizing scholarly and industry knowledge with three frameworks, namely: human factors theory, the Swiss cheese model and human error theory, to examine human error in Nigerian aviation accidents. The design integrates established theories (Cash, 2018), offering a systemic understanding of aviation safety to inform resilient policies, training and regulation in Nigeria.

The paper demonstrates how interrelated frameworks can inform aviation safety strategies in complex contexts such as Nigeria. This approach deepens understanding of human error beyond individual, organizational or systemic explanations.

This study is guided by four research questions: What categories of human error most frequently contribute to aviation accidents and incidents in Nigeria? In what ways can pilot and crew training programs be structured to minimize human error? How does regulatory oversight influence the prevention of human error-related aviation accidents in Nigeria? How human factors principles be systematically can integrated into aviation accident investigation and safety strategies in Nigeria?

The paper employs conceptual triangulation, using multiple theories to interpret the same issues (Donkoh & Mensah, 2023). This approach seeks to reinterpret available knowledge and propose pathways for advancing safety practices. The analysis proceeds in three stages. First, a conceptual review of global literature and accident reports identifies error types, safety practices and regulatory challenges. Second, the three theories are applied as lenses to address the research questions across business, engineering and training. Third, findings are integrated into a comparative discussion highlighting implications for Nigerian aviation.

Focused debate and evidence

Excellent framing. Based on your methodology and the way you've structured the conceptual framework, the **Discussion** section can be organized around **five key areas of debate** on human error, each grounded in empirical studies (e.g., Nigerian cases, ICAO/FAA reports, HFACS-based studies). These areas let you bring in data and existing findings while analyzing them through the three theories. Here's how they can be structured:

DISCUSSION

Communication Breakdowns in Aviation Operations

Communication between flight crews and air traffic control (ATC) remains a persistent contributor (Taiwo et al., 2024). Yet, scholarly debates centre on whether errors stem from individual misinterpretation or systemic shortcomings such as outdated technology and weak phrase enforcement. On one hand, some studies emphasize that communication breakdowns often arise from pilot or air traffic controller misinterpretation, particularly in contexts where English language proficiency is uneven or phraseology use is inconsistent (Ghanbari et al., 2019; Zeng et al., 2021). This perspective positions errors as largely rooted in the cognitive and linguistic limitations of individuals.

Conversely, a growing body of work highlights structural and systemic determinants, such as outdated communication technology, inadequate ATC training and organizational failures in enforcing standardized phraseology, as more significant drivers of miscommunication (Sylva & Amah, 2021). Empirical evidence reinforces both dimensions of this debate. International Civil Aviation Organization reports

(2019-2023) and Nigerian Civil Aviation Authority investigations both identify pilot-ATC miscommunication, often linked to language barriers and inconsistent phraseology, as a recurrent factor in accidents, highlighting gaps in training and regulatory oversight. In addition, HFACS-based analyses have documented how communication errors often intersect with broader organizational and environmental issues, thereby extending responsibility beyond individual operators (Taiwo et al., 2024).

Theoretically, this aligns with competing lenses. From the perspective of human factors theory, communication errors emerge from poor human-machine-environment alignment, emphasizing the need for training and improved interface design. In contrast, the Swiss cheese model interprets these breakdowns as latent organizational failures, where systemic weaknesses, such as insufficient ATC oversight or failure to update technology create conditions in which individual errors manifest. The tension between these frameworks underscores the need to integrate both operator-centered and system-centered approaches to fully address communication-related risks in aviation safety.

Skill-Based Errors and Supervision

In Nigerian aviation, a recurring safety debate concerns whether frequent skill-based errors should be viewed as failures of individual competence (Habib & Türkoğlu, 2020). Issues that have attracted scholarly research include those occasioned by poor manual flying technique, inattentiveness or checklist omissions or as the result of broader supervisory and organizational weaknesses (Elele & Elele, 2023). Skill-based errors are often highlighted in accident and incident reports where crews either misapplied standard operating procedures or failed to monitor automated systems effectively. At the same time, safety investigations frequently reveal that these errors were not isolated acts of incompetence but rather unfolded in contexts of inadequate training, weak supervisory oversight and fatigue-inducing work schedules.

A prominent area where skill-based lapses have been noted in Nigeria is during landing and take-off phases (Okafor et al., 2018). While these appear at face value to be individual errors, subsequent inquiries often point to insufficient simulator exposure to unpredictable events, limited recurrent training and over-reliance on rote checklists. In this sense, what looks like a pilot's slip often reflects a training system that produces rigid responses unable to cope with novelty or stress (Ejalonibu et al., 2025).

Fatigue and workload pressures are also issues that feature prominently in the Nigerian contexts. According to Taiwo et al. (2024), long duty rosters, insufficient crew rotation and compressed rest periods are peculiar to domestic routes with tight turnaround times. This creates conditions where lapses become more likely. Similarly, crews under such pressure have been reported to miss checklist items, mishear ATC clearances or make incorrect control selections (Habib & Türkoğlu, 2020).

These are classified as skill-based errors, but their roots lie in organizational scheduling practices and the absence of robust fatigue risk management frameworks.

In several Nigerian accidents, supervision and oversight also shape the prevalence of skill-based errors. Research highlight that airline proficiency checks were narrowly scripted, focusing on routine scenarios rather than adaptive decision-making (Uhuegho et al., 2025). Weak cockpit resource management and limited monitoring by training captains allowed slips to go unchecked until they escalated into incidents. Similarly, in maintenance-related events, supervisory lapses such as rushed inspections and poor procedural adherence foster routine errors such as missed defects and incorrect installations that ultimately undermine flight safety.

The accidents and incidents recorded in Nigeria suggest that skill-based errors rarely represent simple failings of individual competence. More often, they reflect brittle training systems, poor supervision and organizational choices that expose personnel to fatigue and high workload. Theoretical speaking, the human error theory helps classify these slips and lapses, while human factors theory explains highlights why they occur with emphasis on mismatches between humans, training systems and operational environments. This implies that strengthening safety requires both improving individual training regimes and addressing systemic issues of supervision, rostering and maintenance oversight.

Maintenance-Related Errors and Engineering Oversight

Maintenance-related lapses in the Nigeria aviation raises a critical debate about whether the responsibility lies primarily with frontline technicians or with broader systemic failures (Haruna & Taiwo, 2024). Improper component installation, falsified inspection logs or deviations from established maintenance manuals can be framed as individual technician negligence or procedural non-compliance. Accordingly, the lapses reflect skill deficiencies, shortcuts or deliberate violations that undermine technical reliability (Habib & Türkoğlu, 2020). However, framing the problem narrowly around technician behaviour risks obscuring the broader organizational and regulatory environments in which maintenance is conducted.

In Nigeria, where resource shortages and managerial pressure are recurrent, such oversimplification may ignore systemic roots of failure. Empirical evidence highlights that many African accident reports, including those from Nigeria, cite poor inspection practices, incorrect component fittings and incomplete records as key contributing factors (Taiwo et al., 2024). For example, the Nigerian Civil Aviation Authority (NCAA) and African regional investigations have pointed to maintenance irregularities in several fatal accidents. Such lapses often arise from cost-cutting, weak supervision and/or shortage of genuine spare parts, compelling maintenance crews to improvise. Comparative studies also reveal that while developed nations experience occasional maintenance-related

errors (Hayes et al., 2025), the recurrence and systemic patterns are more acute in African contexts where regulatory audits may be inconsistent (Tchouamo, 2023).

Theoretically, the Swiss cheese model provides a useful lens, showing that maintenance lapses are rarely isolated acts but rather “holes” in the layered defenses of aviation safety. A falsified logbook or incorrect installation is often the last breach in a chain of latent weaknesses, such as regulatory under-enforcement or poor resourcing. Likewise, human error theory distinguishes between slips (unintended mistakes) and violations (intentional deviations), which is critical in analyzing whether maintenance failures stem from fatigue, knowledge gaps, or deliberate circumvention of costly procedures. Ultimately, Nigerian cases demonstrate that both individual accountability and systemic safeguards must be jointly examined to address maintenance as a safety risk.

Human Factors: Fatigue, Stress and Organizational Pressure

The attribution of accidents to fatigue and stress raises a contentious debate: should they be understood as failures of individual resilience or as structural issues shaped by organizational practices? From one perspective, fatigued pilots or technicians may appear to be at fault for failing to manage their workloads, exercise judgment or seek rest when needed (Adjekum, 2022). Yet, such an individual-focused approach often neglects the role of airline scheduling practices, inadequate staffing and cost-cutting pressures that systematically induce fatigue and stress. In Nigeria, the pressure on crews to operate long duty hours, sometimes with inadequate rest facilities, reveals a structural imbalance between commercial priorities and safety imperatives (Ubogu et al., 2018).

Empirical studies of aviation accidents across Africa and have identified fatigue and time pressure as significant contributors (Thabethe, 2023). This same issue applies to Nigeria, where findings suggest that accident rates involving fatigue exceed global averages, reflecting systemic pressures unique to the region (Uhuegho, 2025). Pilots and ground staff often report facing excessive workloads due to resource shortages, delays in salary payments or understaffing. Comparatively, while fatigue is a recognized factor worldwide, robust rostering systems and stricter enforcement of crew duty-time limitations in developed countries mitigate its impact more effectively.

Theoretically, the human factors theory explains these dynamics through workload mismatch, where demands exceed the physical or cognitive resources of operators. Such mismatches directly compromise judgment, decision-making and technical performance. Combining this with the Swiss cheese model, fatigue can be conceptualized as a latent failure embedded in weak rostering systems, insufficient regulatory monitoring and organizational underinvestment in safety. The Nigerian context illustrates how repeated reliance on extended work hours without adequate rest increases the probability of errors, positioning fatigue not as an individual weakness but as

an organizationally engineered hazard.

Systemic Safety Culture and Regulatory Oversight

Recurring aviation accidents in Nigeria invite critical reflection on whether the problem lies more with weak regulatory enforcement or with airline-specific cultures of non-compliance. The Nigerian Civil Aviation Authority (NCAA) appears to exert weak regional oversight mechanisms, which often lack the resources, autonomy or political backing to rigorously enforce compliance (Salawu & Osho, 2025). This results into weak audits, inconsistent sanctions and underfunded safety programs create an environment where lapses go undetected or unpunished. On the other hand, some scholars suggest that the persistence of accidents reflects internal airline cultures where profit maximization trumps safety and informal norms normalize violations of operational standards (Nwaeze, 2024).

Empirical evidence supports both claims. ICAO audits and independent reports have repeatedly flagged gaps in African and Nigerian oversight mechanisms, particularly in areas such as surveillance of smaller operators and enforcement of international safety standards (Oji & Abili, 2024; Sylva & Amah, 2021). At the same time, accident investigations reveal organizational patterns of cost-cutting, inadequate training and habitual non-compliance that point to airline-level deficiencies (Nwaeze, 2024). Comparative global analyses underscore this divide: while regulatory oversight in developed nations enforces high compliance, Nigerian and broader African data suggest a more fragile balance between economic survival of airlines and adherence to safety culture (International Air Transport Association, 2021; International Civil Aviation Organization, 2025).

The Swiss cheese model again underscores how multiple layers of defense such as regulators, management and frontline operators, may simultaneously fail, thereby allowing threats to materialize into accidents. On the other hand, the human error theory sheds light on routine violations within airlines, often tolerated or even encouraged as “practical” adaptations to resource scarcity. While, human factors theory situates safety culture as a key determinant of liveware-software interactions. This emphasizes how organizational norms shape daily operational choices. Therefore, the risks in the Nigerian aviation are not reducible to isolated errors but are embedded within systemic cultures and oversight weaknesses.

CONCLUSION AND IMPLICATION

Human error continues to occupy a central place in aviation safety discourse, shaping both the occurrence of accidents and the effectiveness of mitigation strategies. This paper has shown that communication breakdowns, skill-based lapses, maintenance-related failures and organizational stressors cannot be reduced to individual mistakes alone but must be understood as outcomes of complex interactions across human, technical and systemic levels. The human error theory,

Swiss cheese model and human factors theory demonstrate how integrating multiple theoretical lenses enriches the analysis of aviation safety. This triangulated perspective highlights how individual slips and violations are embedded within organizational practices, regulatory gaps and business decisions. In Nigeria, where empirical evidence points to recurrent oversight lapses and resource constraints, this paper offers a more holistic framework for diagnosing and addressing safety risks.

The implications of this study extend beyond academic analysis to practical reform. Strengthening Nigerian aviation safety requires systemic interventions: training curricula must be restructured to emphasize adaptability and resilience; engineering and maintenance oversight must be reinforced through independent auditing and stricter adherence to international standards; and airlines must prioritize safety investments over short-term cost-cutting. Equally, the Nigerian Civil Aviation Authority (NCAA) should adopt transparent, data-driven oversight practices that close the “holes” in systemic defenses. At a broader level, this study underscores the need for a cultural shift within Nigerian aviation toward a safety-first business model, where regulatory enforcement, organizational accountability and individual competence are mutually reinforcing.

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