JOURNAL OF TECHNICAL EDUCATION AND TRAINING
ISSN: 2229-8932 e-ISSN: 2600-7932

JTET

Vol. 17 No. 4 (2025) 1-16
https://publisher.uthm.edu.my/ojs/index.php/jtet

Root Cause Analysis Framework for Regulatory Compliance in Philippine Aviation Training

Arthur C. Dela Peña[1]*, Jefferson C. Clariza[1], Eric B. Tiansay[1], Mark Anthony M. Ganal[1]

[1] *Aircraft Maintenance Technology,*
Philippine State College of Aeronautics, PHILIPPINES

Corresponding Author: artair248@gmail.com
DOI: https://doi.org/10.30880/jtet.2025.17.04.001

Article Info

Received: 14th March 2025
Accepted: 3rd December 2025
Available online: 30th December 2025

Keywords

Root cause analysis, civil aviation authority of the philippines, compliance framework, aviation training, ATO, TVET

Abstract

Approved Training Organizations (ATOs) in the Philippines operate under the Civil Aviation Authority of the Philippines (CAAP) through PCAR Part 3 and ICAO Annex 1. However, recurring non-conformities—especially in documentation, instructional delivery, and internal quality assurance—indicate systemic control gaps. This study proposes a systems-oriented Root Cause Analysis (RCA) framework to strengthen regulatory compliance in aviation training. Using a qualitative multiple-case design (three ATOs, 2021–2023), we analyzed CAAP surveillance reports, Corrective Action Requests (CARs), compliance checklists, and internal audit reports, complemented by key-informant interviews with quality officers, instructors, and managers. Reflexive thematic analysis (NVivo-supported) and clause-level mapping to PCAR Part 3 were integrated with RCA tools (5 Whys, cause-and-effect/Fishbone) to trace observable findings to organizational causes across people, process, tools/technology, and policy. Findings show persistent weaknesses in record-keeping and control (documentation), incomplete implementation of approved syllabi (training delivery), management of instructor authorization/licensing (personnel), and scheduling and execution of internal audits (IQA). These patterns reflect process and governance deficiencies rather than isolated instances of non-compliance. The primary contribution is a six-stage Audit–RCA–CAPA cycle that embeds proactive compliance within IQA: observation → categorization → RCA → CAPA escalation → targeted training/controls → internal validation, with feedback loops for continuous improvement. Policy recommendations focus on clearer audit communications and more developmental CAP evaluations by CAAP. Framing RCA as both an investigative and governance mechanism, the model is transferable to similarly regulated training systems.

1. Introduction

Approved Training Organizations (ATOs) play a critical role in aviation education, tasked with developing licensed aviation professionals who meet international competency standards. In the Philippines, these institutions operate under the regulatory authority of the Civil Aviation Authority of the Philippines (CAAP), which implements national aviation policy in alignment with the standards set by the International Civil Aviation

Organization (ICAO). Specifically, Part 3 of the Philippine Civil Aviation Regulations (PCAR) outlines the certification, operational, and oversight requirements for Approved Training Organizations (ATOs), including mandates for curriculum design, instructor qualifications, infrastructure adequacy, and the establishment of internal quality assurance (IQA) systems (CAAP, 2024). These provisions ensure that aviation training is consistent, effective, and aligned with global safety standards (ICAO, 2022).

Maintaining regulatory compliance is fundamental to aviation safety and institutional credibility. Effective compliance enables ATOs to deliver training that meets regulatory bodies' and industry stakeholders' expectations while minimizing the risk of operational errors. However, recurring audit findings during CAAP's annual surveillance inspections highlight persistent non-conformities in several Philippine ATOs. These include outdated or missing documentation, inconsistent implementation of training procedures, and weaknesses in internal quality assurance systems (Dela Cruz et al., 2021; Shanahan & Kelly, 2019). Despite the routine submission of Corrective Action Requests (CARs), many institutions exhibit similar deficiencies year after year, suggesting that existing interventions often fail to address the root causes of non-compliance. This phenomenon reflects what Harvey and Newton (2007) describe as an "audit culture," where institutions prioritize surface-level conformity over deep-seated quality improvement.

To address this persistent compliance gap, this study introduces Root Cause Analysis (RCA) as a systematic, evidence-based approach to identifying the underlying issues driving recurring audit findings. RCA tools—such as the 5 Whys technique and the Fishbone Diagram—allow institutions to trace surface problems to systemic failures in processes, personnel, policies, and resource allocation (Traeger, 2024; Compliance Quest, 2021). These tools are widely used in aviation safety management and maintenance operations to investigate incidents and inform long-term corrective strategies (FAA, 2012; Mahachandra, 2021). In the context of aviation training, RCA provides a strategic lens through which ATOs can enhance their internal compliance mechanisms and strengthen quality assurance practices. Moreover, integrating RCA within the broader framework of IQA—guided by the Plan-Do-Check-Act (PDCA) cycle and Total Quality Management (TQM) principles—enables institutions to move from reactive compliance to proactive quality development (Mulyasa et al., 2020; Jingura & Kamusoko, 2019).

This study-is guided by three primary objectives: (1) to identify the root causes of repeated audit findings in Philippine ATOs; (2) to develop a compliance enhancement framework using RCA principles tailored to the aviation training environment; and (3) to propose policy-level recommendations that support CAAP and training institutions in building more robust and sustainable quality systems. The significance of this study lies in both its academic and practical implications. Academically, it contributes to the growing literature on quality assurance and regulatory compliance in technical education, particularly within the aviation sector. It extends the application of RCA beyond operational safety into educational compliance and institutional quality. Practically, the study provides ATOs and regulators with a data-driven model to enhance internal systems, minimize recurring findings, and foster a culture of continuous improvement. In a sector where safety and precision are paramount, such contributions are timely and essential to sustaining trust in aviation training in the Philippines and beyond.

2. Theoretical Framework

This study integrates Total Quality Management (TQM), the Plan–Do–Check–Act (PDCA) cycle, Root Cause Analysis (RCA), and Regulatory Compliance Theory to explain how ATOs internalize and operationalize CAAP requirements. Together, these frameworks provide a systems-oriented lens for analyzing recurring non-conformities and for shaping a proactive compliance model. TQM and PDCA establish the study's quality foundation by emphasizing continuous improvement, structured problem-solving, and evidence-based decision-making—principles consistent with PCAR Part 3 and internal quality assurance expectations (Talavera, 2004; Mulyasa et al., 2020). RCA builds on this by offering a diagnostic method for tracing audit findings to deeper institutional causes across people, processes, tools, and policies. Tools such as the 5 Whys and the Fishbone Diagram help identify systemic deficiencies underlying compliance lapses (Groot, 2021; Vivek & Krupskyi, 2024).

Regulatory Compliance Theory adds a behavioral dimension, explaining how ATOs respond to deterrence pressures, rule-adherence norms, and governance capacity under CAAP oversight (Sutinen & Kuperan, 1999). Contemporary collaborative governance perspectives further highlight the value of shared accountability and developmental regulation in achieving sustainable compliance (Hendra et al., 2023). Combined in a single conceptual model (Figure 1), these frameworks show how TQM–PDCA shapes process discipline, RCA diagnoses underlying causes, and Compliance Theory explains institutional responses, thereby forming an integrated theoretical basis for strengthening ATO compliance performance.

3. Conceptual Framework

The conceptual framework integrates four interrelated models—Total Quality Management (TQM), the Plan–Do–Check–Act (PDCA) cycle, Root Cause Analysis (RCA), and internal quality assurance (IQA) systems—to explain how aviation training institutions achieve sustained regulatory compliance. As shown in Figure 1, TQM provides the overarching foundation for continuous improvement and accountability. At the same time, the PDCA cycle

operationalizes these principles through a structured sequence of planning, implementation, evaluation, and corrective action.

RCA is embedded within the "Check" and "Act" phases of the PDCA cycle to diagnose the systemic sources of audit findings across people, processes, tools, and policy domains. These diagnostic insights inform improvements in internal quality assurance mechanisms, strengthening institutional capacity to detect, prevent, and correct non-conformities.

To illustrate the operational flow of this integrated model, Figure 2 presents the sequential cycle linking TQM principles, PDCA processes, RCA tools, IQA functions, and improved audit and regulatory outcomes. Together, Figures 1 and 2 depict a circular, feedback-driven approach to institutional governance, emphasizing compliance not as a periodic requirement but as a continuous learning process embedded within the quality culture of Approved Training Organizations (ATOs).

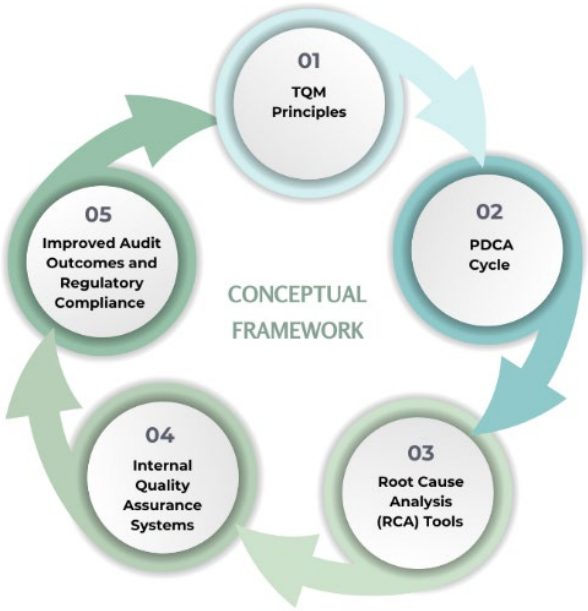

Fig. 1 *The circular compliance model integrates root cause analysis (RCA) with TQM, PDCA, and compliance theory to promote continuous improvement and regulatory alignment in ATOs*

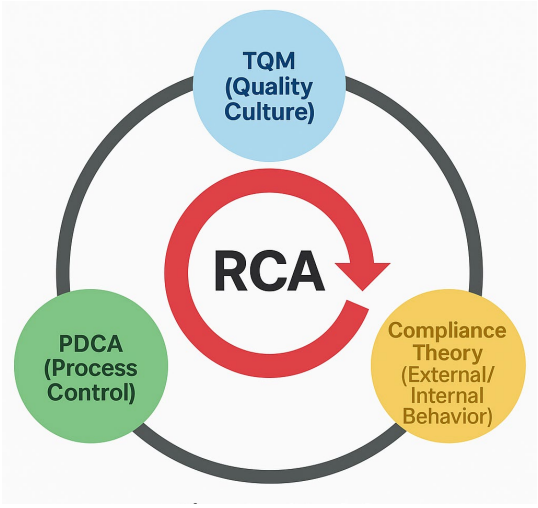

Fig. 2 *Conceptual framework integrating TQM, PDCA, and RCA for enhancing regulatory compliance in ATOs*

3.1 Theoretical Linkage

The integration of Total Quality Management (TQM), the PDCA cycle, Root Cause Analysis (RCA), and Compliance Theory provides a comprehensive analytical foundation for this study. Each framework contributes distinct yet complementary functions to understanding institutional compliance behavior in aviation training organizations. As summarized in Table 1, Total Quality Management (TQM) serves as the philosophical anchor for quality-focused institutional operations. At the same time, the Plan-Do-Check-Act (PDCA) cycle provides a practical mechanism for iterative improvement. RCA functions as a diagnostic tool within the PDCA structure, enabling the identification of systemic nonconformities. Ultimately, Compliance Theory provides a behavioral lens for interpreting institutional responses to regulatory oversight. Together, these frameworks guide the design, analysis, and interpretation of this study, ensuring both theoretical robustness and practical relevance.

Table 1 *Summary of theoretical frameworks and their roles in the study*

Framework / Model	Key Concepts	Role in Study	Application in ATO Context
Total Quality Management (TQM)	Continuous improvement, system focus, stakeholder-driven quality	Philosophical foundation for institutional quality	Underpins audit culture and IQA mindset
PDCA Cycle	Plan, Do, Check, Act	Process model for ongoing improvement	Guides internal audit cycles and CAPA planning
Root Cause Analysis (RCA)	5 Whys, Fishbone Diagram, systemic investigation	Diagnostic method for identifying deep issues	Used to trace non-compliance back to systemic causes
Compliance Theory	Behavioral compliance, deterrence, capacity-building	Interpretive lens for institutional response	Explains how ATOs respond to CAAP audit findings

4. Literature Review

4.1 Regulatory Oversight in Aviation Training

Regulatory oversight ensures that aviation training meets internationally recognized competency and safety standards. At the global level, ICAO codifies minimum requirements for personnel licensing through Annex 1, which national authorities adapt into domestic regulation (ICAO, 2022). In the Philippines, these standards are implemented by the Civil Aviation Authority of the Philippines (CAAP) through PCAR Part 3, which governs ATO certification, curriculum compliance, instructor qualification, facilities, and internal quality assurance (CAAP, 2024). Surveillance audits and Corrective Action Requests (CARs) issued under this framework frequently reveal persistent non-conformities, particularly in documentation practices, curriculum execution, and IQA implementation.

Empirical studies show that such issues are not unique to the Philippines. ATOs across the Asia-Pacific region commonly face challenges in documentation control, audit preparedness, and alignment with evolving ICAO requirements (Shanahan & Kelly, 2019). Local findings similarly indicate that recurring CARs often reflect gaps in internal quality systems rather than deliberate non-compliance (Dela Cruz et al., 2021). These patterns are consistent with broader analyses of "audit culture," wherein institutions prioritize audit responsiveness over substantive quality improvement (Harvey & Newton, 2007). Complementary evidence from maintenance and pilot-training environments highlights parallel concerns in personnel readiness, procedural application, and regulatory adaptation (Vyskoč & Rostáš, 2023; Adanov et al., 2020; Knez et al., 2022). Emerging technologies also introduce new oversight demands, including AI integration and software certification (Ronell, 2020; Emanuilov & Dheu, 2021).

Despite extensive literature on aviation regulation and audit performance, few studies examine the institutional mechanisms that generate recurring audit findings or how oversight frameworks can be systematically linked to root-cause investigation. This gap underscores the need for an approach that moves beyond describing compliance outcomes to diagnosing their systemic origins—a central aim of the present study.

4.2 Root Cause Analysis in Aviation Safety and Compliance

Root Cause Analysis (RCA) is a structured method for tracing safety events and non-compliance issues to their underlying causes using tools such as the 5 Whys and Fishbone Diagram, which categorize contributing factors across people, processes, tools, and environment (EasyRCA, n.d.). Initially applied in industrial quality control, RCA is now embedded in aviation Safety Management Systems (SMS), where it supports the investigation of incidents and near-misses and promotes systemic rather than symptomatic corrective actions (Compliance Quest, 2021). Evidence from MRO environments demonstrates its value: recurring delays, documentation gaps, and procedural inconsistencies have been effectively mapped to planning, data management, and resource-related root causes (IEOM Society, 2020; FAA, 2012).

RCA is also central to accident analysis, with causal modeling approaches such as Why–Because Analysis offering more precise mapping of complex event chains (Ladkin & Loer, 1998). Case-based studies show that structured RCA strengthens organizational learning and compliance culture, particularly among smaller operators and training entities (Adamanov & Mezhenko, 2024; Ardestani, 2024). However, the literature across high-risk industries notes persistent implementation weaknesses—such as a narrow focus on proximate causes or poorly designed corrective actions—which limit RCA's effectiveness unless supported by systems thinking and a strong safety culture (Peerally, 2021; Kwok et al., 2020; Chwat et al., 2023).

While RCA is well established in aviation safety and maintenance reliability, its application to the compliance and quality assurance challenges of Approved Training Organizations (ATOs) remains limited. Existing research seldom links recurring audit findings to institutional root causes. This gap highlights the need to adapt RCA as a proactive compliance tool that strengthens internal governance, supports effective CAPA development, and aligns ATO practices with regulatory expectations.

4.3 Internal Quality Assurance and Compliance Culture

Internal Quality Assurance (IQA) systems are essential in translating regulatory expectations into sustainable institutional practices. Drawing from Total Quality Management (TQM) and the Plan-Do-Check-Act (PDCA) model, effective IQA includes setting standards, performance monitoring, audits, self-evaluation, and continuous improvement (Mulyasa et al., 2020; Mulyono et al., 2021). In aviation training, IQA facilitates alignment of operational practices with CAAP and ICAO standards.

IQA practitioners require competencies in quality systems, analytics, and organizational communication (Jingura & Kamusoko, 2019). Quality audits serve not just as compliance checks but as diagnostic tools that identify areas for institutional development (Karapetrovic & Willborn, 2000). Corrective and Preventive Action (CAPA) systems, if properly implemented, can sustain long-term improvements and prevent regulatory findings from recurring (Tashi et al., 2016). Despite global trends toward audit-based compliance in education (Shah & Jarzabkowski, 2013), institutional culture and proactive quality improvement remain central to authentic educational excellence.

However, while existing literature highlights the importance of IQA frameworks and CAPA systems in education and technical training, few studies explicitly examine how these mechanisms can be systematically strengthened through Root Cause Analysis (RCA). The lack of integration between IQA practices and RCA-driven diagnostics represents a critical gap, as institutions often address audit findings reactively rather than embedding continuous, system-based improvements. This study addresses this gap by linking IQA culture with RCA tools to promote sustainable compliance in aviation training organizations.

5. Methods

5.1 Research Design

This study adopted a qualitative case study design to examine compliance challenges within aviation training institutions in their real-life organizational contexts. Case studies are well-suited for exploring multifaceted institutional phenomena where multiple variables interact within bounded systems (Mohd Noor, 2008; Baskarada, 2014). This approach enabled an in-depth analysis of how ATOs interpret regulatory expectations, respond to audits, and manage internal quality assurance processes.

The design also supported the integration of diverse evidence sources—documents, interviews, and RCA outputs—consistent with Wahyuni's (2012) view that qualitative methods provide the flexibility needed to explore complex causal mechanisms. Embedding Root Cause Analysis (RCA) within the case study framework added a diagnostic dimension, enhancing the identification of technical and behavioral drivers of non-conformities (Vivek & Krupskyi, 2024). Although Design Science Research (DSR) offers a solution-oriented stance, it was not adopted, as the case study design better captured the contextual interdependencies essential to understanding regulatory compliance in ATOs.

5.2 Research Setting

The study was conducted in selected Approved Training Organizations (ATOs) in the Philippines certified under PCAR Part 3 and subject to routine surveillance by the Civil Aviation Authority of the Philippines (CAAP). These ATOs, engaged in aircraft maintenance and aviation technical training, were chosen based on the availability of recent CAAP audit reports (within the last 3 years), the accessibility of internal quality assurance personnel, and the institutional willingness to participate. As ATOs operate under strict national and international standards enforced by CAAP's Flight Standards Inspectorate Service (FSIS), they provide an appropriate setting for examining compliance behavior and recurring non-conformities. Situating the study within active, regulated training institutions enabled the application of Root Cause Analysis (RCA) to identify systemic factors influencing audit outcomes. They informed the development of a context-specific compliance enhancement framework for the Philippine aviation training sector.

5.3 Data Collection

Data collection for this study drew from two complementary sources: (a) documentary evidence from CAAP and internal ATO records, and (b) key informant interviews (KIIs) with personnel directly involved in regulatory compliance processes. Separating these two streams supports analytic transparency and aligns with established qualitative research guidance on the construction of multi-source data (Dalglish, Khalid, & McMahon, 2020; Campbell et al., 2020).

5.3.1 Document Analysis

Documentary data consisted of six audit-related documents from three ATOs (2021–2023), including CAAP surveillance reports, Corrective Action Requests (CARs), compliance checklists, and one internal audit report. Documents were obtained through formal requests to participating ATOs and selected based on their relevance to non-conformities, corrective actions, and institutional responses. All documents were digitized and analyzed using the READ process—Ready materials, Extract, Analyze, Distil (Dalglish et al., 2020). Files were imported into NVivo, where key excerpts were coded and mapped to specific PCAR Part 3 clauses to ensure regulatory traceability. This systematic review provided a structured evidence base for identifying recurring compliance gaps across institutions.

5.3.2 Key Informant Interviews

To complement documentary evidence, six key informant interviews were conducted with two QA officers, two instructors, and two ATO managers. Participants were purposively selected for their direct involvement in audits, CAPA processes, and internal quality assurance (Campbell et al., 2020). Interviews followed a semi-structured guide (DeJonckheere & Vaughn, 2019), lasted 30–45 minutes, and were audio-recorded with consent. Transcripts were anonymized, coded in NVivo, and analyzed using reflexive thematic analysis (Braun & Clarke, 2021). Data saturation was reached when no new themes emerged (Guest et al., 2020; Hennink & Kaiser, 2022). Triangulation of interview insights with document findings enhanced credibility and analytic consistency (Noble & Heale, 2019).

5.3.3 Data Analysis

The analysis followed a reflexive thematic analysis approach to organize audit findings and interview data into recurring themes aligned with common areas of non-compliance (documentation, training delivery, SOP implementation, instructor qualifications). This approach emphasizes iterative coding, analytical memoing, and ongoing theme refinement to ensure conceptual coherence (Braun & Clarke, 2021).

To move beyond symptomatic descriptions, we integrated Root Cause Analysis (RCA) within the thematic framework. Each coded issue was interrogated with 5 Whys and mapped using a cause-and-effect (Fishbone) diagram to surface contributory factors across people, processes, tools/technology, and policy—supporting the systematic decomposition of problems into actionable causes (Gangidi, 2019).

Credibility was strengthened through method triangulation (documents + interviews) to corroborate convergent patterns and limit single-source bias (Noble & Heale, 2019). CAQDAS support (NVivo) was utilized to maintain a transparent audit trail, including codebooks, coding queries, and analytic memos, thereby enhancing the dependability and traceability of decisions across analysis cycles (Dalkin, Forster, et al., 2021).

Finally, we documented analytic decisions and linkage from evidence → code → theme → root cause to promote transparency and reproducibility, consistent with contemporary guidance on qualitative rigor and reporting.

Figure 3 provides a synthesized 6-Stage Audit–RCA–CAPA Compliance Cycle that visualizes the pathway from audit identification to RCA-driven CAPA and internal validation.

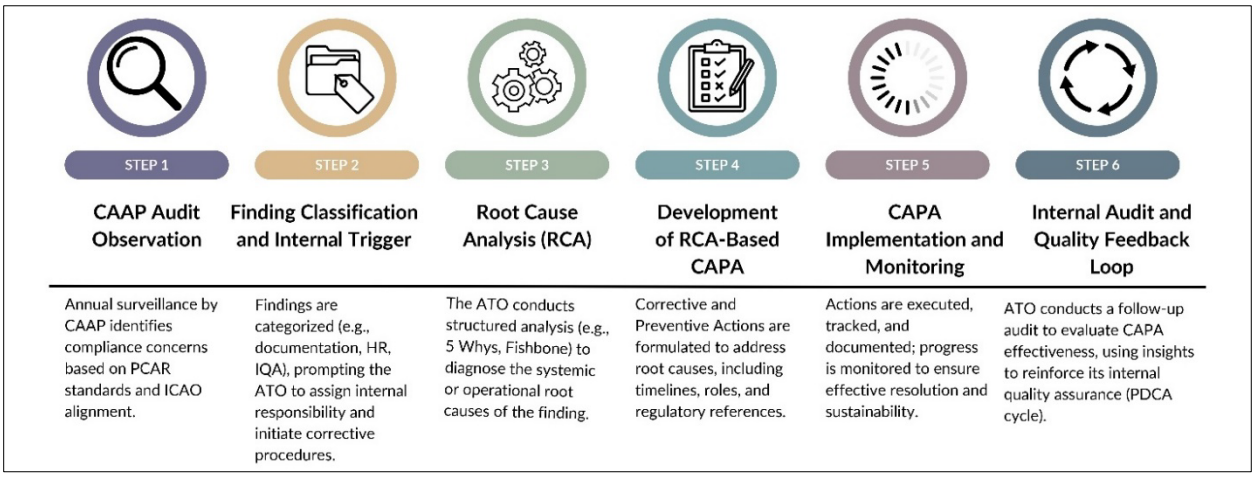

Fig. 3 *Audit–RCA–CAPA cycle: six stages from observation to RCA, action planning, and internal validation toward sustainable compliance.*
Source: Author's own illustration (2025)

5.4 Ethical Considerations

This study followed established ethical principles for qualitative research involving human participants and organizational documents. All interviewees—QA officers, instructors, and ATO managers—received a clear explanation of the study's purpose, procedures, voluntary participation, and their right to withdraw at any time. Written informed consent was obtained before data collection.

Confidentiality was maintained by anonymizing individuals and institutions, using coded identifiers, and removing personally identifiable information from transcripts and reports. All recordings, notes, and audit-related documents were securely stored in password-protected files accessible only to the researcher, thereby protecting sensitive organizational data.

Although the researcher's institution does not have a formal Institutional Review Board (IRB), the study was conducted in accordance with institutional research ethics guidelines and national standards for responsible data handling, privacy protection, and participant welfare. These measures ensured that the study upheld ethical integrity and minimized risks to both individuals and participating organizations.

5.5 Trustworthiness and Qualitative Rigor

To ensure the rigor and credibility of the qualitative findings, this study employed several strategies to enhance trustworthiness, consistent with established qualitative research standards. Credibility was established through methodological triangulation, utilizing multiple data sources, including CAAP audit reports, Corrective Action Requests (CARs), internal quality documents, and key informant interviews. This approach enabled cross-validation of findings and minimized the risk of data-source bias. Dependability was ensured by maintaining a detailed audit trail of all methodological decisions, coding iterations, and analytical memos. This documentation provides transparency, enabling the replication or review of the analytical process.

Confirmability was supported through systematic coding validation. Emerging themes and root cause patterns were verified using NVivo software, and categorized data were cross-checked through Excel tracking sheets. This dual-system approach enhanced analytical accuracy and minimized researcher bias. These strategies collectively reinforce the study's trustworthiness and support the reliability of its conclusions regarding systemic compliance behavior in Approved Training Organizations (ATOs).

6. Results

6.1 Collection of CAAP Audit Reports (Primary Documents)

Six primary audit documents from three ATOs (2021–2023)—including CAAP surveillance reports, compliance checklists, Corrective Action Requests (CARs), and one internal audit report—were analyzed to identify recurring non-conformities. Findings were consolidated and clause-mapped in Table 2, which summarizes each issue by

institution, year, document type, non-conformity category, specific problem, PCAR reference, and prescribed corrective action.

Non-conformities consistently clustered in five areas: Documentation, Training Delivery, Instructor Qualification, Internal Quality Assurance (IQA) Process, and Facilities. Documentation issues were most frequent, including missing training logs (2021) and inaccurate record-keeping procedures (2023), reflecting persistent weaknesses in compliance with PCAR documentation requirements (e.g., PCAR 3.7.2, 3.7.4). Training Delivery findings indicated a remarkably incomplete implementation of approved syllabi and gaps between curriculum design and instructional execution (PCAR 3.10.2). Instructor Qualification issues—such as expired licenses and incomplete credential files—highlighted deficiencies in personnel monitoring systems (PCAR 3.8.1).

IQA-related observations, including absent or incomplete internal audit cycles, underscored weaknesses in self-monitoring and quality assurance structures (PCAR 3.11.1), consistent with previous studies on audit culture and compliance performance (Dela Cruz et al., 2021; Orencia, 2023). Facility-related findings, though fewer, involved inadequate or outdated training equipment affecting readiness and re-certification (PCAR 3.9.3). Overall, the audit evidence suggests that these recurring non-conformities stem largely from systemic process and oversight gaps rather than intentional non-compliance. These patterns support the use of a Root Cause Analysis (RCA) approach to connect audit-identified symptoms to deeper institutional causes and inform the design of a sustainable compliance enhancement framework (see Figure 3).

Table 2 *Summary of CAAP audit findings from selected ATOs (2021–2023), categorized by document type, issue, and regulatory reference*

Year	ATO Code/Name	Document Type	Category of Finding	Specific Issue Noted	PCAR Reference (corrected)	Corrective Action Required
2021	ATO-001	Surveillance Report	Documentation	Missing student training logs	PCAR 3.2.3(a)(1), (b) – Record Keeping	Submit updated logs and control measures
2021	ATO-002	CAR	Training Delivery	Incomplete syllabi implementation	PCAR 3.2.4(b)(1), (c); 3.2.9 – Training Program & Manuals	Revise and align syllabi with CAAP standards
2022	ATO-001	Compliance Checklist	Instructor Qualification	Instructor license not updated	PCAR 3.2.2(b) – Personnel (instructor rating/authorization); 3.2.3(a)(4) – instructor qualification records	Renew and verify the instructor license.
2022	ATO-003	CAR	IQA Process	No internal audit was conducted within the year	IS 3.1.2.2 Appendix C, (11) & (15) – Quality audit & audit scheduling	Establish an internal audit calendar
2023	ATO-002	Surveillance Report	Facilities	Inadequate training facilities	PCAR 3.2.8(a) – Training Facilities	Upgrade or replace facility equipment
2023	ATO-003	Internal Audit	Documentation	Incorrect record-keeping procedures	PCAR 3.2.3(a), (b) – Record Keeping	Implement standard filing protocol

As shown in Table 3, documentation-related findings were the most frequent, recurring in both 2021 and 2023. Although generally classified as minor, their persistence indicates ongoing gaps in standardized record-keeping systems. In contrast, findings related to training delivery, instructor qualification, and internal quality assurance (IQA) were categorized as major, reflecting higher regulatory risk and deeper institutional vulnerabilities in curriculum execution, personnel oversight, and internal monitoring. Facilities-related issues were less common and minor, but still highlight the need for adequate physical resources to sustain training compliance.

The combined frequency and severity patterns point to systemic weaknesses that cannot be addressed through superficial corrective actions alone. Accordingly, Root Cause Analysis (RCA) was applied to trace these audit findings to their underlying institutional causes, as presented in the following section.

Table 3 *Frequency of audit findings by category and year (2021–2023)*

Category	2021	2022	2023	Total	Severity (Minor/Major)
Documentation	1	0	1	2	Minor
Training Delivery	1	0	0	1	Major
Instructor Qualification	0	1	0	1	Major
IQA Process	0	1	0	1	Major
Facilities	0	0	1	1	Minor

6.2 Root Cause Patterns

Root Cause Analysis (RCA) revealed recurring systemic drivers behind the non-conformities identified in the CAAP audit reports. As shown in Table 4, most issues stemmed from weaknesses in institutional processes and internal control systems rather than deliberate neglect. Missing training records, for example, were traced to the absence of standardized documentation protocols. At the same time, unrenewed instructor licenses resulted from ineffective personnel tracking and poor integration between administrative and compliance functions. Incomplete syllabus implementation similarly reflected gaps in academic oversight and unclear instructional guidance.

These causal relationships are summarized in the Fishbone Diagram (Figure 4), which groups root causes into four domains—Process, People, Policy, and Tools. Process-related gaps, such as missing checklists and irregular internal reviews, directly contributed to documentation failures. People-related factors, including insufficient training and unclear role assignments, further weakened compliance readiness. Collectively, these interdependent deficiencies illustrate that most audit findings represent systemic vulnerabilities rather than isolated operational lapses.

The RCA results underscore the need for ATOs to adopt a structured, systems-oriented approach to compliance—strengthening internal processes, enhancing staff capability, and institutionalizing robust quality assurance mechanisms to prevent the recurrence of non-conformities.

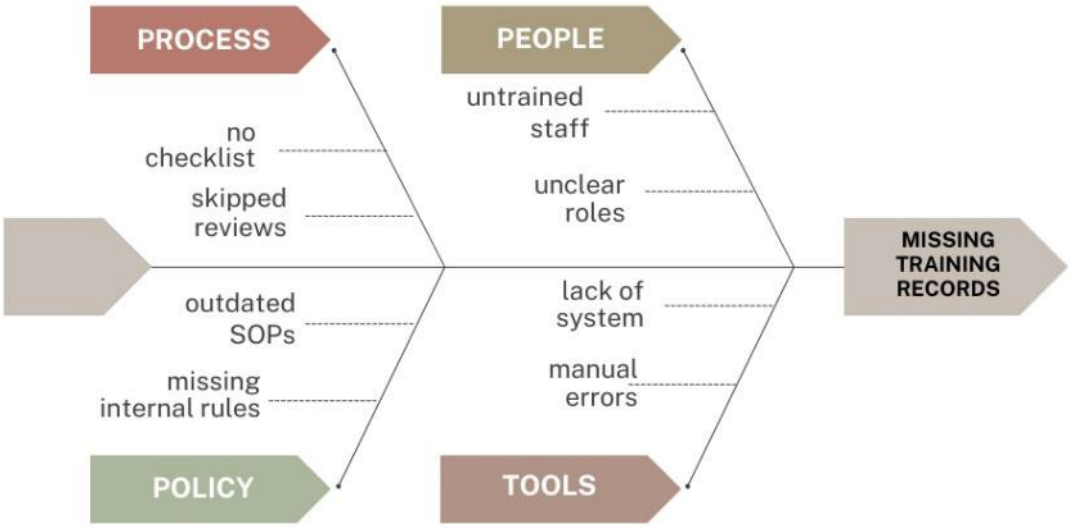

Fig. 4 *Fishbone diagram identifying the root causes of missing training records, categorized into process, people, policy, and tools domains*
Source: Author's own illustration (2025)

To visualize the systemic sources of non-compliance, a root cause frequency matrix was constructed. This matrix [Table 5] links the most frequently cited audit findings to the four primary RCA categories: people, process, policy, and tools. By mapping each issue to these categories, the figure highlights which dimensions are most commonly implicated in recurring non-conformities. Notably, process-related root causes were dominant, often intersecting with deficiencies in personnel oversight and documentation practices. This diagnostic visualization supports the study's contention that many audit issues stem from deeply embedded operational gaps rather than isolated oversights.

Table 4 *Root causes mapped to CAAP audit findings and interventions*

CAAP Finding	RCA Category	Specific Root Cause	Severity	Suggested Intervention
Missing training records	Process	No standardized filing SOP	Minor	Develop and implement SOP
Incomplete syllabi implementation	People/Process	Faculty not oriented on curriculum execution	Major	Conduct structured faculty orientation
Unrenewed instructor license	People	No tracking of license expiration	Major	HR to maintain the instructor credential registry
No internal audit conducted	Policy	IQA calendar not institutionalized	Major	Establish an annual audit schedule

Table 5 *Root cause frequency matrix linking CAAP audit findings to systemic categories in Philippine ATOs*

Audit Finding	People	Process	Policy	Tools	Total
Missing training records	✓	✓		✓	3
Incomplete syllabus execution	✓	✓			2
Unrenewed instructor licenses	✓				1
No internal audit conducted			✓		1

6.3 Common Systemic Issues Identified Across ATOs

Across the three ATOs, audit findings and RCA outcomes revealed recurring systemic issues clustered around four domains: training delivery, SOP enforcement, documentation practices, and internal quality assurance (IQA) systems. As summarized in Table 7, training delivery problems included incomplete implementation of approved syllabi, poor documentation of student assessments, and deviations from standard lesson plans, indicating misalignment between curriculum design and classroom implementation. SOP-related gaps included outdated or inconsistently applied procedures, resulting in variable workflows and unclear operational responsibilities.

Documentation weaknesses—such as missing training records, disorganized filing, and reliance on manual logs—reflected inadequate data management systems and limited traceability, which complicate audit response and institutional learning. IQA deficiencies were both frequent and consequential: several ATOs lacked structured QA schedules, maintained incomplete QA records, or had weak CAPA implementation, suggesting that compliance remains largely reactive and audit-driven rather than anchored in continuous internal monitoring.

Overall, the systemic issues depicted in Table 6 point to deep-rooted institutional challenges that extend beyond isolated non-conformities. Addressing them requires a shift from short-term corrective actions toward a proactive quality assurance culture supported by clearer governance structures, robust procedures, and strengthened institutional capacity.

Table 6 *Summary of common systemic issues identified across ATOs, their observed weaknesses, and operational implications*

Systemic Issue	Observed Weakness	Implication
Training Delivery	Incomplete syllabi, poor assessment tracking	Inconsistent curriculum execution
SOP Implementation	Outdated/missing SOPs, unclear workflows	Operational ambiguity, audit failures
Documentation Practices	Lost or incomplete records, manual systems	Low audit readiness, poor traceability
Internal QA	No IQA schedule, lack of CAPA follow-through	Weak self-monitoring, overreliance on CAAP oversight

7. Discussion

7.1 Interpretation of Root Causes

The Root Cause Analysis (RCA) indicates that recurring compliance gaps across ATOs reflect deeper institutional deficiencies rather than isolated errors. These gaps are primarily linked to weaknesses in governance, workforce capability, procedural consistency, and supporting technology.

Frequent issues, such as missing or incomplete training records, were traced to the absence of standardized documentation procedures, limited staff training, and decentralized digital recordkeeping systems. As illustrated in the Fishbone Diagram (Figure 4), interacting factors across the people, process, policy, and tools domains converge to undermine documentation control. Similarly, incomplete syllabus implementation and deviations from approved content arise from unclear academic oversight, inadequate instructor orientation, and weak monitoring and accountability mechanisms.

Unrenewed instructor licenses highlight lapses in human resource tracking and the lack of formal systems for monitoring compliance timelines, while internal quality assurance (IQA) weaknesses—such as unscheduled internal audits, undocumented CAPA activities, and weak follow-through—reveal a reactive rather than proactive compliance posture. Collectively, these patterns point to constrained organizational capacity, fragmented governance, and underdeveloped compliance infrastructure. Addressing them requires not only corrective actions but a shift toward a quality culture in which compliance and assurance are embedded in everyday institutional practice.

7.2 Alignment with Literature

The patterns identified in Philippine ATOs—documentation lapses, inconsistent training delivery, and weak internal quality assurance—are consistent with international evidence on systemic compliance challenges in regulated aviation training. Studies on EASA Part-147 implementation report that compliance often breaks down at the level of integrated QA systems and instructor preparedness (Vyskoč & Rostáš, 2023), while work on European pilot training similarly highlights gaps in curriculum implementation and oversight (Adanov et al., 2020). In the Asia–Pacific region, aviation training organizations frequently struggle with documentation control and internal audits under evolving ICAO requirements, driven by limited human resources and reactive compliance cultures (Shanahan & Kelly, 2019). Philippine findings that repeated audit issues stem from ineffective IQA implementation rather than deliberate non-compliance (Dela Cruz et al., 2021) reinforce this structural interpretation.

The results also align with scholarship on audit culture and quality assurance. Harvey and Newton (2007) argue that external audits often elicit episodic, formalistic responses rather than continuous improvement—a dynamic reflected in ATOs' reliance on CAAP audits to trigger internal corrections. Consistent with Jingura and Kamusoko (2019) and Mulyono et al. (2021), this study confirms that internal audit mechanisms must be competency-based, systematic, and embedded in institutional planning to support proactive compliance. Overall, the convergence with prior work suggests that the challenges observed in Philippine ATOs reflect broader systemic issues, underscoring the need for capacity-building, strengthened compliance governance, and the institutionalization of root-cause-based quality frameworks tailored to the regional regulatory context.

7.3 Framework for Compliance Enhancement

Drawing on the systemic issues and root causes identified across ATOs, this study proposes an integrated, RCA-based compliance framework to strengthen alignment with CAAP requirements and reinforce institutional quality assurance. At its core, the framework embeds Root Cause Analysis within a unified audit–CAPA cycle, using tools such as the 5 Whys and Fishbone Diagrams to trace non-conformities to underlying issues across people, process, policy, and tools. This moves corrective action beyond symptom-level fixes toward addressing structural weaknesses.

The diagnostic process is sustained through a continuous internal audit feedback loop, in which scheduled IQA activities verify the implementation and effectiveness of corrective actions, monitor recurrence, and inform management review—operationalizing a Plan–Do–Check–Act (PDCA) learning cycle. Given the prominence of human factors in the RCA results, the framework incorporates periodic, role-specific compliance training on PCAR Part 3, SOP use, documentation standards, and audit procedures to enhance staff competence and embed compliance awareness in daily operations. CAPA mechanisms are directly linked to RCA outputs and audit findings, with escalation pathways ensuring that unresolved or repeat issues trigger higher-level intervention and governance attention, thereby shifting practice from reactive "compliance-by-audit" toward proactive "compliance-by-design."

Strategically, the framework aligns with international norms such as ICAO Annex 1 and EASA Part-147 and carries clear policy implications for CAAP. Potential measures include requiring RCA-based CAP submissions,

standardizing audit reporting templates with clearer risk indicators, and adopting tiered follow-up protocols for major or recurrent findings. Establishing a Compliance Support Unit (CSU) within FSIS to provide technical guidance, RCA toolkits, and CAPA coaching—particularly for ATOs with limited QA capacity—would further reposition CAAP from a purely procedural enforcer to a developmental partner, supporting more sustainable compliance and a more resilient aviation training sector in the Philippines.

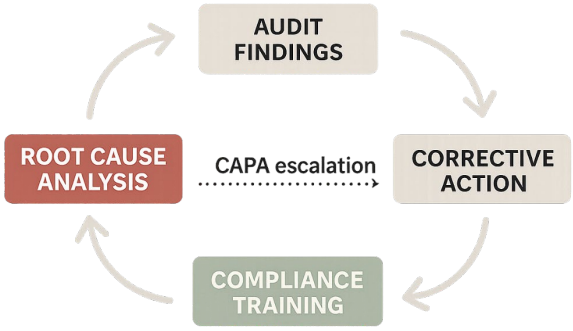

Fig. 5 *The RCA-based internal quality assurance and compliance framework for ATOs*
Source: Author's own illustration (2025)

7.4 Implications

This study has several implications for both institutional practice and regulatory oversight in aviation training. For ATOs, the RCA-based compliance framework offers a structured approach to identifying and resolving systemic issues, promoting proactive internal audits and continuous improvement. Embedding Root Cause Analysis (RCA) into Corrective and Preventive Action (CAPA) systems and staff training protocols can enhance institutional readiness and reduce the frequency of repeat audit findings.

For CAAP, the findings suggest that current audit protocols may benefit from a developmental shift that encourages deeper institutional engagement with quality systems rather than focusing solely on surface-level compliance. The proposed framework also supports the development of standardized RCA-based CAP requirements and the enhancement of audit communication mechanisms.

At the policy level, the study underscores the need for a national compliance support strategy, especially for resource-constrained ATOs. This could include RCA toolkits, technical debriefings, and capacity-building initiatives to elevate the overall compliance culture in Philippine aviation education. Academically, the study extends RCA's application beyond safety and maintenance contexts, demonstrating its utility as a governance tool in education and regulatory settings.

7.5 Limitation

This study has several limitations. First, it is based on a purposive sample of ATOs that were willing to share CAAP audit records and internal QA documents, which may not represent the full range of compliance practices across all Philippine ATOs. Second, the qualitative case study design and focus on the Philippine regulatory context constrain generalizability; the proposed RCA-based framework may be transferable, but its application elsewhere requires contextual adaptation. Third, despite using Root Cause Analysis and document triangulation, the analysis relied primarily on secondary data (audit reports, CARs) with limited direct observation and interviews, which restricts deeper insight into organizational culture and day-to-day behavior. Finally, the three-year audit window captures recurring patterns but may not fully reflect the long-term trajectory of reforms or delayed institutional responses. These limitations point to the need for broader, more diverse, and methodologically varied follow-up studies rather than undermining the value of the present findings.

7.6 Recommendation

This study recommends that Philippine Approved Training Organizations (ATOs) institutionalize Root Cause Analysis by embedding tools such as the 5 Whys and Fishbone Diagrams into internal audits and CAPA processes, treating RCA as a routine quality assurance function rather than an ad hoc response. ATOs should implement PDCA-based internal monitoring systems to support audit readiness and proactive compliance, and provide regular, role-specific compliance training for instructors, QA staff, and administrators focused on PCAR Part 3,

SOP enforcement, and documentation standards. On the regulatory side, CAAP could enhance oversight effectiveness by standardizing audit templates to include severity ratings, explicit regulatory references, and risk implications, and by requiring RCA-informed CAPs that clearly identify root causes and propose systemic solutions. Collectively, these measures aim to shift the sector from reactive, audit-driven compliance toward a more system-oriented, preventive quality culture.

7.7 Future Research Direction

Future research should validate and refine the proposed RCA-based compliance framework across a larger, more diverse set of ATOs, including both public and private institutions with varying audit histories, to improve external validity and comparative insight. Incorporating quantitative indicators—such as audit closure times, CAPA completion rates, recurrence of findings, and training hours—would enable more precise evaluation of RCA interventions, ideally within a mixed-methods design that combines institutional metrics with qualitative accounts of behavior and culture. Longitudinal studies could track the sustained impact of RCA integration on audit performance, IQA maturity, and organizational learning over multiple audit cycles. Further work should also examine CAAP auditors' and policymakers' perspectives to understand enforcement practices and regulatory constraints better, and comparative studies across ICAO-, EASA-, or FAA-regulated contexts could illuminate how RCA adaptability, audit culture, and regulatory readiness vary globally.

8. Conclusion

This study examined recurring compliance challenges in Philippine Approved Training Organizations (ATOs) by analyzing three years of CAAP audit findings and applying Root Cause Analysis (RCA) to identify underlying institutional drivers. Non-conformities clustered in five domains—documentation, training delivery, instructor qualification, internal quality assurance (IQA), and facilities—and were traced mainly to systemic weaknesses such as inconsistent procedural enforcement, underdeveloped internal audits, limited staff capability, and the absence of standardized quality systems, rather than isolated administrative oversights.

A key contribution of the study is the development of an RCA-based compliance enhancement framework tailored to ATOs operating under CAAP regulations. The framework embeds RCA within the audit–CAPA cycle, linking audit findings, root cause diagnosis, corrective and preventive actions, role-specific compliance training, and escalation pathways into a continuous feedback loop. By aligning with principles reflected in ICAO Annex 1 and EASA Part-147, the model supports a shift from reactive, audit-driven responses toward proactive, system-oriented compliance and is conceptually adaptable to other regulated training environments.

Methodologically, the study demonstrates the value of a qualitative case study approach that integrates document analysis with RCA to illuminate institutional behavior in regulated settings. For CAAP, the findings suggest avenues to strengthen audit feedback, CAP requirements, and support to ATOs; for training institutions, they offer a practical guide to improve audit readiness, reinforce IQA structures, and embed continuous improvement into routine operations. Overall, the study underscores that regulatory compliance should be treated not as a periodic obligation but as a core dimension of institutional governance, with root cause thinking serving as a critical lever for achieving sustainable, standards-aligned aviation training.

Acknowledgement

The authors gratefully acknowledge the support and cooperation of the participating Approved Training Organizations and their personnel, who provided access to audit documents and shared valuable insights during this study.

Conflict of Interest

The authors declare no conflict of interest related to the conduct, authorship, or publication of this research.

Author Contribution

*Arthur Dela Peña** ***conceptualized the study, supervised the research process, and prepared the manuscript draft and final manuscript editing****. Jefferson Clariza contributed to* ***data collection and validation****. Eric Tiansay assisted in* ***data analysis and interpretation****. Mark Anthony Ganal supported the* ***review of related literature****. All authors reviewed and approved the final version of the manuscript.*

References

Adamanov, & Mezhenko (2024). Temporal regulation and emergency decision-making skills for future pilots. *Proceedings of the National Aviation University. Series: Pedagogy, Psychology*, (23). https://doi.org/10.18372/2411-264x.23.18180

Adanov, Macintyre, & Efthymiou (2020). An exploratory study about the challenges with pilot training and recruitment in Europe. *International Journal of Aviation Science and Technology*, 1(2), 1–6. https://doi.org/10.23890/ijast.vm01is02.0201

Ardestani (2024, May 19). Root Cause Analysis in Small Aviation Operators. *LinkedIn*. Retrieved May 31, 2025, from https://tinyurl.com/3pdndtpk

Braun, & Clarke (2021). One size fits all? What counts as quality practice in (reflexive) thematic analysis. *Qualitative Research in Psychology*, 18(3), 328–352. https://doi.org/10.1080/14780887.2020.1769238

Campbell, Greenwood, Prior, Shearer, Walkem, Young, Bywaters, & Walker (2020). Purposive sampling: complex or simple? Research case examples. *Journal of Research in Nursing*, 25(8), 652–661. https://doi.org/10.1177/1744987120927206 SAGE Journals

Chwat, Seisdedos, Lemme, Iudica, & Cingolani (2023). "Never event" in surgery: Root-cause analysis. *Revista Argentina de Cirugía*, 115(1). https://doi.org/10.25132/raac.v115.n1.1695

Civil Aviation Authority of the Philippines (2024). *Philippine Civil Aviation Regulations: Part 3 – Approved Training Organizations (January 2024 ed.)*. https://tinyurl.com/4crxhd7j

ComplianceQuest (2021, December 2). ComplianceQuest's Next-Gen '5 Why' Root Cause Analysis for Effective Problem Solving. *ComplianceQuest*. https://tinyurl.com/ytms99kb

Da Silveira, & Henriqson (2021). Design science research – Alternative pathway for aviation training-related studies. *Journal of Aviation/Aerospace Education & Research*, 30(1). https://doi.org/10.15394/jaaer.2021.1902

Dalglish, Khalid, & McMahon (2020). Document analysis in health policy research: the READ approach. *Health Policy and Planning*, 35(10), 1424–1431. https://doi.org/10.1093/heapol/czaa064 PMC

Dalkin, Forster, et al. (2021). Using CAQDAS (NVivo) to assist realist theory generation, refinement, and testing. *International Journal of Social Research Methodology*, 24(1), 123–134. https://doi.org/10.1080/13645579.2020.1803528

DeJonckheere, & Vaughn (2019). Semistructured interviewing in primary care research: a balance of relationship and rigour. *Family Medicine and Community Health*, 7(2), e000057. https://doi.org/10.1136/fmch-2018-000057 PubMed

Dela Cruz, Santos, & Mercado (2021). Factors influencing compliance behavior in aviation training institutions: A case study of regulatory audits in the Philippines. *Asia-Pacific Journal of Aviation Education and Training*, 14(2), 88–102.

Emanuilov, & Dheu (2021). Flying high for AI? Perspectives on EASA's roadmap for AI in aviation. *Air & Space Law*, 46(1), 1–18. https://doi.org/10.54648/aila2021001

Federal Aviation Administration (2023). *Aviation Maintenance Technician Handbook – General (FAA-H-8083-30B)*. U.S. Department of Transportation. https://www.faa.gov/regulations_policies/handbooks_manuals/aviation

Flannery (2018). Focus on compliance: Using data to enhance the physical environment of care. *Management in Healthcare: A Peer-Reviewed Journal*. https://doi.org/10.69554/yjvc3816

Gangidi (2019). A systematic approach to root cause analysis using the 3 × 5 why's technique. *International Journal of Lean Six Sigma*, 10(3), 822–838. https://doi.org/10.1108/IJLSS-10-2017-0114

Groot (2021). Root cause analysis – what do we know? *Maandblad voor Accountancy en Bedrijfseconomie*, 95(6), 266–273. https://doi.org/10.5117/MAB.95.60778

Guest, Namey, & Chen (2020). A simple method to assess and report thematic saturation in qualitative research. *PLOS ONE*, 15(5), e0232076. https://doi.org/10.1371/journal.pone.0232076 PMC

Harvey & Newton (2007). Transforming quality evaluation: Moving on. *Quality in Higher Education*, 13(2), 81–94. https://doi.org/10.1080/13538320701629176

Hendra, Kurnianto, & Endrawijaya (2023). Collaborative governance for aviation approved training organisation: An adapted model for multi-stakeholder collaboration. *Higher Education, Skills and Work-based Learning*. https://doi.org/10.1108/heswbl-06-2023-0164

Hennink & Kaiser (2022). Sample sizes for saturation in qualitative research: a systematic review of empirical tests. *Social Science & Medicine*, 292, 114523. https://doi.org/10.1016/j.socscimed.2021.114523 ScienceDirect

ICAO (2022). *Annex 1 to the Convention on International Civil Aviation: Personnel Licensing* (15th ed.). International Civil Aviation Organization. https://www.icao.int

Jingura, & Kamusoko (2019). A competency framework for internal quality assurance in higher education. *International Journal of Management in Education*, 13(4), 321–337. https://doi.org/10.1504/IJMIE.2019.10018030

Karapetrovic, & Willborn (2000). Quality assurance and effectiveness of audit systems. *The TQM Magazine*, 12(1), 30–39. https://doi.org/10.1108/02656710010315256

Knez, Podbregar, & Graham (2022). Challenges and development of training in the aviation industry. *Proceedings of the 41st International Conference on Organizational Science Development* (Article 30). https://doi.org/10.18690/um.fov.3.2022.30

Krupa, & Myers (2017). Data mining root cause analysis findings. *2017 Annual Reliability and Maintainability Symposium (RAM)* (pp. 1–6). IEEE. https://doi.org/10.1109/RAM.2017.7889719

Kwok, Mah, & Pang (2020). Our first review: An evaluation of effectiveness of root cause analysis recommendations in Hong Kong public hospitals. *BMC Health Services Research*, 20, Article 1006. https://doi.org/10.1186/s12913-020-05356-6

Ladkin, & Loer (1998). Why–because analysis: The formal logic of failure (Technical Report RVS-Bk-98-01). University of Bielefeld. https://tinyurl.com/335fc9ms

Mahachandra (2021). Aircraft redelivery project risk assessment: A case study in maintenance, repair and overhaul (MRO) company. *Proceedings of the 2nd South American International Conference on Industrial Engineering and Operations Management*, 2058–2076. IEOM Society International. https://doi.org/10.46254/SA02.20210682

Mohd Noor (2008). Case study: A strategic research methodology. *American Journal of Applied Sciences*, 5(11), 1602–1604. https://doi.org/10.3844/ajassp.2008.1602.1604

Mulyasa, Sauri, Aryani, & Alhamidi (2020). Continuous quality–Instructional improvement through implementation of an internal quality assurance system. *Systematic Reviews in Pharmacy*, 11(3), 620–627. https://doi.org/10.31838/SRP.2020.3.91

Mulyono, Rahmawati, Basuki, & Darmawan (2021). Implementation of the internal quality assurance system at UIN Malang Indonesia. *Turkish Journal of Computer and Mathematics Education*, 12(6), 2372–2379. https://doi.org/10.17762/TURCOMAT.V12I6.2372

Naweed, & Kourousis (2020). Winging it: Key issues and perceptions around regulation and practice of aircraft maintenance in Australian general aviation. *Aerospace*, 7(6), 84. https://doi.org/10.3390/aerospace7060084

Noble, & Heale (2019). Triangulation in research, with examples. *Evidence-Based Nursing*, 22(3), 67–68. https://doi.org/10.1136/ebnurs-2019-103145

Orencia (2023). Exploring the role of internal audit: A qualitative study of institutions in the Philippines. *International Journal of Multidisciplinary Applied Business and Education Research*, 4(11), 2649–2656. https://doi.org/10.11594/ijmaber.04.11.03

Peerally (2021). Improving risk controls following root cause analysis of serious incidents in healthcare [Data set]. *University of Leicester Research Data Repository*. https://doi.org/10.25392/LEICESTER.DATA.15112434.V1

Ronell (2020). Discussion of aviation software oversight improvement. *Proceedings of the SIGPLAN Symposium on New Ideas, New Paradigms, and Reflections on Programming and Software*, 2. https://doi.org/10.1145/3426428.3426926

Shah, & Jarzabkowski (2013). The Australian higher education quality assurance framework. *Perspectives: Policy and Practice in Higher Education*, 17(3), 96–106. https://doi.org/10.1080/13603108.2013.794168

Shanahan, & Kelly (2019). Regulatory alignment and audit preparedness in aviation training organizations: Insights from Asia-Pacific. *Journal of Air Transport Studies*, 10(3), 45–60. https://doi.org/10.38008/jats.v10i3.47

Sutinen, & Kuperan (1999). A socio-economic theory of regulatory compliance. *International Journal of Social Economics*, 26(1/2/3), 174–193. https://doi.org/10.1108/03068299910229569

Talavera (2004). Development and validation of TQM constructs: The Philippine experience. *Gadjah Mada International Journal of Business*, 6(3), 355–375. https://doi.org/10.22146/GAMAIJB.5550

Tashi, Mbuya, & Gangadharappa (2016). Corrective action and preventive actions and their importance in quality management system: A review. *International Journal of Pharmaceutical Quality Assurance*, 7(1), 1–4. https://doi.org/10.25258/IJPQA.7.1.1

ThinkReliability (2017). Flight 1549 "Miracle on the Hudson". *ThinkReliability*. Retrieved May 31, 2025, from https://blog.thinkreliability.com/flight-1549-miracle-on-the-hudson-cause-map

Traeger (2024, February 8). Root cause and effect analysis: 5 Whys vs. Fishbone. *EasyRCA*. https://tinyurl.com/sntphzt5

Vivek, & Krupskyi (2024). Exploring synergy: Integrating qualitative research methods with root cause analysis for holistic problem understanding. *European Journal of Management Issues*, 32(1), 19–29. https://doi.org/10.15421/192422

Vyskoč, & Rostáš (2023). Analysis of the implementation of Part-147 in the environment of air transport department and aviation training and educational centre. *Práce a štúdie*, 2(2023). https://doi.org/10.26552/pas.z.2023.2.07

Wahyuni (2012). The Research Design Maze: Understanding Paradigms, Cases, Methods, and Methodologies. *Journal of Applied Management Accounting Research*, 10, 69–80. http://maaw.info/JAMAR.htm