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# "Organizational Factors Influencing Safety Culture in Aircraft Maintenance"

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*"To my family, friends and partner for their continued support and encouragement throughout the master's studies. Special thanks and sincere gratitude to all the professors for their invaluable contributions to this academic journey.*
*This dissertation is dedicated to all aviation maintenance personnel whose commitment and professionalism ensure the safety and airworthiness of aircraft."*

# Abstract

In the context of aviation, safety culture is a pivotal element of operational reliability and risk management, especially in the aircraft maintenance sector where human and organizational factors play a significant role in aviation safety. Despite all the technology and regulatory requirements, there is still a significant amount of maintenance-related errors which contribute to operational risk. This study explores the effect of the selected organizational factors on safety culture in the aircraft maintenance organizations in this context. Specifically, the study will investigate how communication, training and employee involvement influence maintenance personnel's attitudes and behaviors related to safety.

The study is descriptive quantitative research that utilizes a structured questionnaire that is sent electronically to the respondents who are aircraft maintenance personnel such as technicians, engineers, supervisors and quality managers. There were 130 valid responses that were analyzed using SPSS statistical software. The analytical techniques used were descriptive statistics, reliability analysis, Confirmatory Factor Analysis (CFA), and Multiple Regression techniques were used to assess the proposed conceptual model and to test the proposed hypotheses.

The results show that employee involvement is the most influential and statistically significant positive factor affecting the safety culture, which suggests that employee involvement, empowerment and frontline involvement in processes concerning safety are important factors in safety culture. Communication and training showed positive but not statistically significant relationships with safety culture, indicating that these organizational tools could be more effective if they are supported by active participation of the employees. The study makes a significant contribution to aviation safety literature, which is dominated by theoretical research, as it is empirical, specifically oriented on the aircraft maintenance organizations, and gives practical recommendations to managers and regulators aiming to improve organizational level of security and minimize maintenance risks.

**Keywords**

Aircraft Maintenance, Safety Culture, Organizational Factors, Communication, Training, Employee Involvement, Aviation Safety

# "Οργανωσιακοί Παράγοντες που Επηρεάζουν την Κουλτούρα Ασφάλειας στη Συντήρηση Αεροσκαφών"

Γεώργιος Κολλιόπουλος

## Περίληψη

Στο πλαίσιο της αεροπορίας, η κουλτούρα ασφάλειας αποτελεί κεντρικό στοιχείο της επιχειρησιακής αξιοπιστίας και της διαχείρισης κινδύνων, ειδικά στον τομέα της συντήρησης αεροσκαφών, όπου οι ανθρώπινοι και οργανωσιακοί παράγοντες παίζουν σημαντικό ρόλο στην ασφάλεια της αεροπορίας. Παρά τις τεχνολογικές και ρυθμιστικές απαιτήσεις, εξακολουθεί να υπάρχει σημαντικός αριθμός σφαλμάτων που σχετίζονται με τη συντήρηση και συμβάλλουν στον λειτουργικό κίνδυνο. Η παρούσα μελέτη διερευνά την επίδραση των επιλεγμένων οργανωτικών παραγόντων στην κουλτούρα ασφάλειας στους οργανισμούς συντήρησης αεροσκαφών σε αυτό το πλαίσιο. Συγκεκριμένα, η μελέτη θα διερευνήσει πώς η επικοινωνία, η εκπαίδευση και η συμμετοχή των εργαζομένων επηρεάζουν τις στάσεις και τις συμπεριφορές του προσωπικού συντήρησης σχετικά με την ασφάλεια.

Η μελέτη είναι μια περιγραφική ποσοτική έρευνα που χρησιμοποιεί ένα δομημένο ερωτηματολόγιο που αποστάλθηκε ηλεκτρονικά στους ερωτηθέντες που είναι εργαζόμενοι στη συντήρηση αεροσκαφών, όπως τεχνικοί, μηχανικοί, επόπτες και διαχειριστές ποιότητας. Υπήρξαν 130 έγκυρες απαντήσεις που αναλύθηκαν χρησιμοποιώντας το στατιστικό λογισμικό SPSS. Οι αναλυτικές τεχνικές που χρησιμοποιήθηκαν ήταν η περιγραφική στατιστική, η ανάλυση αξιοπιστίας, η Επιβεβαιωτική Ανάλυση Παραγόντων (CFA) και οι τεχνικές Πολλαπλής Παλινδρόμησης για την αξιολόγηση του προτεινόμενου εννοιολογικού μοντέλου και για τον έλεγχο των προτεινόμενων υποθέσεων.

Τα αποτελέσματα έδειξαν ότι η συμμετοχή των εργαζομένων είναι ο πιο ισχυρός και στατιστικά σημαντικός θετικός παράγοντας που επηρεάζει την κουλτούρα ασφάλειας, γεγονός που υποδηλώνει ότι η συμμετοχή, η ενδυνάμωση και η εμπλοκή των εργαζομένων

στην πρώτη γραμμή των διαδικασιών που αφορούν την ασφάλεια είναι σημαντικοί παράγοντες της κουλτούρας ασφάλειας. Η επικοινωνία και η εκπαίδευση έδειξαν θετικές αλλά όχι στατιστικά σημαντικές σχέσεις με την κουλτούρα ασφάλειας, υποδεικνύοντας ότι αυτά τα οργανωσιακά εργαλεία θα μπορούσαν να είναι πιο αποτελεσματικά εάν υποστηρίζονται από την ενεργό συμμετοχή των εργαζομένων. Η μελέτη συμβάλλει σημαντικά στη βιβλιογραφία για την ασφάλεια της αεροπορίας, στην οποία επικρατεί η θεωρητική έρευνα, καθώς είναι εμπειρική, προσανατολισμένη ειδικά στους οργανισμούς συντήρησης αεροσκαφών και παρέχει πρακτικές συστάσεις σε διευθυντές και ρυθμιστικούς φορείς με στόχο τη βελτίωση του οργανωσιακού επιπέδου ασφάλειας και την ελαχιστοποίηση των κινδύνων συντήρησης.

**Λέξεις – Κλειδιά**

Συντήρηση Αεροσκαφών, Κουλτούρα Ασφαλείας, Οργανωσιακοί Παράγοντες, Επικοινωνία, Εκπαίδευση, Συμμετοχή Εργαζομένων, Ασφάλεια Αεροπορίας

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# List of Abbreviations & Acronyms

| | |
|---|---|
| **AVE** | Average Variance Extracted |
| **CFA** | Confirmatory Factor Analysis |
| **CR** | Composite Reliability |
| **ICAO** | International Civil Aviation Organization |
| **HRO** | High Reliability Organization |
| **MEDA** | Maintenance Error Decision Aid |
| **SMS** | Safety Management Systems |

# 1. Introduction

## 1.1 Background of Study

It is common knowledge that aviation safety is one of the most important priorities in the aviation industry worldwide (Barnett, 2020). The last several decades have seen tremendous technological growth, stringent regulatory measures as well as enhanced operation processes that have left air transport as one of the most secure modes of transport (Gudmundsson, 2019). International aviation bodies like the International Civil Aviation Organization and the European Union Aviation Safety Agency have developed detailed safety standards and monitoring systems to reduce the risks in operations and guarantee high safety performance rates in the aviation industry. Even with such advances, safety incidents and accidents sometimes take place, thus emphasizing the fact that the analysis of the underlying factors, which affect safety outcomes, is necessary (Vaugeois, 2019).

Maintenance of aircraft is essential in maintaining the airworthiness and operational reliability of aircraft. Maintenance activities entail inspection, repair, adjustment and preventive measures which help to make aircraft systems work within the parameters of regulatory and manufacturer requirements. Since the maintenance procedures have a direct impact on the performance and the structural integrity of the aircraft, even the slightest mistakes or missed steps during the maintenance operations may cause critical implications on the work. It is due to this fact that aircraft maintenance organizations must comply with stringent regulatory provisions and quality assurance procedures to avoid maintenance-related breakdowns (Paidisetty et al., 2024).

Nevertheless, studies have indicated that technological safeguards cannot help to reduce maintenance errors on its own. Human and organizational condition usually has a strong impact on the appearance of such errors. Maintenance technicians are often faced with complicated working conditions where working hours are time-constrained and they work through shifts, with tight schedules and complicated technical duties. Such circumstances may precondition the risk of human error, especially in the situations, when organizational mechanisms fail to support communication, training, and engagement of the employees.

This has led to the realization that learning the organizational setting of maintenance workers is considered a key focus of aviation safety studies (Prasad et al., 2024).

In this context, the term safety culture has become one of the keystones of the competent safety management. The term safety culture is used to describe the common values, beliefs, attitudes, and practices that determine the way individuals and organizations approach and go about managing safety in their day-to-day activities. Having a robust safety culture leads to open communication, never-ending learning, and proactive reporting of the safety concerns, which allows organizations to recognize and avert the risks before they evolve into an incident or accident. The promotion of a positive safety culture in the aircraft maintenance setting is thus crucial to minimize the number of errors, enhance safety performance, and increase the overall organizational reliability (Bisbey et al., 2019).

## 1.2 Problem Statement

Although the aviation technology and the introduction of the all-encompassing regulatory measures have been progressing consistently, the errors associated with maintenance remain one of the constant threats of the aviation system (Suebsuwong, 2024). Contemporary airplanes represent sophisticated technological systems and they demand rigorous and uniform procedures of maintenance so that their reliability in terms of operations can be the order of the day. Nevertheless, aviation accident investigations have shown on numerous occasions that maintenance operations may still assist in causing safety events when the correct procedure is not applied or when some mistakes happen during inspection or repair operations or installation. Compared to operational errors that happen during the time of flight, maintenance ones can go unnoticed until the plane is put into action again, which further magnifies the possible impact of failure to find the causes of errors as soon as possible (Olaganathan, 2024).

The nature of the aircraft maintenance operations implies that the safety performance can and is impacted by both the technical competence and the organization as a whole within which maintenance personnel work. Workers in maintenance companies are often subjected

to the high workload, work stress, and technical complexities (Timjerdine et al., 2024). The structure of organization should communicate, train, and engage employees in the workflow in such environment and its influence on the understanding, interpretation, and application of safety procedures in the daily work may be significant. Organizational practices can either enhance commitment of employees towards safety or they can be the cause of unintentionally creating an environment that leads one to commit more errors. As such, the concept of employing the internal organizational dynamics to improve the safety behavior of the employees is critical in enhancing the overall safety outcomes (Nævestad et al., 2018).

One more significant problem is the lack of proper empirical research, specifically, aircraft maintenance organizations. Although a significant focus on aviation safety research has been on flight operations and the manner in which pilots make decisions, limited literature has been done to study the effect of organizational variables on safety culture in a maintenance context. The maintenance workers are subject to various conditions of work than the flight crew such as shift work, hangar conditions and task-based technical work. Consequently, other fields of aviation might come up with findings that do not give a clear picture of the reality of maintenance work. The absence of specific empirical data makes it hard to determine the most effective internal practices fostering safe behaviors among employees as it would be by the maintenance organizations (Pratama & Caponecchia, 2025).

These reasons complicate the need to further research the topic of consideration of the relationship between the particular organizational factors and the influence on the safety culture in the aircraft maintenance setting. These relationships can help to illuminate valuable insights to organizations aiming to improve the quality of maintenance errors and enhance the safety performance of organizations by means of better organizational practices (Timjerdine et al., 2024; Olaganathan, 2024).

## 1.3 Aim of the Study

The main goal of the research is to examine the role of the chosen organizational variables in the development and formation of safety culture in aircraft maintenance companies.

Safety performance in complex technical settings like aviation maintenance can be viewed as both a response to compliance requirements and regulatory frameworks and the internal practices and internal frameworks which shape behavior among employees. Conditions within the organization may greatly influence the way the maintenance staff understands the importance of safety, shares possible risks, and takes part in the safety-related processes (Nævestad et al., 2018).

This study specifically examines three features in an organization, which include communication, training, and involvement. These factors are the significant elements of organizational effectiveness and are thought to be critical in defining how employees may feel towards safety and whether they are willing to operate in safe ways. Proper communication systems may be used to ensure that safety information is exchanged in a timely manner and that the competency of the personnel to undertake the maintenance as safe activities is undertaken through well laid down training programs. On the same note, the engagement of the employees in safety-related procedures can prompt them to be more responsible, report more actively, and engage in the process of constant safety enhancement (Bah et al., 2024; Paidisetty et al., 2024).

Analyzing the aspects with the concept of aircraft maintenance organizations, the study will help define where these aspects are related to the formation of the positive safety culture. It is believed that the results will give empirical information that can empower organizations to improve their internal practices that enhance safer maintenance operations (Truong and Lee, 2025).

## 1.4 Research Objectives, Research Questions and Hypotheses

This study aims to examine the effect of a number of organizational factors on the formation of safety culture in aircraft maintenance organizations. The study draws from literature on aviation safety, organizational behavior and safety management systems and targets organizational aspects with a high frequency of association to safety-related attitudes and operational performance, namely communication, training and employees involvement. All

the factors were chosen because they are fundamental organizational mechanisms that convey safety expectations, build competencies and motivate employees to be active in safety-related activities.

The first study aim is to explore the importance of communication to the creation of a safety culture in aircraft maintenance settings. Communication is seen as critical to convey safety information, report operational issues and coordinate maintenance work. Therefore, the initial research question aims to find out the effect of communication on the safety culture in aircraft maintenance organizations. The hypothesis for this study is that, based on the theoretical and empirical literature reviewed in the previous chapter, the following hypothesis is put forward:

**H1: Safety culture is positively influenced by effective communication.**

The second goal is to explore the impact of training on safety attitudes and behaviors of employees. Training is a basic component of the organisation that enables maintenance staff to develop technical expertise, safety awareness and procedural knowledge. As continuing education is a major concern in the aviation maintenance industry, the second research question relates to the effect of training on work attitudes and behaviors of employees regarding the safety of the job. Hence, the following hypothesis is put forward:

**H2: Safety culture is positively impacted by training quality.**

The third objective is to assess the contribution of employee involvement to the development of safety culture. It is often considered a key component of proactive safety management by having employees involved in safety discussions, reporting, and organizational decision making. Hence, the third research question explores how much employee involvement contributes to the safety culture in aircraft maintenance companies. The hypothesis, based on the literature reviewed, is that:

**H3: The employee's involvement plays a positive role in safety culture.**

The whole set of objectives, research questions and research hypotheses constitute the analytical framework of the research in this study, and this serves as the basis for the empirical investigation, which is presented in the next chapter on methodology and data analysis. The study aims to explore these relationships to determine which organizational

elements have the most influence on safety culture and offer evidence-based suggestions for aircraft maintenance organizations wanting to improve their safety.

## 1.5 Significance of the Study

The current research work is relevant to the larger body of literature in the sphere of aviation safety studies because it addresses the organizational factors that can potentially affect the formation of the safety culture in the field of aircraft maintenance. Although the concept of safety culture has long debated in aviation research, much of the literature available has historically focused on flight operations, cockpit decision-making and pilot performance. As a result, the number of empirical studies that directly deal with the organizational circumstances that determine safety culture in maintenance environments is relatively small. With its emphasis on communication, training, and employee engagement, the study will contribute to the current body of knowledge by offering empirical evidence of the ways in which the internal organizational practices can influence the safety-related attitudes and behaviors of the maintenance personnel.

In addition to the theoretical contribution, the study is also practically relevant to maintenance organizations of aircraft. Knowledge of organizational processes involved in facilitating or obstructing the establishment of a robust safety culture can help the management develop more effective internal policies, training programs, and communication programs. These advancements can eventually lead to better maintenance practices and minimization of operation risks.

Lastly, the results can also be applicable to the aviation regulators and policymakers tasked with the responsibility of monitoring safety management activities in the industry. The information obtained during the research may help to develop more specific regulatory policies and organizational suggestions that will help to enhance safety-focused behavior in aircraft maintenance.

## 1.6 Structure of the Dissertation

The present dissertation consists of five main chapters, each adding incrementally to the discussion of the organizational factors and safety culture in aircraft maintenance organizations. The overall structure is also logical, starting with the theoretical background of the study, then moving onto the empirical study, analysis of the data, discussion of the findings and the conclusions.

In Chapter One, the general background of the research is introduced, and the significance of aviation safety is discussed, and the role of aircraft maintenance in making the aircraft reliable to maintain its operations is discussed in the critical way. The chapter introduces the background of the study, research problems, aim and objectives of the research, research questions and hypotheses. It also provides background information on the importance of the study and why the three organizational factors of communication, training, and employee involvement were analyzed.

Literature review and theoretical framework of the dissertation is given in Chapter Two. The chapter reviews the literature on safety culture in aviation and aircraft maintenance organizations critically. Organizational communication, training practices and employee involvement are emphasized as important factors of safety-oriented behavior. In addition, the chapter covers the Swiss Cheese Model, High Reliability Organization Theory, and Safety Climate Theory that will form the theoretical basis of the study. The conceptual research model is also presented along with the identification of the major literature gaps which justify the need for the present empirical study.

The methodological approach that was taken in the study is explained in Chapter Three. The chapter specifically discusses quantitative research design, the target population and the sampling strategy used to collect the data. It also explains the process for creating questionnaires, the online survey and the statistical tools used for the analysis of data. The chapter also provides an explanation of how to use SPSS AMOS software for Reliability analysis, Confirmatory Factor Analysis and Multiple Regression Analysis. Ethical issues related to anonymity, voluntary participation and research integrity are finally discussed.

The empirical results of the research are presented in Chapter Four. The first analysis concerns the demographic features of the sample, in order to give an overall picture of the

composition of the sample. This is followed by descriptive statistical analysis, the reliability test, the result of the Confirmatory Factor Analysis and the Multiple Regression Analysis. The statistical analyses of the research hypotheses are also included and enable the study to assess the effect of communication, training and employee involvement on safety culture in aircraft maintenance organizations.

Finally, Chapter Five provides a discussion of the results of the study in terms of literature and theory. The chapter explains the findings of the study, offers practical and managerial implications, and provides a discussion of the role organizational practices can play in creating a more positive safety culture in the aircraft maintenance environment. Furthermore, the research study has limitations that are recognized and suggestions are made for future studies. The dissertation ends with a summary of findings and the overall contribution of the dissertation to aviation safety and organizational research.

# 2. Literature Review

## 2.1 Safety Culture in Aviation

The idea of the safety culture has grown to be a key component of modern aviation safety management and can be considered as the response to the shift towards the more complex perception of safety issues based on organizational values, behavior, and structure as the factors that precondition the emergence of safety results. Safety culture is the common set of beliefs, norms, and practices adopted in an organization that dictate approaches to understanding safety, its importance, and the manner of its application in everyday operations (Bisbey et al., 2019). It involves the attitude of the management and the employees to safety responsibilities, and the degree to which the safety is incorporated in the decision-making process. The aviation context extensively views safety culture as the key to avoiding the occurrence of operational errors and preserving the important role of safety as one of the priorities of the organization instead of a procedure (Prasad et al., 2024).

Another definition that is frequently referred to is safety culture as the aggregate result of individual and group values, attitudes, competencies, and behavior patterns that define commitment to, and the expertise of, health and safety management of an organization (Yorio et al., 2019). Regarding aviation setting, this idea goes beyond the observation of technical protocols and regulations, placing more emphasis on the need to actively respond to matters of safety. A good safety culture promotes transparency, incident learning and willingness of workers to report the risks or errors without accompanying fear of unfair treatment. This view acknowledges that formal rules are not the only determinants of safety performance, and informal organizational processes that define how people act in operational environments also influence it (Vierendeels et al., 2018).

Safety culture has been noted to be an imperative aspect of a wider safety governance system by international aviation authorities. Safety culture has become an inherent element of the international aviation safety policy as defined by the International Civil Aviation Organization (Pratama & Caponecchia, 2025). ICAO facilitates the creation of favorable safety cultures in aviation organizations by fostering leadership commitment, open communication, lifelong learning as well as effective management of safety risks. As per

ICAO guidance documents, the mature safety culture is defined as organizational transparency, trust of the employees in safety reporting mechanisms, and the management that places a high priority on safety in its operations in addition to efficiency (Rodrigues & Filho, 2025). Such a framework emphasizes the necessity of matching organizational structures, organizational policies and practices with safety goals.

In this wider context, the introduction of Safety Management Systems (SMS) has emerged as one of the important strategies of operationalizing the safety culture in aviation organizations. SMS is a formalized and organized method of dealing with safety risks by implementing organizational policies, risk assessment procedures, safety assurance mechanisms, and safety promotion activities. Instead of merely adjusting to the prescriptive regulations, SMS promotes organizations addressing the hazards, assessing possible risks, and taking preventive actions prior to an incident taking place (Al-Dmour et al., 2025).

A successful SMS is done in four interrelated elements, which include safety policy, safety risk management, safety assurance, and safety promotion. Safety policy defines the organizational dedication towards safety and safety risk management is dedicated to detection and reduction of operational hazards. Safety assurance keeps safety controls effective over a period and safety promotion focuses on training, communication and organizational learning. These factors combined contribute to the creation of a context where safety will be integrated into the daily practice of operations (Khalid et al., 2021).

The relevance of safety culture and SMS in the aviation industry is especially high. Although SMS offers the structural and procedural underpinning on the management of safety, much of the success of this system relates to the safety culture of the organization. Even the scaling down of safety management systems which are well designed can be rendered useless without the presence of a conducive culture that would support transparency, responsibility, and ongoing improvements. As a result, safety culture development has become a highly important requirement of the effective introduction of safety management practices in all aviation operations (Adjekum & Tous, 2020).

## 2.2 Safety Culture in Aircraft Maintenance

The maintenance of aircraft is one of the most tech-intensive and operationally important areas in the aviation sector. Maintaining activities compared to flight operations are usually performed under different operational conditions (when compared to highly structured setting which is monitored) and involve multifaceted technical activities coupled with operating tight operational schedules and intersecting systems. The idea of safety culture emerges with an even greater degree of relevance in this situation because maintenance workers should fully show high rates of accuracy, responsibility, and procedure compliance to maintain the airworthiness of aircraft in the future (Abdallah & Fan, 2020).

One aspect that has a major effect on maintenance safety outcomes is the human factor. The research on human factors in the maintenance of the aviation industry analyzes the influence of physical, mental, and organizational factors on the performance of the maintenance personnel (Dereje et al., 2025). Technical environments are often associated with time pressure, shift work, fatigue, and strenuous technical processes, which maintenance technicians often work in. These circumstances can also add to the risk of human error provided that the organizational protective measures are not taken. Poor communication, lack of documentation, poor allocation of tasks and inadequate supervision by the supervisors are some of the factors that can also contribute to the weaknesses in the operations. Therefore, the interplay between human performance and organizational structures is a crucial factor that can be used to enhance safety in maintenance operations (Haruna and Taiwo, 2024).

In order to deal with such difficulties, the aviation sector has come up with systematic methods of identifying and controlling errors that are related to maintenance. The Maintenance Error Decision Aid (MEDA) is one of the best-known frameworks, initially created by Boeing as a systematic way to research the maintenance events and determine the cause of those events. MEDA enables an organization with a unified approach in analyzing maintenance failures, and it does not only consider the single actions but also the wider conditions of the organization, which could lead to such occurrences. It is point-based on the framework that mistakes are frequently caused by a combination of various

interdependent influences, such as the work environment, organizational processes, communication, and training (Newman and Scott, 2022).

The MEDA model facilitates a non-punitive investigation method that enables organizations to explore structural factors leading to maintenance errors instead of blaming individual technicians that cause the error. Understanding the contributing factors like poor documentation, lack of training or poor supervision, the maintenance organizations can take corrective actions to ensure that operational procedures are fortified and chances of future mistakes are minimized. This view corresponds to the current safety management policies that put the focus on incident-driven learning and the enhancement of the organizational processes (Key et al., 2022).

Historical studies of aviation accidents also pointed out the possible impact of the errors associated with maintenance in cases where the organizational safety is inadequate. There are several documented aviation accidents that have revealed how gaps in the maintenance processes, inspection, or communication systems can be the cause of critical safety incidents (Stroeve et al., 2022). To illustrate the point, the structural issue that the Aloha Airlines Flight 243 incident demonstrated was the result of poor inspection protocols concerning structural fatigue (Freeman, 2021). Equally, the accident that occurred with Japan Airlines Flight 123 crash was attributed to improper repair, which was conducted many years before the accident. The events described can demonstrate that the problems related to maintenance can be hidden over long periods of time before they can become operation failures (Insley and Turkoglu, 2020).

The cases highlight the need to enhance safety culture among aircraft maintenance organizations. A safety conducive atmosphere promotes careful observation of procedures, voluntary reporting of hazards and organizational learning. Smart combination of human factors awareness, systematic error control mechanisms like MEDA, and efficient organizational supervision helps maintenance organizations to considerably improve their ability to detect risks and mitigate maintenance-related accidents before they undermine flight safety (Newman and Scott, 2022; Key et al., 2022).

## 2.3 Organizational Factors Affecting Safety Culture

### 2.3.1 Communication

Communication is a key organizational process that involves transfer, interpretation and operationalization of safety-related information in aviation maintenance settings. In extremely technical and safety-sensitive fields like aviation, the quality of communication processes directly affects the level of knowledge about procedures, hazards, and coordination of the complex maintenance processes among personnel (Kimeria et al., 2022). The functioning of effective communication systems facilitates the delivery of timely operational information thus supporting informed decision-making and mitigating the chances of misconceptions which can lead to safety being compromised (Öz, 2024).

A key element of safety communication deals with the aspects of availability and efficiency of formal means of communication in maintenance companies. These mediums are generally in form of technical documentation, maintenance manuals, safety briefs, internal bulletins and formal safety meetings. These mechanisms equip the technicians and supervisors with the information that they need in terms of maintenance processes, safety updates, and operational needs. When these channels are transparent, available, and constantly utilized, they help to create a common perception of safety priorities at various organizational levels (Pratama & Caponecchia, 2025).

The other important aspect of communication in safety-oriented organizations is the existence of sound safety reporting mechanisms. With the help of these systems, maintenance workers can share the information about hazards, procedure abnormalities, or operational issues without any fear of adverse outcomes (Bhattarai et al., 2022). A good reporting system will help the organizations to recognize the possible risks early enough in advance and allow the organizations to tackle the problems before they lead to safety incidents. Transparent reporting environment also helps to learn by operational experience and work towards the constant improvement of safety practices (Bhattarai et al., 2022).

Lastly, communication between management and technicians is also crucial in defining the awareness of safety in the organization. The open and two-way communication between operational teams and management allows organizations to grasp frontline issues more effectively and make management decisions in connection to the realities in operations

(Pratama & Caponecchia, 2025). The active and open nature of such communication flows helps to enhance organizational trust and increase the willingness to comply with the requirements of ensuring high safety levels of aircraft maintenance operations (Kimeria et al., 2022).

### 2.3.2 Training

Training is an essential organizational process that involves acquiring technical knowledge, procedural and safety awareness by aviation maintenance personnel to carry out complex maintenance tasks (Timjerdine et al., 2024). In the aircraft maintenance setting, the competency of the technicians and engineers that inspect, conduct repairs and certify the aircraft systems are critical in the reliability of the operational outcomes. In turn, well-organized and intensive training tools are an essential element of organizational solutions to maintain high standards of operational safety (Olaganathan, 2024).

One of the main aspects of training within the maintenance organizations concerns the establishment of technical competence. Maintenance workers should have an excellent knowledge of aircraft systems, diagnostic processes, and maintenance methods to be able to carry out their work (Gudmundsson, 2019). The training on technical competence will make sure that employees are conversant with aircraft technologies, manufacturer requirements and regulations that govern maintenance practices. As the modern aircraft systems are under constant technological development, the acquisition and strengthening of specific technical knowledge is a precondition to the accuracy and reliability of operations (Barnett, 2020; Vaugeois, 2019).

Besides technical competence, safety-oriented training with a focus on risk awareness, compliance with procedural compliance, and human-centeredness in the context of maintenance activities should be offered in organizations as well (Kimmeria et al., 2022). Safety training programs are expected to not only improve the skill of employees to identify possible hazards, to use the laid down safety procedures and to be aware of the bigger picture of the consequences of maintenance decisions on the general flight safety. With the help of learning structured activities, the personnel are encouraged to acquire a proactive attitude towards risk identification and prevention (Almusaed et al., 2025).

Continuous professional development is another necessary element because it helps to maintain professional competence in the long term. The aviation maintenance workers work in a setting with dynamic technologies, revised regulations, and operational practices (Olaganathan, 2024). Continuous training programs enable the employees to keep up with the latest operations, safety standards, and technologies. Through continuous learning, organizations can enhance professional responsibility and help to make operational practices safety-focused practices more durable over time (Pratama & Caponecchia, 2025; Timjerdine et al., 2024).

### 2.3.3 Employee Involvement

One of the most important organizational aspects that can lead to the creation and maintenance of safety culture in the environment of complex aircraft maintenance activities is its involvement of the employees (Paidisetty et al., 2024). People will be more responsible towards operational standards and protection against possible hazards in the organizations where employees are actively involved in the safety-related process. Engagement in safety operations promotes the personnel to go beyond merely following procedures and taking an active part in the identifying, reporting, and mitigation of safety-related issues in their workplace (Paidisetty et al., 2024).

One of the key features of employee involvement is associated with participation in the safety decision-making processes. Organizations will gain much when maintenance staff are given a chance to offer their frontline experience in terms of safety discussions, risk evaluation, or process enhancement. Technicians and engineers also have specific understanding about the maintenance processes and the limits of operations, which can assist in establishing effective solutions to the safety problems. The given participatory strategy can also promote the feeling of ownership and accountability of safety outcomes among employees (Paidisetty et al., 2024).

The other important factor involves involvement in safety reporting. The desire of employees to report the hazards, inconsistencies in procedures, and anomalies in operation is critical towards having an effective safety management environment. As soon as the personnel engage in reporting, the organization stands in a better position to notice the

emerging risks and put preventive measures in place before the incident takes place (Bisbey et al., 2019).

Lastly, employee empowerment is very important in reinforcing safety-oriented behavior. Empowerment means enabling employees with the power and the trust to raise safety issues, challenge unsafe lifestyle and play a role in organizational learning. By making employees feel that their input is appreciated and honored, they will be more inclined to participate constructively in safety programs, thus supporting the idea of sharing a common goal of safety maintenance operations (Naji et al., 2022).

## 2.4 Theoretical Framework

The theoretical foundation for the present study is built on three theories that have been widely used in safety management research: the Swiss Cheese Model, the High Reliability Organization (HRO) Theory and Safety Climate Theory. These frameworks offer a detailed insight into the role of organizational processes, employee behavior and management practices and how they affect safety in the context of aircraft maintenance organizations.

The first theoretical framework that will be used in this study is the Swiss Cheese Model created by Reason (1990; 1997). This model suggests that accidents are unlikely to be the result of a single human failure. Rather, adverse events arise when several weaknesses in the organization coincide and enable hazards to progress through multiple lines of defense. The Swiss cheese model is a way to understand the ways that organizations provide protection, as it can be thought of as a series of slices with holes. The weaknesses may be due to lack of communication, training, supervision, procedure or due to organizational decisions. The risk of an accident greatly rises when the holes in various defensive layers overlap. Instead of focusing on the individual, the model proposed to look for latent conditions within the organization that open up opportunities for failure. The Swiss Cheese Model is especially relevant in aircraft maintenance because in this context, a maintenance error may be caused by a combination of technical, human and organizational factors. As a result, communication systems, employee ability and involvement in safety activities can

be seen as critical organizational obstacles that lessen the chances of maintenance-related incidents (Reason, 1990; Reason, 1997).

The second theoretical perspective is the High Reliability Organization (HRO) Theory of Weick and Sutcliffe (2007), which was first developed by Roberts (1990). The theory of accidents is a study of how organizations that work in areas of high hazard can have very few accidents. From this point of view, highly reliable organizations have a number of unique behaviors, such as always thinking about what went wrong, not wanting to simplify the meaning of operational events, being sensitive to the ongoing operations, being committed to being resilient, and deferring to expertise. HRO theory is not focused on adherence to procedures but on ongoing learning, organizational awareness, and anticipating risk. These principles are especially critical in aircraft maintenance organizations, where workmen work in a complex technical setting where even a small error can result in serious repercussions. Organizational reliability is a direct result of effective communication, ongoing training, and active participation from employees, which all increase employee situational awareness and help mitigate risk by fostering proactive responses to new risks (Weick & Sutcliffe, 2007; Roberts, 1990).

Safety Climate Theory is the third theoretical perspective of the study. Safety climate was first defined by Zohar (1980) as the perceptions held by employees about the significance that management gives to safety in the workplace. Safety climate is the employees' perceptions of management priorities, policies, procedures, and behavior related to safety, while safety culture is more deeply entrenched in the organization values and assumptions. Many studies have shown that positive perceptions of safety climate correlate well with employee safety behaviors, hazard reporting, adherence to safety procedures, and fewer accidents (Zohar, 1980; Neal & Griffin, 2006). In maintenance organizations, staff monitor on a regular basis whether safety really is a priority of management or whether organizational decisions are being driven by production pressures. The quality of communication, training opportunities and employee involvement in safety-related activities are significant factors that influence these perceptions. Thus, safety climate can offer a useful tool to gain insight into the relationship between organizational practices and safety attitudes and behaviors for aircraft maintenance workers.

These three theoretical perspectives can be used together to explain the development of safety culture in aircraft maintenance organizations in a multidimensional way. The Swiss Cheese Model describes why organizational failures can lead to safety failures, HRO Theory describes the characteristics of organizations that must have high levels of reliability, and the Swiss Cheese Model of Safety Climate Theory describes how employees' perceptions of organizational commitment to safety shape their behavior. The cross-over between these frameworks offers good theoretical support for the analysis of how communication, training and employee involvement influences safety culture and the conceptual model used in this study.

## 2.5 Conceptual Research Model

The theoretical research design that was created to study is a conceptual scheme that gives a systematic expression of the associations among the chosen organizational determinants as well as safety culture in aircraft maintenance institutions. Empirical studies typically involve the use of conceptual models to portray theoretical assumptions on which the study is based and clarify the way various variables are likely to interrelate within the analytical construct (Sas et al., 2021). The model applied in the framework of the current research concentrates on three organizational aspects, namely, communication, training, and employee involvement, and discusses their possible impact on the formation of safety culture in maintenance staff (Abdallah and Fan, 2020).

The model suggested presupposes that the work of the maintenance personnel is pre-conditioned by the organizational practices that define the environment and explain how the employees perceive the safety-related tasks (Dereje et al., 2025). Communication is one of the important processes by which the safety information is delivered, and the operational expectations are explained. With well-operating communication systems, employees can possibly have more access to important information, enhanced coordination of operations during the maintenance activities, and a clearer perspective of safety operations. In the conceptual framework, communication is, therefore, predicted to serve as a significant precursor of safety-oriented organizational behavior (Kavalela et al., 2024).

Training is another important aspect that is included in the research model. The maintenance staff should not only be competent technologically but also understand the safety principles and standards of operation. Training programs that are structured help the employees be well equipped with the knowledge and skills which they must execute the maintenance procedures accurately and with the awareness of possible risks (Newman and Scott, 2022). The application of training in this model is based on the notion that training can be regarded as a resource of an organization that contributes to building safe working practices and strengthening professional responsibility (Haruna and Taiwo, 2024).

Employee involvement is the third variable that was incorporated in the model. The operational experience of technicians and engineers is often used by maintenance organizations in identifying the possible safety issues and assisting in improving the processes. Employees can become more responsible towards the need to uphold safe operational practices when they are actively involved in safety-related conversation, reporting mechanisms, and organizational initiatives. The engagement of employees thus is a condition of an organization that can be used to enhance unity of commitments towards safety (Kimeria et al., 2022).

These three independent variables, which are communication, training and participation of the employee are theorized within the conceptual framework of this study to affect the dependent variable, which is the safety culture. The model presupposes that the enhancement of these organizational dimensions can lead to building a more robust safety culture through the formation of the perception, attitudes, and behavior of the employees concerning safety. Such a conceptual framework is the foundation of the empirical study in the further chapters of the work (Insley and Turkoglu, 2020).

## 2.6 Literature Gaps and Critical Evaluation of Existing Research

Despite the extensive discussion of the notion of safety culture in the aviation-related research, there are other significant gaps and limitations in the current literature, especially when it comes to aircraft maintenance settings. Much of the academic literature on the topic

of aviation safety has mostly focused on flight operations, pilot decision making, and cockpit management, with relatively minor focus on the topic of maintenance operations, even though they play a vital role in aircraft airworthiness and operational reliability. Such an imbalance has led to an empirical lack of knowledge about the role of organizational practices in the safety culture, in maintenance context. As is stressed in the literature, a great number of studies deal with aviation safety on a general industry level without paying enough attention to the operational nature and risk profile of maintenance operations (Pratama & Caponecchia, 2025; Suebsuwong, 2024).

The other major limitation is the methodological procedures that were used in earlier research. Several studies exploring safety culture also depend largely on discussions on the concept or qualitative studies in lieu of quantitative empirical models that can be used to test a causal relationship between the organizational variables. As an example, studies investigating safety culture framework tend to be more interested in theoretical consolidation of the available models without providing an empirical analysis of organizational determinants of safety behavior in the operational setting (Bisbey et al., 2019; Vierendeels et al., 2018). Though these works are helpful in conceptual development, they offer a little empirical data on the mechanisms by which organizational variables influence the construction of safety culture.

Moreover, the current literature often studies safety culture in a general organizational context and does not single out the exact organizational mechanisms that could contribute to the safety-related attitudes and behavior of employees. The issue of organizational communication, quality of training and participation of employees are usually covered as general aspects of safety management systems but not empirically tested as variables that can influence safety culture. Research on the topic of safety management practices is more likely to focus on regulatory frameworks or system-level strategies in comparison to the analysis of the effects of everyday organizational interactions on employee safety perceptions (Adjekum and Tous, 2020; Kimeria et al., 2022). Consequently, the comparative impact of these aspects of the organizations has not been studied thoroughly in aviation maintenance settings.

The other gap that is also important has to do with the scarcity of studies that targeted the views on the maintenance personnel themselves. Most of the studies are based on

managerial or organizational level data and not the views of technicians, engineers and supervisors who are more directly engaged in the maintenance activities. Nevertheless, operational issues, communication barriers, and procedural inconsistencies that could affect safety outcomes are also critical and may be known to frontline employees more often (Haruna and Taiwo, 2024; Dereje et al., 2025). The current body of research can be insufficient to capture the significance of organizational dynamics influencing the safety culture in practice unless the perspectives of these operational actors are considered.

Lastly, it would be desirable to have more combined empirical models that will study the interaction of various organizational variables in the maintenance environment. Although earlier studies have recognized the value of communication systems, training programs and employee involvement, very few studies have been able to conduct a combined analysis of the elements in one analysis framework. Thus, the available literature does not give much information on how these organizational aspects can be used together to develop a culture of safety within aircraft maintenance organizations (Timjerdine et al., 2024; Truong and Lee, 2025).

These gaps need to be addressed to achieve progress in knowledge and applications of safety culture in aviation maintenance. The current study aims to make a contribution to the overarching picture of organizational practices and maintenance settings through the empirical investigation of the impact of communication, training, and involvement in employees on the safety culture.

# 3. Research Methodology

## 3.1 Research Design

The current research implements a quantitative research design to be able to study the connections between the chosen organizational variables on the one hand, and safety culture in the aircraft maintenance organizations systematically. Quantitative research is suitable especially where the aim is to measure variables, test theoretical relationships and evaluate hypotheses statistically. This method allows the researcher to see patterns, evaluate the relationship between variables, and make empirically supported conclusions on the research questions being studied by using structured data collection and numerical measurement (Fischer et al., 2023).

The quantitative approach can be utilized in the framework of the current study to investigate how the organizational practices can affect the perceptions and attitudes of the employees towards safety. Quantitative approaches can operationalize the following key constructs: communication, training, employee involvement, and safety culture, which are measured indicators and can be statistically analyzed. The approach to methodology will assist in testing the hypotheses about research formulated in the previous chapter and help to determine the possible association between the variables that are formed in the conceptual model (Nunen et al., 2022; Churruca et al., 2021).

A survey-based research method is used in collecting the data used in the study. The use of surveys in organization and safety research is high due to its capability of enabling researchers to collect standardized data of a relatively high number of participants under a structure. Using a questionnaire, the respondents will be required to rate statements associated with organizational practices and safety perceptions, usually on Likert-type scales. This approach will help to collect similar information based on the set of individuals who must operate in similar operational conditions in a systematic manner (Forza & Sandrin, 2023).

The survey technique is especially appropriate in this study, as it will enable the maintenance staff to give their perceptions of organizational situations that can impact safety-related behavior. The study will gather input of those who are directly engaged in maintenance

activities, so the study will capture experience, operational experience. The derived data presents the empirical basis of further statistical analysis, which will be performed with the help of statistical software to measure the correlations suggested in the research model (Sammut et al., 2021).

## 3.2 Research Population

The population of the current research is composed of professionals engaged in the aircraft maintenance industry who are directly or indirectly involved in the processes of operations that relate to maintenance and the processes of safety management. The maintenance processes of aircraft involve a concerted effort of various professional functions, which promote general reliability and airworthiness of the aircraft systems. As a result, the study of safety culture in this setting should involve people holding various technical and managerial roles that combine their efforts to form maintenance practices and the decisions related to safety (Tyagi et al., 2023).

The main section of the population being considered in the research is that of the aircraft maintenance technicians who are tasked with carrying out inspection, repair and replacement duties on the components and systems in the aircraft. These are the professionals who are on the front line in maintenance processes, and they are the ones who are directly involved in the implementation of maintenance tasks based on the set technical standards and regulations. Their day-to-day operation experience gives them a good understanding of the real-life situation in which maintenance operations are undertaken (Jong et al., 2023).

Aeronautical engineers are also a part of the population, as they are involved in the technical control of the maintenance processes, system diagnostics, and the analysis of maintenance processes. Engineers are also highly involved in deciphering engineering documentation, assessing engineering requirements, and assisting the execution of the proper maintenance solutions (Peña, 2025).

Besides this, maintenance supervisors are included in the research population. The functions of these people are to organize maintenance work teams, monitor the work process, and make sure that maintenance activities are performed by organizational procedures and policies. The positions they are placed in put them on the contact point between the operational employees and the management (Rafiq, 2025).

Lastly, quality and safety managers are part of the population, and they are to counter compliance with safety standards, internal audits and assisting in the execution of safety management practices in maintenance organizations. This inclusion of the participants of these various professional occupations would seek to bring into the study a comprehensive outlook of organizational conditions that might be affecting the safety culture in aircraft maintenance settings (Nnaji and Karakhan, 2020).

## 3.3 Sampling Method

The sampling approach followed in the research is to ascertain the gathering of pertinent and significant data among people who have first-hand experience of aircraft maintenance procedures and the safety-related inter-organization procedures. Since the aviation maintenance industry is highly specialized, and the study aims to access an entirely random population of the maintenance professionals, the study is conducted using the non-probability sampling technique. A purposive sampling method combined with the convenience one is applied to sample out and recruit the right survey participants (Rahman, 2022; Pace, 2021).

The use of purposive sampling will be implemented to make sure that the respondents will have the professional experience necessary to give informed answers on the maintenance operations and safety practices in the organization. In this way, the researcher can purposely choose the participants who satisfy certain criteria, e.g., they must be engaged in aircraft maintenance process, be a technical supervisor, engineer, or safety manager. The study aims to collect reactions of those who act in the maintenance environment to obtain answers to

the subject of the study, given that they have some practical understanding of what organizational processes can affect safety-related behavior (Wassenhove et al., 2022).

Besides the purposive selection, some aspects of convenience sampling are also employed to enable the convenience selection of aviation maintenance community members (Obilor, 2023). Because the aviation industry has operational limitations and there are limited numbers of maintenance staff available to take part in the research, convenience sampling will be useful to the researcher to distribute questionnaire to individuals that are readily available and willing to participate in the research. This method is common in the study of organizations when the study population is very special and cannot be easily accessed by random sampling methods.

The study will have a target population of between 100 and 130. Such a sample size is deemed to be suitable for a quantitative survey study and offers an adequate sample to accomplish statistical analysis. Moreover, it suffices the application of multivariate methods and structural analysis procedures that will be implemented with the help of statistical software in the next phases of the research.

## 3.4 Data Collection Method

A questionnaire was used to gather data, with a focus on the relationship between organizational factors and safety culture in aircraft maintenance organizations. The use of questionnaires for surveys is common in the field of organizational and safety research due to the capacity to systematically gather standardized data from a large number of the respondents, while maintaining the uniformity of the process of measuring the data of all the respondents (Forza & Sandrin, 2023).

The questionnaire was developed, drawing on previous literature on safety culture, safety communication, employee involvement and organizational safety practice (Bisbey et al., 2019; Kimeria et al., 2022; Naji et al., 2022; Van Nunen et al., 2022). The instrument was divided into two parts. The first section consisted of demographic questions about gender, occupational position and professional experience. The second part consisted of items on

Likert scales related to the study constructs: communication, training, employee involvement, and safety culture. The complete questionnaire is presented in Appendix A.

Data was gathered using an online survey that was created using Google Forms. The online mode allowed for easy access for aviation maintenance personnel from various organizations and operating locations, and reduced geographical limitation. The survey link was sent to aviation maintenance personnel via a combination of professional networks, aviation maintenance networks, and industry communications.

The target group comprised aircraft maintenance technicians, aircraft engineers, maintenance supervisors and quality and safety managers. After data screening, a total of 130 valid responses were collected and saved for analysis. The online questionnaire allowed participants to fill it out when they were able to, and helped to attract workers from a variety of operational experiences.

Participants were told that the responses would be anonymous, and would only be used for academic research purposes, to encourage an honest and unbiased response. The process of data collection did not involve gathering any personally identifiable information.

## 3.5 Data Analysis Methods

The statistical software package SPSS Amos which are broadly used in quantitative research to analyze the relationships between latent constructs and test the theoretical models are used in the analysis of the collected data. With the help of these tools of analysis, the researcher will be able to conduct not only initial statistical analysis but also advanced structural modeling to verify the hypotheses that were formulated during the conceptual framework (Mustafa et al., 2025).

The initial phase of the analysis is the use of descriptive statistics to generalize the nature of the dataset. The frequency, the means, and standard deviations are descriptive measures through which one can receive an overview of the demographic profile of respondents and examine the overall distribution of responses throughout the questions of the questionnaire. Such a step will allow recognizing possible anomalies in the data set and getting a

preliminary idea about what participants think about the variables being studied (Cooksey, 2020).

After that, the internal consistency of the measurement scales is determined by taking the reliability test, that is, by Cronbach alpha coefficient. This statistical statistic determines the degree to which several items which are supposed to measure the same construct are showing the same response. The acceptable levels of reliability suggest that the questionnaire items are successful to represent the underlying variables used in the research model (Izah et al., 2023).

After the reliability assessment, the correlation analysis is done to assess the level of association among the key study variables. The given step presents initial evidence on the possible connections between organizational aspects and safety culture. Confirmatory Factor Analysis (CFA) to verify the measurement structure is done using AMOS. CFA also enables the researcher to determine whether the survey items observed are sufficient in capturing the latent constructs that make part of the conceptual model (Mustafa et al., 2020). Lastly, Multiple Regression is used to test the hypothesized relationship among the variables.

## 3.6 Ethical Considerations

Ethical integrity was a basic principle in the course of the research. The study was conducted within the bounds of ethical norms in social and organizational research, guaranteeing the respect of the rights, privacy and autonomy of the subjects in all aspects of data collection and analysis.

Anonymity of participants was ensured. No personally identifiable information was gathered on the questionnaire, such as name, contact information or employer-specific identifiers. All responses were anonymous and analysed in aggregated form using the online survey platform. Thus, the individual participants or their organizations could not be identified in the reporting of the findings.

All participation in the study was voluntary. Respondents were given an introductory statement before filling the questionnaire which explained the purpose of the research, the academic nature of the study and how the data collected in the research would be used. Completion of the questionnaire was deemed to be informed consent. It was also explained that the participants could leave whenever they wanted without any repercussions.

There was full confidentiality of data throughout the study. The collected data was only accessible to the researcher and the information was only used for academic purposes. No data were shared with third parties or used for commercial purposes.

Last but not least, the research followed the standards of honesty, transparency and academic integrity. The results were reported honestly and fairly, and not fabricated, falsified, or manipulated. Such ethical protections added to the validity of the research process and the trustworthiness of the study results.

# 4. Data Analysis and Findings

## 4.1 Demographic Profile of Respondents

This section outlines the socio-demographic profile of respondents to the study on the effect of organizational factors on the safety culture in aircraft maintenance organizations. This demographic analysis is especially noteworthy as it offers a picture of the professional makeup of the sample and helps to interpret the statistical results reported in the later sections. After data cleaning, 130 valid responses remained in the final set of data. The respondents were aviation maintenance professionals working in various roles in the aircraft maintenance environment.

Gender was the first demographic variable considered. As shown in Table 1, the average age of the sample was 42 years, with the average age for women being 41.4 years, and for men being 42.6 years. The sample consisted mainly of males, as is typical in the aviation maintenance industry. Of these, 117 (90.0%) identified as a male and 13 (10.0%) identified as a female.

| Gender | Frequency | Percent |
|---|---|---|
| Male | 117 | 90,0% |
| Female | 13 | 10,0% |
| Total | 130 | 100,0% |

**Table 1: Gender Distribution of Respondents**

Results show a significant gender disparity in the sample and confirm the male predominance of technical aviation maintenance careers. This distribution is consistent with aviation workforce trends found in previous studies in the industry and safety sectors. While it is still a relatively small number of women participating, gender-neutral inclusion helps to gain a wider perspective into safety perceptions throughout the maintenance workforce (See figure 1).

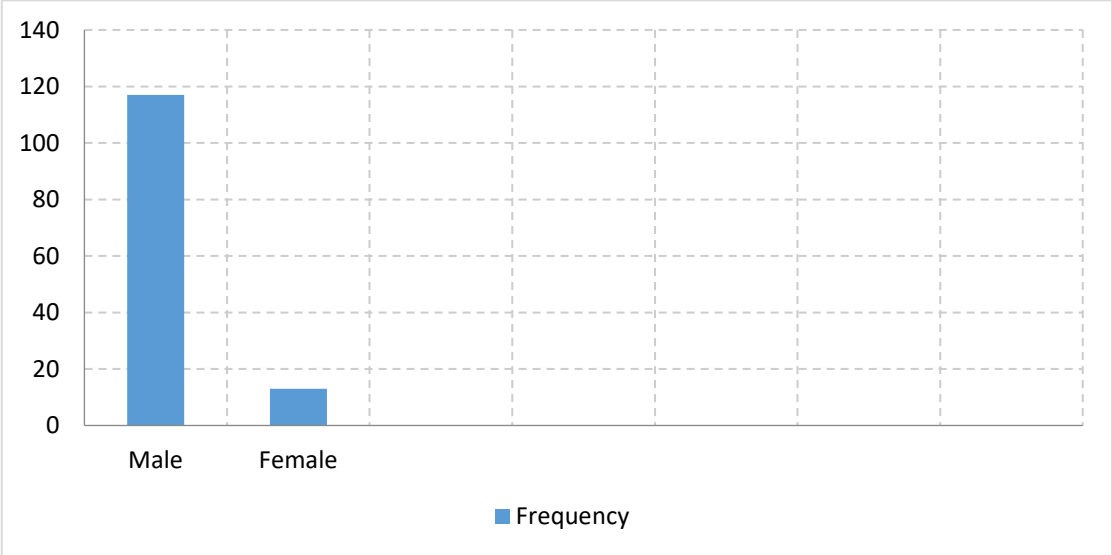


**Figure 1: Gender Distribution**

The second demographic variable looked into the respondents' years of experience in aircraft maintenance operations. Professional experience is especially pertinent in safety-related research due to the fact that staff members with varying operational exposure might have varying perceptions of organizational practices and safety procedures.

Table 2 shows that the largest number of respondents were those who have been in the job for 1-5 years, accounting for 47 (36.2%) of the respondents. Respondents who had 6–10 years of experience comprised 38 (29.2%) of the respondents. In addition, there was a significant number of very experienced respondents with over 15 years of experience (37, 28.5%). 8 respondents (6.1%) were categorized in the 11–15year age group.

| Years of Experience | Frequency | Percent |
|---|---|---|
| 1–5 years | 47 | 36,20% |
| 6–10 years | 38 | 29,20% |
| More than 15 years | 37 | 28,50% |
| 11–15 years | 8 | 6,20% |
| Total | 130 | 100,00% |

**Table 2: Experience of Respondents**

The distribution shows that the sample contains more recent employees and quite seasoned maintenance experts. This diversity helps to make the research findings more reliable as responses are based on perceptions gained because of differing levels of operational exposure and technical responsibility.

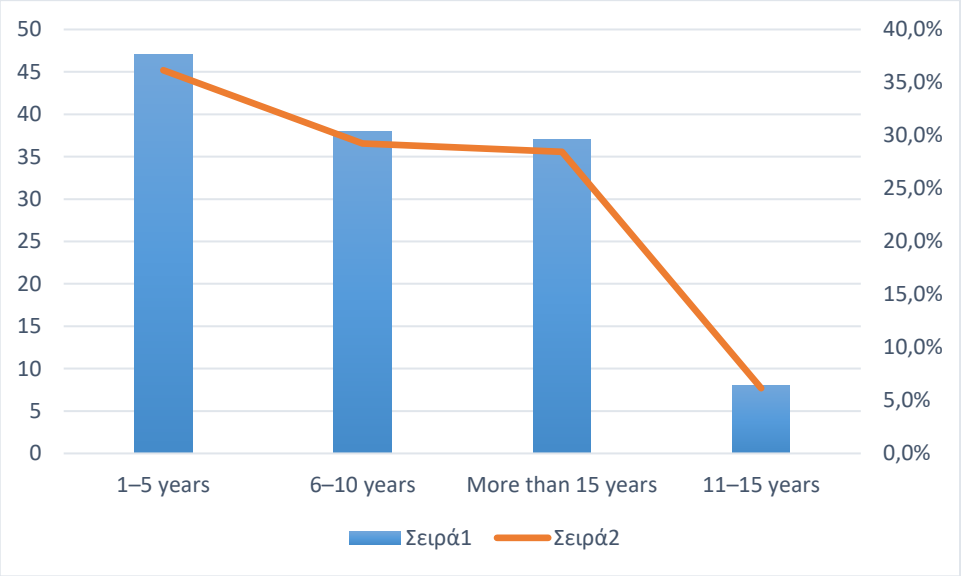


**Figure 2: Experience Distribution with %**

For the third demographic variable, the participants' role in their organizations was measured. As can be seen in the findings of Table 3, most of the respondents were directly engaged in operational maintenance activities.

Specifically, Aircraft Maintenance Technicians had the highest number of respondents, 55 (42.3%) of the total sample. Other (18.5%) was the second largest group, which consisted of specialized operational or technical roles not identified in the questionnaire. In addition, 16.9% (22) of the respondents described their occupation as Maintenance Supervisor and 16.2% (21) as Aircraft Engineer. Lastly, 8 (6.1%) were in Quality Manager roles.

| Position | Frequency | Percent |
|---|---|---|
| Aircraft maintenance technician | 55 | 42,3% |
| Other | 24 | 18,5% |
| Maintenance supervisor | 22 | 16,9% |
| Aircraft engineer | 21 | 16,2% |
| Quality manager | 8 | 6,2% |
| Total | 130 | 100,0% |

**Table 3: Position of Respondents**

The occupational distribution is highly skewed towards frontline technical staff directly engaged in aircraft maintenance activities. This is especially important for the study, since such workers have first-hand knowledge about organizational communication, training methods, employee participation in the workplace, and safety-related behaviors. Simultaneously, it brings supervisors, engineers and quality managers into the picture, which gives a wider organizational view on the implementation of safety culture in maintenance organizations.

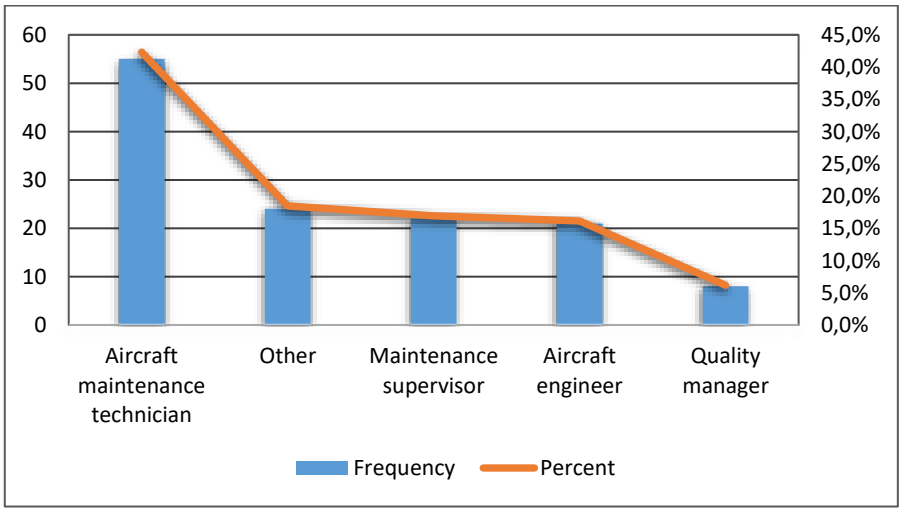


**Figure 3: Position Distribution with %**

The demographic analysis overall shows that the sample is well experienced in operation and is well represented in key aircraft maintenance roles. The characteristics of the respondents are therefore deemed suitable for studying the organizational aspects of safety culture in aviation maintenance settings.

## 4.2 Descriptive Statistics

Descriptive statistical analysis was used to analyze the central tendencies and variability of respondents' perceptions of communication, training, employee involvement and safety culture in aircraft maintenance organizations. Means and standard deviations were calculated for each of the questionnaire items ranked on a five-point Likert scale with higher scores reflecting greater agreement with the statement. The number of valid responses received were 130 and was considered adequate for further stages of reliability testing.

The results showed that participants have a positive attitude on the organizational factors studied. The mean scores of the communication-related variables were relatively high, implying that maintenance personnel feel the safety communication mechanisms in their systems are basically effective. Specifically, COM3 (that is, "Are employees encouraged to report safety concerns without fear of negative consequences") had one of the highest mean scores ($M = 4.11$, $SD = 0.97$) for the communication domain. The same was true for COM2, which is meant to be used between technician and supervisor, where the average score was very high ($M = 4.05$, $SD = 0.89$). The results indicate that communication is seen as an important part of operational safety and coordination in maintenance.

The overall score for the training construct showed the highest scores with all the variables analyzed. Training for TR4 (safety implications of maintenance errors) had the highest mean score for all the employees ($M = 4.47$, $SD = 0.71$) across the entire questionnaire. At the same time, the respondents had positive attitudes towards training programs that are adequate and updated regularly. The mean values for both TR1 and TR2 were above 4.20, with the majority of participants believing training practices have a positive effect on the

maintenance performance conducted in a safe manner. The relatively small standard deviations found within the training construct indicate that the participants' responses were relatively homogeneous, indicating a relatively concordant perception of the importance and effectiveness of training in aircraft maintenance organizations.

Employee involvement had moderately positive responses, although there was more variation than with communication and training. The lowest mean in the construct was for EI1: participation in safety-related discussions, M = 3.45, SD = 1.50, suggesting that opportunities for employees to participate in discussions relating to safety may be quite different across organizations. EI2 and EI3 showed higher levels of agreement, however, indicating that a large proportion of respondents believe that maintenance staff can help identify risk and provide procedural feedback. The relatively high standard deviations for some of the items related to employee involvement suggest that the employee involvement practices in the organizations may vary somewhat from one setting to another within the sample.

The overall perception of the safety culture construct was moderate to positive. When assessing whether safety is a core value of the organization, the mean score for SC1 was 3.64 (SD = 1.23), and the mean score for SC4 (overall strength of safety culture) was 3.50 (SD = 1.04). However, the score on the safety culture item was the lowest with the mean score for SC2 being M = 3.10, SD = 0.84, which indicates that operational pressures and time constraints still have an effect on maintaining a high priority for safety in maintenance activities. These results suggest that respondents have positive perceptions of safety culture, but that some operational aspects could still create conditions that present a challenge in applying the safety-oriented behaviors.

The descriptive statistical result, at Table 4, indicated that the communication, training and employee involvement dimensions of an organization are relevant to safety culture in aircraft maintenance organizations, at a preliminary level. The mean values observed indicate general favorable perceptions about most of the variables and the standard deviation results show that the perceptions vary depending on the organizational practice examined, as there are different levels of agreement between the participants.

| Variable | Mean | N |
|---|---|---|
| Communication | 3,985 | 130 |
| Training | 4,246 | 130 |
| Employee Involvement | 3,758 | 130 |
| Safety Culture | 3,423 | 130 |

**Table 4: Descriptive Statistics of Questionnaire Items**

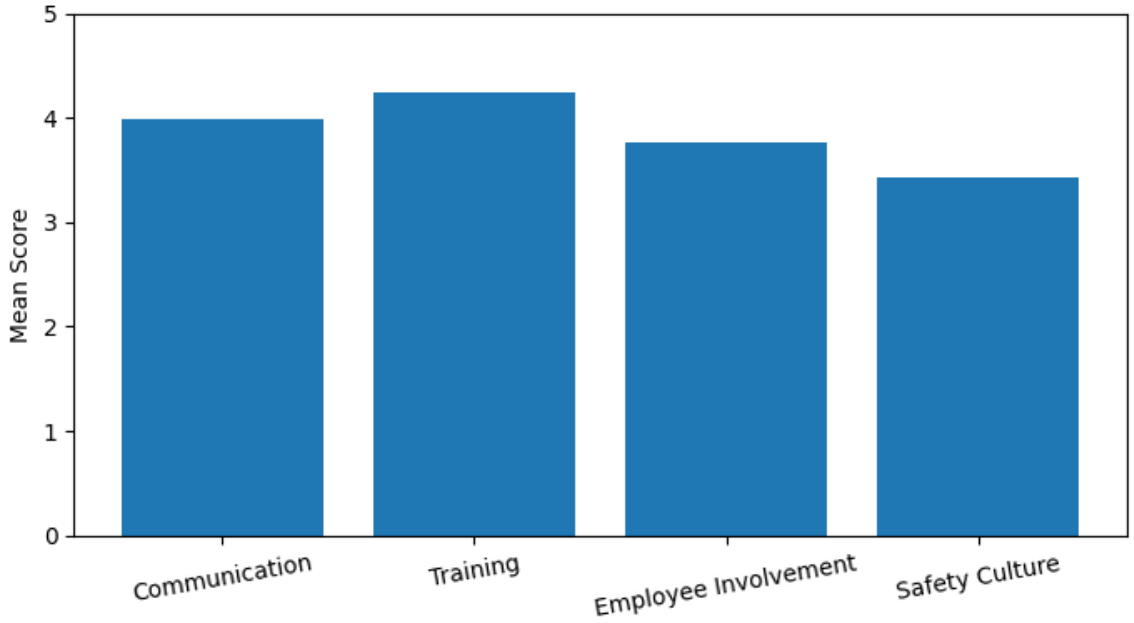


**Figure 4: Mean Scores by Construct**

Figure 4 presents the mean scores of the four main study constructs. For each construct, a composite score was calculated by averaging the responses to the corresponding questionnaire items. Specifically, the Communication score was calculated as the mean of items COM1–COM4, the Training score as the mean of items TR1–TR4, the Employee Involvement score as the mean of items EI1–EI4, and the Safety Culture score as the mean of items SC1–SC4. Higher mean values indicate stronger agreement with the statements associated with each construct.

## 4.3 Reliability Analysis

Reliability analysis was carried out to assess the internal consistency of the measurement scales of the questionnaire. Cronbach's Alpha was computed on each latent construct, as the study had four latent constructs namely: Communication, Training, Employee Involvement and Safety Culture. There were four items in each of the two scales for a total of sixteen measurement items. This analysis is performed on valid data provided by 130 respondents. All constructs demonstrated satisfactory internal consistency. Communication achieved acceptable reliability (α = .794), whereas Training (α = .862), Employee Involvement (α = .823), and Safety Culture (α = .895) demonstrated strong internal consistency, exceeding the recommended threshold of .70 (see Table 5).

| Construct | Cronbach's Alpha | N of Items |
|---|---|---|
| Communication | 0,794 | 4 |
| Training | 0,862 | 4 |
| Employee Involvement | 0,823 | 4 |
| Safety Culture | 0,895 | 4 |

**Table 5: Reliability and Validity Indicators**

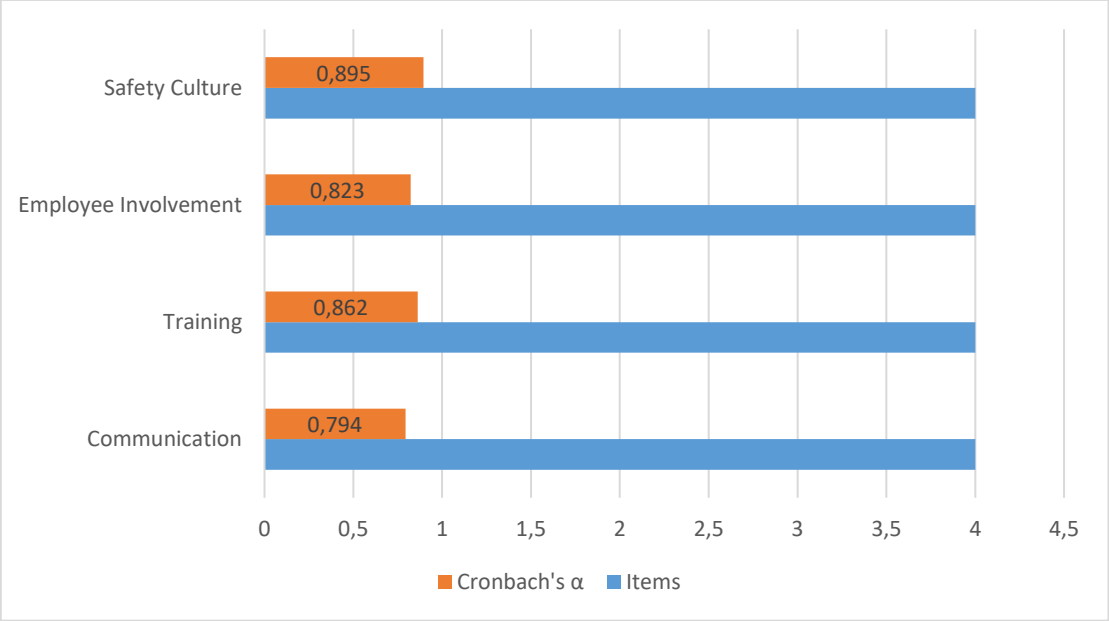


**Figure 5: Cronbach Alpha Chart**

Results showed that all constructs have values above the 0.70 level which are the normal level of internal consistency among measurement scales. A Cronbach's Alpha (0.794) was obtained for the Communication construct, which was considered acceptable. This indicates that the four communication-related items are consistently capturing the level of awareness of safety related information, reporting, and communication in the aircraft maintenance environment.

The Cronbach's alpha was .862 for the Training construct, indicating good internal consistency. The result revealed that the four items assessing technical preparation, safety training updates, maintenance-error consequences, and human factors coverage are very coherent on one scale. Thus, the training items seem appropriate to use in order to assess the quality and effectiveness of safety related training in aircraft maintenance organizations.

The Employee Involvement scale had a Cronbach's Alpha of 0.823, which was also found to be a good level of reliability. This validates that the participation in safety discussions, procedural feedback, identification of risk and frontline knowledge are well aligned. The findings provide validation for the use of this construct as a valid indicator of worker involvement and empowerment in the safety-related functions of the organization.

The highest value Cronbach's Alpha was obtained for Safety Culture at 0.895, which is excellent internal consistency. The results indicate that the four items of safety culture are measuring a very integrated construct, respondents' perceptions of safety as an organizational value, of safety prioritization when faced with difficulties, of learning from errors and of the general strength of safety culture.

In general, reliability analysis indicates that the questionnaire has good to very good internal consistency. Hence, all four constructs are valid for further analysis such as descriptive statistics, correlation analysis and Confirmatory Factor Analysis. This will empower the methodological design of the study which is based on the analysis of Communication, Training and Employee Involvement as organizational variables affecting the concept of Safety Culture in aircraft maintenance organizations.

## 4.4 Confirmatory Factor Analysis (CFA)

To validate the measurement of the four latent constructs in the study, Confirmatory Factor Analysis was performed. Standardized factor loadings, Average Variance Extracted (AVE), and Composite Reliability (CR) were the factors of the CFA assessment. The following are indicators that the items observed in questionnaires have a good representation of the theoretical constructs they measure.

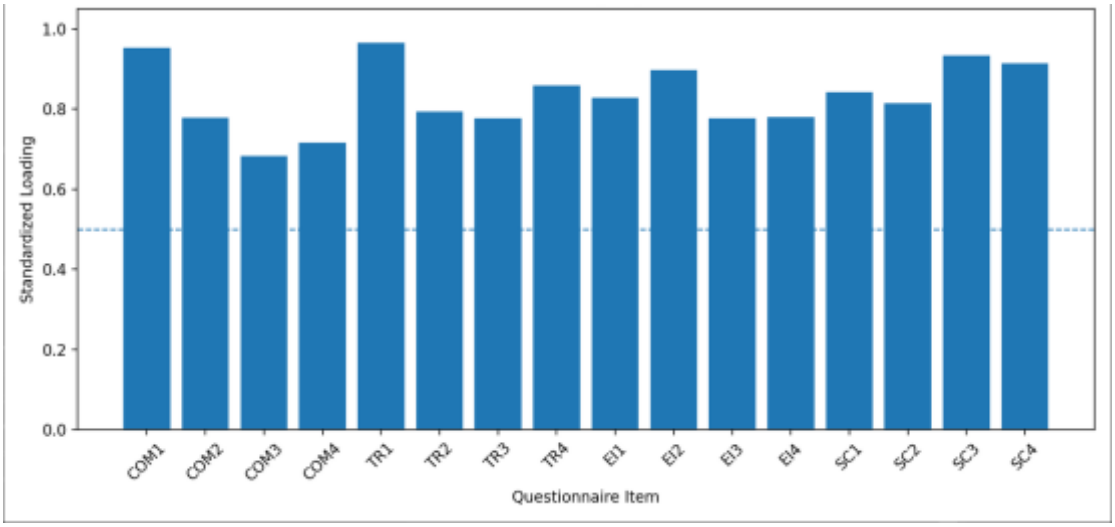


**Figure 6: Standardized Factor Loadings**

| Construct | Number of Items | Cronbach's Alpha | Composite Reliability (CR) | Average Variance Extracted (AVE) |
|---|---|---|---|---|
| Communication | 4 | .794 | .867 | .623 |
| Training | 4 | .862 | .913 | .725 |
| Employee Involvement | 4 | .823 | .893 | .676 |
| Safety Culture | 4 | .895 | .930 | .770 |

**Table 6: CFA Reliability and Validity Indicators**

The internal consistency and construct reliability of the four constructs were found satisfactory. Cronbach's alpha was between 0.794 and 0.895 for all the scales, which is higher than the generally accepted 0.70. This indicates that there is good internal consistency among the items within each construct and that they measure the same construct. In addition, the composite reliability values were good (from 0.867 to 0.930). All CR values are greater than 0.70 and can be said to be reliable for further structural analysis.

Concurrence validity: All AVE values were greater than 0.50. The communication average was 0.623, the training was 0.725, the Employee Involvement was 0.676 and the Safety Culture was 0.770. The results suggest that more than 50 percent of the variance of the indicators of each construct is accounted for by the construct. Thus, the convergent validity of the measurement model is acceptable (See Table 6).

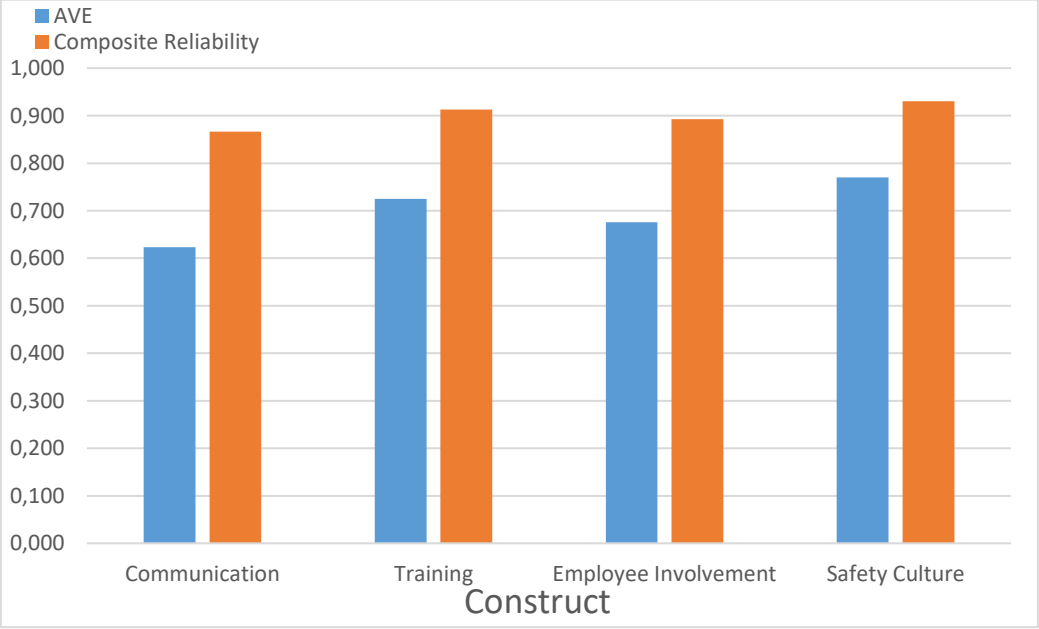


**Figure 7: AVE and Composite Reliability**

| Construct | Estimate |
|---|---|
| COM1 ← Communication | .953 |
| COM2 ← Communication | .778 |
| COM3 ← Communication | .683 |
| COM4 ← Communication | .715 |
| TR1 ← Training | .964 |
| TR2 ← Training | .794 |
| TR3 ← Training | .777 |
| TR4 ← Training | .859 |
| EI1 ← Employee Involvement | .828 |
| EI2 ← Employee Involvement | .898 |
| EI3 ← Employee Involvement | .777 |
| EI4 ← Employee Involvement | .780 |
| SC1 ← Safety Culture | .842 |
| SC2 ← Safety Culture | .814 |
| SC3 ← Safety Culture | .933 |
| SC4 ← Safety Culture | .914 |

**Table 7: Standardized Factor Loadings**

In Table 7, the factor loadings were all standardized and were greater than 0.50, indicating that no item should be dropped at this time. The strongest loading was observed for TR1 (0.964), followed by COM1 (0.953), SC3 (0.933), and SC4 (0.914). The COM3 (0.683) was the lowest loading, and this is still within the minimum acceptability criterion. Overall, the CFA results confirm the adequacy of the measurement model and the use of the constructs in the next Multiple Regression Analysis.

## 4.5 Hypothesis Testing

The hypothesis testing procedure was done using structural model with the variables of Communication, Training, and Employee Involvement as independent variables and Safety Culture as dependent variables. The aim of this stage was to see if the three organizational factors proposed in theory had a statistically significant positive effect on the aircraft maintenance organizations safety culture.

The structural model showed a large explanatory power, with the summary results presented in Table 8. The model accounted for about 70.6% of the variance in Safety Culture ($R^2$ = 0.706), suggesting that the model explained the majority of the variance in the dependent variable. The adjusted $R^2$ value was 0.699 which showed that the model was stable after considering the number of predictors. Furthermore, the overall regression model was statistically significant with F = 100.959 and p < .001, meaning that the set of predictors explained safety culture meaningfully.

| Model Indicator | Value |
|---|---|
| $R^2$ | 0.706 |
| Adjusted $R^2$ | 0.699 |
| F-statistic | 100.959 |
| Model p-value | < .001 |

**Table 8: Model Summary**

All three relationships were positive, but only one was significant at the traditional p < .05 level. Communication had a positive but non-significant effect on Safety Culture (β = 0.129, SE = 0.121, t = 1.064, p = .290). That is, with good communication, the strength of the safety culture was not strong enough to support H1. Thus, the hypothesis H1 was rejected.

Training was also positively related to Safety Culture in a non-significant manner (β = 0.122, SE = 0.072, t = 1.692, p = .093). The direction of the coefficient was in the same direction as that predicted by the theory, but the p-value did not meet the .05 criterion. Thus, the evidence did not support the link between training quality and safety culture as a stand-alone predictor. Thus, H2 was not supported.

In contrast, there was a strong, positive and statistically significant relationship between Employee Involvement and Safety Culture (β = 0.632, SE = 0.113, t = 5.576, p < .001). This finding shows a positive correlation between higher levels of employee participation, empowerment and involvement in processes related to safety and the perceptions of an exceptionally good safety culture. Of the three predictors, only Employee Involvement was

a statistically significant predictor of Safety Culture and was the strongest. Thus, we assume that H3 was supported (Table 9).

| Hypothesis | Relationship | Standardized β | SE | t-value | p-value | Result |
|---|---|---|---|---|---|---|
| H1 | Communication → Safety Culture | 0.129 | 0.121 | 1064 | .290 | Not Supported |
| H2 | Training → Safety Culture | 0.122 | 0.072 | 1692 | .093 | Not Supported |
| H3 | Employee Involvement → Safety Culture | 0.632 | 0.113 | 5576 | < .001 | Supported |

**Table 9: Hypothesis Testing Results**

Based on the findings, it can be concluded that, in the current sample, the overall level of safety culture is best directly linked to how engaged the employee is in safety processes. This is particularly significant to aircraft maintenance organizations, as it suggests that the improvement of safety culture may not be achieved solely through means of formal communication systems or training. Rather, staff should sense that they have a contribution to make in the discussion, in the identification of risk, in the reports and in the process of improving procedures.

The lack of significance for the Communication and Training variables must not be interpreted as a lack of importance of these variables. Due to their positive coefficients, both variables will move in the same direction as expected. If Employee Involvement is added to the same structural model, however, its predictive ability outweighs the explanation of Safety Culture. This could indicate that communication and training are more effective if they lead to the 'active employee' and the ownership of safety practices.


**Figure 8: Standardized Path Coefficients**

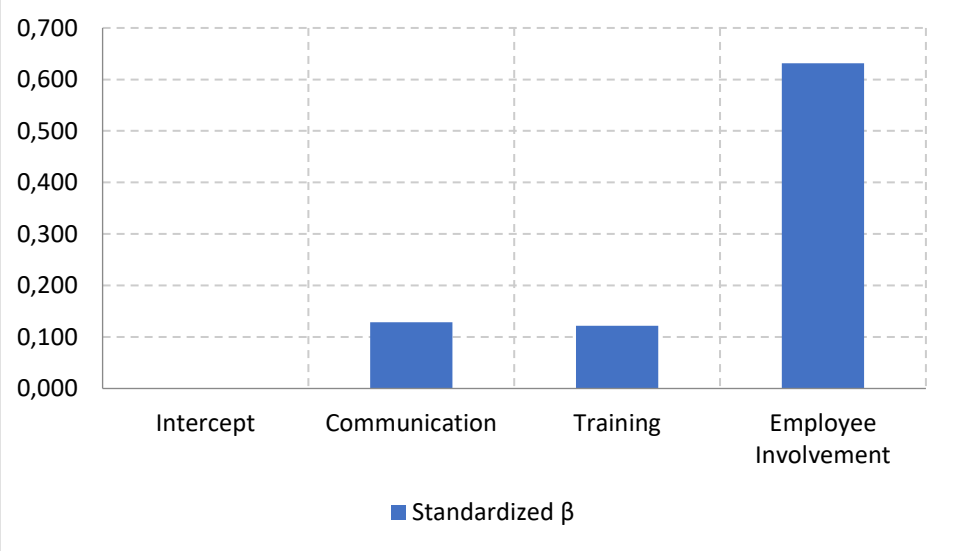


**Figure 9: Statistical Significance of Hypothesized Paths**

Overall, the results from the hypothesis testing support the conceptual model in part. The path from Employee Involvement to Safety Culture was the only path to reach statistical significance in the model, accounting for a large portion of variance in Safety Culture. Therefore, the empirical evidence supports H3 but does not support H1 and H2. The presence of this finding emphasizes the importance of employee involvement as one of the

most important organizational factors to enhance safety culture in aviation maintenance settings.

## 4.6 Multiple Regression

A multiple linear regression analysis was conducted to explore the amount of variance in Safety Culture that can be explained by the three organizational factors studied in this research (Communication, Training, and Employee Involvement) in aircraft maintenance organizations. Communication, Training, and Employee Involvement were all included as independent variables, and Safety Culture was used as the dependent variable. This analysis method was chosen because it allows to assess the unique contribution of each predictor, while accounting for the contribution of the other predictors; this approach will give a full picture of the proposed conceptual model.

Pearson correlation coefficients were first analyzed to determine the relationships between study variables before estimating the regression model. All organizational factors showed positive relationships with Safety Culture as shown in Table 10. The highest correlation was found between Employee Involvement and Safety Culture (r = 0.832); followed by Communication (r = 0.789) and Training (r = 0.654). In addition, moderate to strong positive intercorrelations were found among the independent variables, such that higher scores on the organization communication variable were consistently associated with higher scores on the other variables. The correlations were fairly good but not too high so that the regression could be continued.

| | **Communication** | **Training** | **Employee Involvement** | **Safety Culture** |
|---|---|---|---|---|
| Communication | 1,000 | 0,737 | 0,904 | 0,789 |
| Training | 0,737 | 1,000 | 0,693 | 0,654 |
| Employee Involvement | 0,904 | 0,693 | 1,000 | 0,832 |
| Safety Culture | 0,789 | 0,654 | 0,832 | 1,000 |

**Table 10: Correlations**

The overall performance of the regression model is summarized in Table 11. Results show that the proposed model has a high level of explanatory power of the model ($R^2 = 0.706$) and that the three model constructs, Communication, Training, and Employee Involvement, explain variance of 70.6% in Safety Culture. The coefficient of determination after adjustment for the number of predictors was 0.699, which is very close to the coefficient of determination in the original model. Furthermore, the overall model was statistically significant ($F = 100.959$, $p < .001$), indicating that the three organizational factors together have a significant explanatory power of Safety Culture in aircraft maintenance organizations.

| Model | R Square | Adjusted R Square | F | Sig. |
|---|---|---|---|---|
| 1 | 0,706 | 0,699 | 100,959 | 0,000 |

**Table 11. Model Summary**

The overall model significance was confirmed and then each predictor's contribution was evaluated by looking at the standardized regression coefficients. Communication had a positive standardized coefficient (beta = 0.129), as presented in Table 12, which suggests that a better organizational communication is related with an improvement in the level of Safety Culture. This relationship was not statistically significant ($t = 1.064$, $p = .290$), though. Because of this, communication has a positive contribution to the model, but it is not that much when compared to the effect of the other organizational variables when taken together.

Likewise, Training had a positive standardized regression coefficient ($\beta = 0.122$), indicating that a high perception of training is a positively associated factor with the perception of Safety Culture among employees. However, this correlation was not statistically significant ($t = 1.692$, $p = .093$). Although training is an integral part of aviation safety management systems, it is found that without the support of wider organizational practices that encourage

safety behaviours, training alone is unlikely to impact employees' perceptions of safety culture.

On the other hand, Employee Involvement was the best predictor of Safety Culture. The standardized regression coefficient was significantly greater than the other predictors ($\beta = 0.632$) and highly statistically significant ($t = 5.576$, $p < .001$) as shown in Table 12. The outcome shows that companies that promote employees to actively engage in safety decision making, hazard identification, reporting of hazards and the continuous improvement process have significantly higher odds of having a positive organizational safety culture. This coefficient's value suggests that Employee Involvement is the primary form of organizational mechanism that affects employees' perceptions of their work environment when it comes to safety, in the current sample.

| Model | Predictor | Standardized Beta | Std. Error | t | Sig. |
|---|---|---|---|---|---|
| 1 | (Constant) | 0,000 | 0,048 | 0,000 | 1,000 |
| 1 | Communication | 0,129 | 0,121 | 1,064 | 0,290 |
| 1 | Training | 0,122 | 0,072 | 1,692 | 0,093 |
| 1 | Employee Involvement | 0,632 | 0,113 | 5,576 | 0,000 |

**Table 12. Regression Coefficients**

The results of the regression were directly used to test the proposed research hypotheses. The hypothesis of positive relationship between Effective Communication and Safety Culture (H1) was disregarded because there was no statistical significance as summarized in Table 9. Similarly, H2, which hypothesized a positive relationship between the quality of training and Safety Culture was not supported. H3 on the other hand, was supported and revealed that there is a significant positive relationship between Employee Involvement and the Safety Culture in aircraft maintenance organizations.

Overall, the multiple regression analysis is a good demonstration of the successful explanation of a significant variance in Safety Culture by the proposed model. Relationships between communication and training and the dependent variable were positive, but neither predictor was statistically significant once the other organizational factors were controlled.

However, when looking at both the organizational practices and the attitudes and behaviors of employees, Employee Involvement proved to be the main factor determining Safety Culture, which indicates that meaningful employee involvement is the most important aspect of organizational practice to strengthen attitudes and behaviors for safety in aircraft maintenance organizations. The results of these findings support the importance of implementing participative safety management strategies that enable maintenance personnel to engage actively with organizations' safety performance in an empirical way.

# 5. Discussion and Practical Implications

## 5.1 Discussion of Findings

The results of the present study contribute significantly to the empirical evidence regarding the organizational factors influencing safety culture of aircraft maintenance organizations. The statistical analysis showed that the proposed structural model accounted for a high amount of variance in the safety culture, suggesting that the internal organizational practice plays an important role in shaping the perception and attitude of the employees towards safety. More specifically, the most important and only statistically significant employee involvement predictor for safety culture was found to be employee involvement, with communication and training showing positive (but not statistically significant) relationships with the dependent variable. The results of this study partially confirm the conceptual framework of the study and provide a rich understanding of the organizational dynamics of maintenance.

The results related to employee involvement were supportive of the findings from the literature review that focused on the key contribution of participative safety practices in high-risk operational work. The statistical significance of employee involvement indicates that increased involvement in discussions, reporting, and participation in decisions regarding safety is more likely to lead to positive safety attitudes among maintenance personnel. This research reinforces the notion that safety culture is not something that can be achieved by formally setting down rules or regulations but must also involve engagement from the operational side of the organization through frontline staff. Previous studies have also suggested that employee involvement fosters a sense of ownership among employees and promotes proactive safety actions (Abeje & Luo, 2023). The experience of being involved in a safety process seems to increase an individual's responsibility and an overall sense of safety awareness among aircraft maintenance personnel, working under a technically challenging environment and tight time constraints.

The results also support the theoretical tenets of the High Reliability Organization (HRO) theory mentioned earlier in the dissertation. Individual members from HRO-oriented organizations are encouraged to actively participate in identifying risks and solving

problems as part of their operations, creating a sense of decentralized risk awareness (Paidisetty et al., 2024). The present findings suggest that a participatory work organization may be especially beneficial in maintenance environments because employees, even though not in management, may have first-hand knowledge of the shortcomings of procedures, lack of communication, and technical risks that are not evident at managerial levels. Thus, employee involvement seems to be not only an organizational practice but also an instrument, which can be used by maintenance organizations to enhance the operational resilience and to reinforce safety-related behavior.

Among the other resources, communication had a positive effect that was not statistically significant on safety culture. Respondents' perceptions of communication systems were mostly positive in the descriptive analysis; however, the structural model indicates that communication alone may not be a strong enough predictor to create better perceptions of safety culture when other organizational factors are analyzed concurrently. This result partly contrasts with research that shows that communication is a key factor in safety performance (Kavalela et al., 2024). But it doesn't mean the same thing to say that communication is not important in any aircraft maintenance organization. Instead, it can be a clue that communication mechanisms have a less direct influence on safety culture via other organizational mechanisms like involvement, building trust, and reporting readiness.

The results may be analyzed in the context of Safety Climate Theory. Safety climate research indicates that organizational safety priorities are formulated by employees in addition to formal communication, through observing organizational practices and managerial behavior (Truong & Lee, 2025). Communication systems therefore can only be meaningful if employees feel their concerns are truly listened to and considered in decision making in the organization. In this sense, communication can work better when it is integrated with participatory organizational patterns that make the exchange of information an active involvement of the organizations.

Likewise, training showed a positive, but non-significant, association with safety climate. This is significant because the descriptive statistics indicated that the respondents' ratings of the training practices were highly positive regarding awareness of the consequences of a maintenance error and technical preparation. The lack of statistical significance for the structural model may reflect that training in the maintenance organization is not viewed as

an operational requirement that differs from other organizations, but as a standardized requirement that does not have a strong impact on the overall perception of the organization's culture. Training programs may be required in highly regulated contexts, and may also be standardized and mandated across organizations, thus minimizing variation in participants' training evaluations.

However, the overall results are in line with the previous studies which have highlighted the significance of the continuous professional development and technical skill in aviation maintenance operations (Timjerdine et al., 2024). Training continues to be a vital component in keeping procedures accurate, systems reliable and safety responsibilities. The current findings indicate, however, that training by itself is insufficient to build a strong safety culture, unless employees could actively use their knowledge in the organization's safety processes. This is consistent with the Swiss Cheese Model, which identifies safety failures because of technical failure and because of latent organizational failures that impact operational activities (Suebsuwong, 2024).

A second notable remark relates to the moderate perceptions about some aspects of safety culture, including the aspects related to operational pressure and/or safety prioritizing under time pressure. Participants reported that production pressure can sometimes put demands on maintaining a safe approach. This discovery aligns with general concerns concerning workload intensity, fatigue, and complexity in the aviation maintenance field (Dereje et al., 2025). Within relatively positive communication and training environments exist operational pressures which can continue to generate potential vulnerabilities that can impact decisions related to maintenance.

The study's overall results add to the aviation safety literature by providing empirical evidence that organizational practices have different effects on the nature and extent of organizational safety culture within aircraft maintenance settings. The results indicated that communication and training are also important organizational factors, but that employee involvement is the most significant factor among the perceptions of maintenance personnel regarding the safety culture. This discovery goes beyond the mere compliance-driven safety management system to highlight the need to adopt more participatory approaches to safety, bringing front line workers into the safety system and into the organizational learning process.

## 5.2 Practical Implications

The results of this research have several significant implications for aircraft maintenance organizations, safety managers, and aviation regulatory bodies. While all three organizational factors showed positive correlations with safety culture, employee involvement was the most significant and positive factor that statistically explained safety culture in the model. This finding implies that maintenance organizations should not see safety as just a process or compliance issue, but rather as a process involving participation by the front-line people in not only safety-related work, but also in decision making.

The findings emphasize the need for maintenance organization environments that encourage maintenance personnel to be actively involved in safety activities for aircraft maintenance organizations. Frontline technicians and engineers have first-hand experience on how to maintain the equipment, the operational demands, and what is technically risky. Therefore, organizations that provide opportunities for everyone to participate in safety discussions, processes for improving procedures, and processes for identifying hazards may increase the likelihood of shared responsibility for safety outcomes (Paidisetty et al., 2024). The study results indicate that a safety culture becomes more effective when employees feel they are not just 'followers' of procedures, but also part of the organization's safety performance. From an operational standpoint, the maintenance organizations should be made more participatory in safety meetings, open reporting systems should be promoted, and operational personnel should be engaged in the processes of investigating safety incidents and planning corrective actions (Bisbey et al., 2019).

The results also show that, despite not being statistically significant in the final structural model, communication is still an important organizational tool. This positive relationship indicates that there is still a role for communication practices in influencing safety perceptions of maintenance personnel. As such, maintenance organizations should continue to evolve formal and informal communication systems that enable the timely and accurate flow of operational safety information. Effective communication is consistently highlighted in literature as a key factor that can prevent misunderstanding, inconsistencies in procedures, and coordination problems in maintenance settings (Kimeria et al., 2022). For this reason, it is important that organizations invest in the following: Documentation of maintenance

procedures is improved, there is a standardized reporting procedure, digital communication platforms are in place and briefing systems between technicians, supervisors and organization members are structured. Two-way communication improvement can also help organizations gain insight into the realities they face in their operations from the front-line maintenance team (Pratama & Caponecchia, 2025).

Even if a significant relationship between training and performance did not occur during the hypothesis testing phase, there are significant practical implications that may be drawn from the training practices. The descriptive analysis revealed positive perceptions about training, including awareness of the consequences of maintenance errors and procedures for operation safety. This is an indication that the maintenance organizations already value the significance of technical and safe education. The results suggest that training does not necessarily lead to improved safety culture unless workers are also empowered to implement their lessons learned in a participatory organizational system. From a practical perspective, maintenance organizations need to shift away from training to mere compliance and include more on human factors, scenarios, fatigue and proactive risk identification (Olaganathan, 2024). Airplane maintenance facilities are constantly changing with new technologies, procedures, and regulations, which is why continuous professional development is necessary (Timjerdine et al., 2024).

The research also offers significant implications for safety managers working in an aviation maintenance context. Safety managers have a pivotal role to play in the process of making safety policies real in daily operations. The results indicate that rather than only focusing on compliance-based monitoring from above, organizational trust, employee engagement and proactive reportage should be highlighted in effective safety management. Safety managers should therefore aim to establish a "just culture" that places emphasis on employees' psychological safety in disclosing hazards, operational issues, and procedural shortcomings without risk of unjustified blame or punishment (Rodrigues & Filho, 2025). These can foster organizational learning and enhance the ability to detect and recognize potential operational issues early, preventing them from developing into safety events (Newman & Scott, 2022).

In addition, any safety manager should understand that safety culture cannot be created by documentation or regulations compliance but by consistency of organizational behavior and managerial actions. Staff continually assess management's focus on safety under pressure,

on schedule, or when productivity is a concern. As mentioned in the literature, employees are more likely to adhere to safety protocols and engage in reporting systems when they are in sync with the perception of the organization (Truong & Lee, 2025). Therefore, safety managers need to keep safety in focus throughout everyday maintenance activities and embed safety considerations into decision making processes.

The results are also very material for the aviation regulators and aviation policy makers who have the responsibility for aviation safety performance. Traditionally, regulatory authorities have been very focused on technical compliance, inspection procedures, or documentation requirements. These dimensions may be required but as shown in the current study, the organizational and behavioral dimensions are also crucial for the process of safety culture formation. Thus, aviation regulators must focus more on organizational safety climate assessments, employee engagement indicators and communication effectiveness in aviation safety audits and organizational evaluations (Al-Dmour et al., 2025).

Furthermore, regulators might incentivize maintenance organizations to put more structure into employee participation arrangements in Safety Management Systems (SMS). Communication, learning and safety promotion are already recognized as key areas of safety management within the existing SMS frameworks (Khalid et al., 2021). The results of this study, however, suggest that employee involvement could be a more critical factor to be considered as a practical measure of safety culture in maintenance operations, in addition to being a strong one. The material for regulatory guidance may evolve accordingly, to promote participatory safety governance approaches that develop the participation of operational personnel in safety governance activities.

The practical implications of the study have shown that the development of the safety culture in aircraft maintenance organizations relies heavily on technical systems and the adherence to procedures, but also on the organizational culture that fosters trust, communication, ongoing learning and employee involvement. The results support the understanding that safety culture is a phenomenon of the organization, and every day interaction, operation behavior and whether employees are indeed inserted into the safety management process are the factors shaping the safety culture.

## 5.3 Managerial Recommendations

Based on the results of the present study, it can be concluded that practices in an organization are the key determinant of safety culture in aircraft maintenance. Specifically, employee involvement was found to be the best predictor of safety culture, with positive relationships between communication and training with safety-oriented perceptions and behaviors. From these conclusions, a few management recommendations are suggested to help aircraft maintenance organizations to improve their internal safety policy and decrease the risk of operation failures caused by maintenance.

Improving organizational communication systems is one of the key management challenges. Aircraft Maintenance Operations are highly technical operations performed under operational pressure and where lack of, or delay in, information can lead to a high probability of errors. The results of the study indicate that the quality of communication is considered as an important part of operational safety by employees. Therefore, a more defined and formal communication process between technicians, supervisors, engineers, and management teams should be developed for maintenance organizations. Safety related information should flow quickly and regularly between operational levels, particularly when transitioning shifts, giving technical updates, planning maintenance, etc. Additionally, open communication reduces ambiguity and standardization in the execution of maintenance procedures (Kimeria et al., 2022). In the real world, companies need to raise the frequency of safety briefings, enhance digital recording methods and make sure that critical staff members can access fresh maintenance methods and security documentation easily.

Beyond that, management needs to be actively involved in promoting non-punitive reporting of safety issues. Employees are more inclined to report operational hazards and procedural inconsistencies when they believe that management focuses on learning instead of blaming (Bhattarai et al., 2022). Therefore, maintenance organizations have to create reporting environments that are transparent, trustful and confidential. These can help organizations learn, as management can recognize potential operational hazards before they become major incidents. This recommendation corresponds well with the overall concept of safety culture and Safety Management Systems that seek to identify hazards proactively and encourage the ongoing learning processes within the organization (Rodrigues & Filho, 2025). It is

imperative that managers consider safety reporting as a strategy for improving operations, rather than just a compliance process.

One of the most important recommendations made is the improvement of the recurrent training programs. The results of the descriptive study showed high perceptions of the values of training, particularly in relation to safety implications of maintenance errors. However, the aviation maintenance industry is constantly changing with technology developments, regulatory changes and growing complexity. The goal of training should therefore not be thought of as a single event, but rather as an ongoing organizational process. Maintenance personnel should be regularly subjected to refresher training covering technical ability, human factors, risk awareness for operations and procedural obedience (Timjerdine et al., 2024). Ongoing professional development can provide reinforcement to employees for making decisions that are safe, reinforce abilities to respond to new operational challenges and enhance their ability to adapt to new challenges.

In addition, the training should not only address technical instruction but also include scenarios that involve safety. Also, managers need to ensure training programs are not just technical but also include real-life safety-related scenarios, related to maintenance, as well. Studies in aviation maintenance have shown that human factors, including fatigue, workload stress, communication breakdowns, and adherence to procedures, can play a pivotal role in the occurrence of maintenance errors (Olaganathan, 2024). Recurrent training therefore should include operational simulations, case-based learning and incident analysis exercises for maintenance personnel to be able to identify how the organization's conditions may affect human performance during maintenance tasks. These training practices can help to enhance operational awareness and develop employees' skills to identify and address safety hazards in actual work environments (Prasad et al., 2024).

The main managerial implication of the present study is related to employee involvement. The results of the statistical analysis showed that there was only one organizational factor that had a statistically significant direct effect on safety culture: employee involvement. The result indicates that the traditional hierarchical and top down safety management approach should be replaced with more participatory safety management approaches in maintenance organizations. Frontline workers have first-hand experience with issues, inefficiencies, and real-world safety concerns. Hence, it is important that managers engage technicians and

engineers in safety discussion, operational evaluation and procedural improvement efforts (Paidisetty et al., 2024). Employee involvement can reinforce organizational ownership of safety and contribute to employees to commitment towards safe maintenance practices.

In the real world, formal arrangements should be created to facilitate employee involvement in decisions affecting safety. These can include safety committees, employee feedback systems, operational review meetings and collaborative risk assessment meetings. Incorporating frontline operational experience into an organization's safety processes can help enhance the usability and uptake of safety procedures. Meanwhile, employee empowerment increases employee-management trust, which is viewed as a key factor in the development of mature safety cultures (Bisbey et al., 2019).

A second key recommendation is that managers need to be visible and present in the maintenance environments. Safety culture is strengthened when workers see management placing a strong emphasis on safety in the workplace, not just in policies and procedures. It is therefore important for managers and supervisors to have regular contact with the maintenance staff, address any concerns openly and continually demonstrate commitment to safety goals. This operational interaction can help reinforce that safety is a priority and is more than just a regulatory requirement for employees (Adjekum & Tous, 2020).

In conclusion, the study results indicate that creating a successful safety culture in an aircraft maintenance organization involves a combination of effective communication, ongoing training, and employee involvement. While regulatory compliance is still critical to aviation maintenance, the results show that the internal social and operational environment that management practices create has a strong effect on organizational safety performance. Maintenance organizations looking to lower maintenance risks due to the way things are done should therefore not only ensure that procedures are followed but they should also build up the organization to enhance the culture of safety behavior and joint responsibility for operational safety.

# 6. Conclusions

## 6.1 Limitations of the Study

Although the present study contributes to the knowledge of the organizational factors that affect the creation of a safe work environment in aircraft maintenance organizations, some limitations should be noted while trying to understand the results. The limitations are mainly due to the sample size, geographical range of the study and self-reported data collection techniques. It is essential to understand these limitations as they will impact the generalizability of the conclusions drawn from the findings across the larger aviation maintenance industry and even the understanding of the statistical relationships found in this study.

The sample size of the research is one of the limitations. The total number of valid responses was only 130, although this is an acceptable number for quantitative data analysis and the use of procedures, the sample size is still very limited in comparison with the global workforce in aircraft maintenance. Aviation maintenance is a specialized and operationally demanding sector, that poses challenges in accessing big numbers of participants across organizations and at operational levels. As pointed out in the methodological literature, making use of non-probability sampling methods often has restrictions on representativeness, as participants are selected not in line with random sampling methods but by being accessible and willing to participate (Rahman, 2022; Pace, 2021). Although the current sample size was deemed sufficient to perform statistical analysis, the reliability analysis, CFA procedures, the size of the sample may have increased the statistical stability of the structural model and the generalizability of the results to various maintenance settings. Additionally, there were also a relatively small number of respondents in some occupational groups, which may have restricted the depth of the analysis of managerial perceptions.

The second limitation is related to the geographical extent of the study. The research centers on participants from selected aviation maintenance organizations and professional networks and does not include a sample size that is representative of the global aviation population distributed across various aviation regions. Maintenance activities can vary significantly from one country to the next, culture to culture, technology to technology and standard to

standard. The existing literature in aviation safety has emphasized that the culture of an organization or a nation can impact on the perceptions of safety culture within a specific workplace, such as an airport, by influencing how employees communicate, report issues, and view the management's dedication to safety (Pratama & Caponecchia, 2025). The results from the present research might, therefore, be the result of the operating conditions and working practices of the selected maintenance environments and not the overall international aviation maintenance industry. Especially, the differences in the implementation of safety management systems, the regulatory bodies and the structure of the workforce among countries can create different organizational dynamics than those that are found in the present analysis. Hence, care should be taken in trying to extrapolate the results to maintenance organizations with different cultures or regulations.

Another constraint is that the focus is largely on self-reported questionnaire data as the main source of data. Questionnaires are popular instruments in the study of organizational and safety culture due to their ability to provide systematic data on perceptions and attitudes from a relatively large number of people, but their use presents a number of methodological risks. In highly regulated industries like aviation, participants might inadvertently answer in a socially desirable way since their actions are closely tied to professional responsibility and organizational compliance expectations, which are critical to aviation safety and security. Therefore, some of the organizations or attitudes represented by respondents may have been stated in a more positive light than might be reflected in practice while they are operating. An analogous issue has been noted in safety culture studies, in that workers may be reluctant to provide all of the critical feedback they may have on organizational weaknesses or procedures, even when asked anonymously (Churruca et al., 2021).

Furthermore, the cross-sectional design of the questionnaire does not allow the study to reflect any changes in safety culture over time. As operations under pressure, regulations change, investigations of accidents, or organizational restructuring occur, the practices of organizational communication, employee participation and training effectiveness may change. The present study, however, only captures one measurement time and as such is unable to provide a full assessment of the change in safety culture over time in maintenance organizations. This is relevant as safety culture is understood as a continuous phenomenon

of organizational learning and adaptation, rather than a fixed organizational trait (Bisbey et al., 2019).

Further, the use of perceptual data, a limitation of the study, allowed only for subjective assessment of the organizational practices, and not on objective operational indicators of safety like incident records, audit results, maintenance error rates, or safety performance ratings. Perceptions are key to the concept of safety climate and safety culture, but the lack of operational performance data also hampers the direct link between organizational factors and measurable maintenance safety outcomes. Thus, the study mainly examines the perceived influences on safety culture within the organization and not the actual effectiveness of the maintenance safety systems that are in place.

Finally, the emphasis of the research was on communication, training and employee involvement as three organizational factors. The variables chosen were theoretically and empirically supported in literature, yet other variables that could be considered influential on the organization were not integrated into the conceptual model. Other factors like leadership style, fatigue management, workload pressure, organizational justice and resource allocation can also have a significant impact on the safety culture in aircraft maintenance organizations (Dereje et al., 2025, Haruna & Taiwo, 2024). The present model is thus not to be understood as a comprehensive depiction of all the determinants of maintenance safety culture within organizations.

In summary, while these restrictions do not negate the validity of the study, they point to a number of methodological and contextual factors that must be recognized when making inferences from the results and planning future studies of aviation safety.

## 6.2 Recommendations for Future Research

The results of the present study add empirical data to the knowledge of organizational factors affecting safety culture in aircraft maintenance organizations, but there are a number of areas where further research is warranted. The results of the present research along with the identified limitations in literature review and methodological design suggest that further

studies are needed to provide a more holistic understanding on how safety culture is formed in maintenance environments.

One of the key recommendations is the development of cross-country comparative studies. The above research is conducted in context of operational and cultural setting, whereas the previous research showed that national and organizational culture can have a great influence on the perception of safety, communication, and behavior of the employees on the aviation environment (Pratama & Caponecchia, 2025). The way aviation maintenance organizations apply safety practices and organizational management in other regulatory, economic, and cultural environments can be very different. It may therefore be useful to analyze and compare the impact of communication, training and employee involvement on safety culture between countries and/or regions of different aviation systems. These investigations may also help regulators and multination aviation organizations to identify common organizational practices that will have a consistently positive effect on safety culture, irrespective of the operational conditions. (Yorio et al., 2019)

Additional studies on aviation safety culture should also continue to broaden the range of methods employed in aviation safety culture studies. The present study used a quantitative survey design and Multiple Regression was used to statistically analyze relationships between organizational variables and safety culture, which is appropriate for the type of study. However, the situational complexities and context of maintenance workers' daily work may not be fully understood using quantitative methods. Other researchers also have shown that organizational safety practices are not just directly measurable; they are also influenced by informal interactions, routine working practices and perceptions of the workplace (Bisbey et al., 2019). Future research might include qualitative techniques such as semi-structured interviews, focus groups or case studies using observation of technicians, supervisors, engineers, and safety managers. Qualitative research might help explain why some organizational practices are effective in fostering safety-oriented behavior in maintenance operations, while others are not.

Specifically, qualitative research can provide a deeper understanding of the results of the current study, which found that Communication and Training did not have statistically significant direct effect in the structural model, while Employee Involvement was the strongest predictor of Safety Culture. While quantitative analysis revealed the statistical

relationships, qualitative methods could delve into the operational mechanisms that support these relations. For instance, future scholars may want to explore the perception of communication systems as procedural, or the perception of training programs as compliance-based versus operationally relevant by frontline maintenance staff (Haruna & Taiwo, 2024). These interpretations might enhance the explanatory power of ongoing future safety culture studies.

Still another essential suggestion is related to the use of sequential research designs. The current study used the cross-sectional method to collect data from employees. Safety culture is not a fixed organizational trait, but rather is continually developing as a consequence of organizational learning, operational incidents, management change, technological advances and regulatory changes (Truong & Lee, 2025). Longitudinal studies would thus be able to give a more dynamic view of the evolution of safety culture in the organization of aircraft maintenance. If taken over multiple points in time, the repeated measurement would enable researchers to see if there is any measurable difference in perceptions and behaviors of safety because of the communication system changes, training changes, or employee participation changes.

Longitudinal studies would also be of tremendous value for assessing the long-term impact of implementing SMS in maintenance organizations. Past research has highlighted the need to build safety culture over time across an organization through ongoing initiatives and not one-off efforts, (Adjekum & Tous, 2020). Future studies may track results over multiple years to see how changes to the organization, safety promotion, or human factors over time affect safety culture maturity. These studies would be able to give more robust evidence of causal relationships between organizational practice and operational safety outcomes.

A potential weakness of the conceptual framework is that it does not include other organizational and human factors variables that could be explored by future researchers. Finally, according to the literature, fatigue, workload pressure, supervisory leadership, procedural complexity, and organizational justice could be other factors affecting maintenance related safety behavior (Dereje et al., 2025; Suebsuwong, 2024). Future studies on the formation of safety culture in aircraft maintenance contexts could benefit from the incorporation of such factors into their models. Likewise, future models could explore

mediation and moderation relationships between variables, while not examining the direct relationship between the variables.

Finally, future research should continue to focus on the frontline maintenance workers' point-of-view. Past literature has tended to focus on managerial or systems perspectives, and comparatively little on technicians' operational experiences (Haruna & Taiwo, 2024). As maintenance employees are in more direct contact with the technical systems, operational procedures and restrictions on organizational activities, their perception continues to play an important role in the understanding of how safety culture works in practice. Further empirical study focusing on frontline operational personnel could thus significantly add to the scientific understanding and real-world aviation safety management.

In general, future research should strive to create more comprehensive models of safety culture based on context and longitudinal analysis in the field of aircraft maintenance organizations. These efforts would further build the empirical basis of aviation safety research, and contribute to the evolution of better ways to organize maintenance operations to reduce safety risks.

## 6.3 Conclusion

This research focused on the impact of organizational dimensions on safety culture in aircraft maintenance organizations, specifically communication, training and employee involvement. The results indicate that the safety culture in maintenance is not only determined by regulatory requirements and technical systems, but also by the internal organizational conditions which affect the perception, interpretation and implementation of safety procedures into day-to-day operational activities. This finding aligns with the overall aviation safety literature, which suggests that human factors and organizational processes continue to play key roles in ensuring the reliability of complex aviation systems (Bisbey et al., 2019; Prasad et al., 2024).

A key finding of the study is the fact that employee involvement is a prime driver of safety culture. The statistical analysis revealed that only the organizational variable of employee

involvement in the study had a statistically significant positive correlation with safety culture in the structural model. The findings indicate that when employees are actively involved in safety related discussions, reporting and decision making, it is easier for maintenance organizations to build a strong safety culture. The discovery further bolsters the argument that operational information in the front lines is a critical piece of knowledge that directly influences hazard identification and proactive safety management (Paidisetty et al., 2024; Naji et al., 2022). When organizations encourage maintenance employees to participate, empower and share responsibility for operational risks, they seem to be more involved in contributing positively to safety outcomes than when they are passive recipients of safety procedures.

The results also suggest that, although these dimensions of communication and training were not statistically significant in the final structural model, they are still important dimensions of the organizational setting. Overall, respondents' perceptions were positive about communication practices and training quality, in relation to the clarity of information about safety, supervisory communication and consequences of maintenance errors. The findings indicate that communication and training are still fundamental mechanisms that facilitate operational coordination and technical skills for maintenance in the operation (Kimeria et al., 2022; Timjerdine et al., 2024). However, these organizational mechanisms might be much more effective when turned into active employee involvement and organizational engagement, if not statistically significant. However, if employees are not actively working to build a safety culture within their organization, in practical terms, communication and training might not be enough.

Another important finding is the overall connection between organizational systems and human performance within aviation maintenance tasks. This study reinforces the view that maintenance safety is not limited to a technical reliability or procedural compliance. Rather, safety culture is formed through the interplay of organizational structures, operational practices and perceptions formed by employees under complicated maintenance conditions. This interpretation is closely related to the theoretical principles of the Swiss Cheese Model and High Reliability Organization theory, which focuses on organizational resilience, learning from mistakes, and operational awareness to avoid safety issues (Suebsuwong, 2024; Paidisetty et al., 2024). These results thus confirm that the practice of aircraft

maintenance has to be understood as an organizational issue, a perspective which goes beyond the individual and technical one.

The study also makes contribution to the literature because it is a study which tackles an important empirical gap especially for aircraft maintenance organizations. Past studies on aviation safety have often focused on cockpit activities, pilots' decision making, and flight management, with maintenance areas having received less empirical focus than other areas (Pratama & Caponecchia, 2025). The research directly addresses maintenance personnel, engineers, supervisors and quality managers, offering evidence for the effects of organizational conditions on safety perceptions of the individuals who are directly engaged in maintenance processes. This work thus continues the existing body of literature on aviation safety culture by providing a maintenance-driven perspective of organizational safety culture.

In general, the studies showed that organizational practices is a significant determinant in aircraft maintenance organizations' safety culture. Communication and training were still seen as critical operating processes, but this study found employee involvement to be the most consistent predictor of safety culture. The results indicate that organizations interested in the improvement of maintenance safety performance should take one step further than only compliance-based approaches and foster a culture in which employees are actively engaged in safety-related processes, organizational learning and operational improvement programs. By increasing participation, using clear and transparent communication systems, and providing ongoing support from the organization, maintenance organizations can improve safety awareness, lower the risk of maintenance-related mistakes and increase the long-term reliability of operations in the aviation industry (Truong & Lee, 2025; Haruna & Taiwo, 2024).

# References

Abdallah, A. A., & Fan, I.-S. (2020). Emerging challenges of digital aircraft operations and maintenance: A knowledge management perspective. In *Proceedings of the 9th International Conference on Through-life Engineering Services*.

Abeje, M., & Luo, F. (2023). The influence of safety culture and climate on safety performance: Mediating role of employee engagement in manufacturing enterprises in Ethiopia. *Sustainability, 15*(14), 11274. https://doi.org/10.3390/su151411274

Adjekum, D. K., & Fernandez Tous, M. (2020). Assessing the relationship between organizational management factors and a resilient safety culture in a collegiate aviation program with safety management systems (SMS). *Safety Science, 131*, 104909. https://doi.org/10.1016/j.ssci.2020.104909

Al-Dmour, H., AlKhawaldeh, H., Al-Dmour, A., et al. (2025). The integrated role of safety management systems (SMS) and risk management in achieving aviation sustainability. *Discover Sustainability, 6*, 985. https://doi.org/10.1007/s43621-025-01632-9

Almusaed, A., Almssad, A., & Yitmen, I. (2025). Crafting research questions, objectives, and aims. In *Practice of research methodology in civil engineering and architecture*. Springer. https://doi.org/10.1007/978-3-031-97393-2_4

Bah, M. O. P., Sun, Z., Hange, U., & Edjoukou, A. J. R. (2024). Effectiveness of Organizational Change through Employee Involvement: Evidence from Telecommunications and Refinery Companies. *Sustainability*, *16*(6), 2524. https://doi.org/10.3390/su16062524

Barnett, A. (2020). Aviation safety: A whole new world? *Transportation Science, 54*(1). https://doi.org/10.1287/trsc.2019.0937

Bhattarai, A., Dhakal, S., Gautam, Y., Bhattarai, N., Jha, B., & Sharma, U. (2022). Perception of safety culture in the Nepalese aviation industry: A factor analysis

approach. *Transportation Research Interdisciplinary Perspectives, 16*, 100723. https://doi.org/10.1016/j.trip.2022.100723

Bisbey, T. M., Kilcullen, M. P., & Salas, E. (2019). Safety culture: An integration of existing models and a framework for understanding its development. *Human Factors, 63*(1). https://doi.org/10.1177/0018720819868878

Churruca, K., Ellis, L. A., Pomare, C., et al. (2021). Dimensions of safety culture: A systematic review of quantitative, qualitative and mixed methods for assessing safety culture in hospitals. *BMJ Open, 11*, e043982. https://doi.org/10.1136/bmjopen-2020-043982

Cooksey, R. W. (2020). Descriptive statistics for summarising data. In *Illustrating statistical procedures: Finding meaning in quantitative data*. Springer. https://doi.org/10.1007/978-981-15-2537-7_5

Dela Peña, A. (2024). Optimization of preventive maintenance procedures for aircraft systems in an educational laboratory setting. *International Journal of Research and Scientific Innovation, 11*(9). https://doi.org/10.51244/ijrsi.2024.1109062

Dereje, M., Tilahun, S., Mekuria, G., et al. (2025). Exploring the role of human factors and organizational culture in maintenance management practice within large processing industries. *Public Organization Review*. https://doi.org/10.1007/s11115-025-00975-1

Field, A. (2009). *Discovering statistics using SPSS* (3rd ed.). SAGE Publications.

Fischer, H. E., Boone, W. J., & Neumann, K. (2023). Quantitative research designs and approaches. In *Handbook of research on science education*. Routledge.

Forza, C., & Sandrin, E. (2023). Surveys. In *Research methods for operations and supply chain management* (3rd ed., p. 83). Routledge.

Freeman, R. (2021). Failure of joints in service. In *Welding and joining of aerospace materials* (2nd ed., pp. 427–435). Woodhead Publishing. https://doi.org/10.1016/B978-0-12-819140-8.00014-6

Gudmundsson, S. V. (2019). European air transport regulation: Achievements and future challenges. In *Advances in Airline Economics*. https://doi.org/10.1108/S2212-160920190000008002

Haruna, A. D., & Taiwo, O. O. (2024). Enhancing aviation maintenance oversight through proactive quality auditing and human factors integration. *World Journal of Advanced Engineering Technology and Sciences, 13*(1), 1180–1199. https://doi.org/10.30574/wjaets.2024.13.1.0419

Insley, J., & Turkoglu, C. (2020). A contemporary analysis of aircraft maintenance-related accidents and serious incidents. *Aerospace, 7*(6), 81. https://doi.org/10.3390/aerospace7060081

Izah, S. C., Sylva, L., & Hait, M. (2024). Cronbach's alpha: A cornerstone in ensuring reliability and validity in environmental health assessment.

Jong, C. M., Comer, A. J., Chatzi, A. V., & Kourousis, K. I. (2023). Handling, inspection and repair of aircraft composites: A pilot study on the awareness of maintenance personnel. *The Aeronautical Journal*.

Kavalela, E. N., Ismail, S. B., & Wan Mohd Rani, W. N. M. (2024). Investigating the impact of safety management communications on safety culture in construction industry: Mediating role of behavioural safety and perceived working environment. *Engineering Journal, 13*(3).

Key, K., Schroeder, D. J., Durham, J., Choi, I., Hu, P., & Avers, K. E. (2022). *Procedural noncompliance in aviation maintenance: A multi-level review of contributing factors and corresponding mitigations* (Report No. DOT/FAA/AM-22/01). Federal Aviation Administration. https://doi.org/10.21949/1404269

Khalid, U., Sagoo, A., & Benachir, M. (2021). Safety management system (SMS) framework development – Mitigating the critical safety factors affecting health and safety performance in construction projects. *Safety Science, 143*, 105402. https://doi.org/10.1016/j.ssci.2021.105402

Kimeria, T. B., Kariuki, P., Muturi, W., & Wanjohi, P. (2022). Effect of organizational culture on performance of safety management systems: Civil aviation service providers in Kenya. *African Journal of Education, Science and Technology, 7*(2), 78–88. https://ajest.org/index.php/ajest/article/view/37

Li, Y., Wu, X., Luo, X., Gao, J., & Yin, W. (2019). Impact of Safety Attitude on the Safety Behavior of Coal Miners in China. *Sustainability*, *11*(22), 6382. https://doi.org/10.3390/su11226382

Mustafa, M. Z. B., Nordin, M. N. B., & Razzaq, A. R. B. A. (2020). Structural equation modelling using AMOS: Confirmatory factor analysis for taskload of special education integration program teachers. *Universal Journal of Educational Research, 8*(1), 127–133. https://doi.org/10.13189/ujer.2020.080115

Nævestad, T.-O., Hesjevoll, I. S., & Phillips, R. O. (2018). How can we improve safety culture in transport organizations? A review of interventions, effects and influencing factors. *Transportation Research Part F: Traffic Psychology and Behaviour, 54*, 28–46.

Naji, G. M. A., Isha, A. S. N., Alazzani, A., Saleem, M. S., & Alzoraiki, M. (2022). Assessing the mediating role of safety communication between safety culture and employees safety performance. *Frontiers in Public Health, 10*, 840281. https://doi.org/10.3389/fpubh.2022.840281

Neal, A., & Griffin, M. A. (2006). A study of the lagged relationships among safety climate, safety motivation, safety behavior, and accidents at the individual and group levels. Journal of Applied Psychology, 91(4), 946–953.

Newman, M., & Scott, S. (2022). Identifying the important contributory factors from Maintenance Error Decision Aid (MEDA) data. *Journal of Cognitive Engineering and Decision Making*. https://doi.org/10.1027/2192-0923/a000226

Nnaji, C., & Karakhan, A. A. (2020). Technologies for safety and health management in construction: Current use, implementation benefits and limitations, and adoption

barriers. *Journal of Building Engineering, 29*, 101212. https://doi.org/10.1016/j.jobe.2020.101212

Obilor, E. I. (2023). Convenience and purposive sampling techniques: Are they the same? SEAHI Publications.

Olaganathan, R. (2024). Human factors in aviation maintenance: Understanding errors, management, and technological trends. *Journal of Behavioral and Social Sciences*.

Öz, T. (2024). Exploring the impact of organizational behaviour on safety culture in aviation management: A qualitative study. *İstanbul Nişantaşı Üniversitesi Sosyal Bilimler Dergisi, 12*(Special Issue), 431–452. https://doi.org/10.52122/nisantasisbd.1582643

Pace, D. S. (2021). Probability and non-probability sampling: An entry point for undergraduate researchers. *International Journal of Quantitative and Qualitative Research Methods, 9*(2), 1–15.

Paidisetty, M. K., Singh, S., Kumar, V. S., Prakash, O., & Saladi, R. (2024). Evaluating the crucial influence of aircraft maintenance records and safety control on aviation safety: A comprehensive analysis. *AIAA Aviation Forum*. https://doi.org/10.2514/6.2024-4319

Prasad, V. S. K., Asif, N., Lobo, A. E., & Raveendran, C. V. (2024). A case study of factors impacting fatigue in aircraft maintenance technicians (AMT). *International Journal of Engineering Research*, 5(1), 850–855.

Pratama, G. B., & Caponecchia, C. (2025). Examining the influence of national culture on aviation safety: A systematic review. *Journal of Safety Research, 92*, 317–330. https://doi.org/10.1016/j.jsr.2024.11.020

Rafiq, S. (2025). Supervisor-supervisees relationship and quality of research: Perception of supervisors and supervisees. *Social Science Review Archives, 3*(3), 955–967. https://doi.org/10.70670/sra.v3i3.927

Rahman, M. M. (2023). Sample size determination for survey research and non-probability sampling techniques: A review and set of recommendations. *Journal of Entrepreneurship, Business and Economics, 11*(1), 42–62.

Reason, J. (1990). Human Error. Cambridge University Press.

Reason, J. (1997). Managing the Risks of Organizational Accidents. Ashgate.

Roberts, K. H. (1990). Some characteristics of one type of high reliability organization. Organization Science, 1(2), 160–176.

Rodrigues, R. B., & Ogata Filho, G. K. (2025). Fostering a culture of transparency: Leadership's role in enhancing self-reporting practices in aviation safety. *Next Research, 2*(2), 100290. https://doi.org/10.1016/j.nexres.2025.100290

Sammut, R., Griscti, O., & Norman, I. J. (2021). Strategies to improve response rates to web surveys: A literature review. *International Journal of Nursing Studies, 123*, 104058. https://doi.org/10.1016/j.ijnurstu.2021.104058

Sas, M., Reniers, G., Ponnet, K., & Hardyns, W. (2021). The impact of training sessions on physical security awareness: Measuring employees' knowledge, attitude and self-reported behaviour. *Safety Science, 144*, 105447. https://doi.org/10.1016/j.ssci.2021.105447

Stroeve, S., Smeltink, J., & Kirwan, B. (2022). Assessing and advancing safety management in aviation. *Safety, 8*(2), 20. https://doi.org/10.3390/safety8020020

Suebsuwong, P. (2024). Integrating horizons: A holistic view of predictive maintenance in aviation maintenance practices. *Engineering Journal, 13*(3).

Timjerdine, M., Taibi, S., Moubachir, Y., & Chokri, B. (2024). Evaluating the impact of maintenance personnel competencies on aircraft safety and maintenance efficiency. *Jurnal Ilmiah Teknik Industri, 23*(2), 182–190. https://doi.org/10.23917/jiti.v23i02.7427

Truong, D., & Lee, S.-A. (2025). Developing a new safety culture framework for aviation maintenance: Preliminary results. *Safety Science, 183*, 106729. https://doi.org/10.1016/j.ssci.2024.106729

Tyagi, A., Tripathi, R., & Bouarfa, S. (2023). Safety management system and hazards in the aircraft maintenance industry: A systematic literature review. *Aviation, 27*(3). https://doi.org/10.3846/aviation.2023.19851

Van Nunen, K., Reniers, G., & Ponnet, K. (2022). Measuring safety culture using an integrative approach: The development of a comprehensive conceptual framework and an applied safety culture assessment instrument. *International Journal of Environmental Research and Public Health, 19*(20), 13602. https://doi.org/10.3390/ijerph192013602

Van Wassenhove, W., Foussard, C., Dekker, S. W. A., & Provan, D. J. (2022). A qualitative survey of factors shaping the role of a safety professional. *Safety Science, 154*, 105835. https://doi.org/10.1016/j.ssci.2022.105835

Vaugeois, M. (2019). International Civil Aviation Organization (ICAO). In *Research handbook on the European Union and international organizations* (pp. 222–239). Edward Elgar Publishing. https://doi.org/10.4337/9781786438935.00018

Vierendeels, G., Reniers, G., Van Nunen, K., & Ponnet, K. (2018). An integrative conceptual framework for safety culture: The Egg Aggregated Model (TEAM) of safety culture. *Safety Science, 103*, 323–339. https://doi.org/10.1016/j.ssci.2017.12.021

Wan Mustafa, W. A., Che Lah, N. H., Adnan, E., Hanafi, A. G., Wan Muhamad, W. Z. A., & Asni, F. (2025). The implementation and challenges impact of e-learning among Asnaf students in Perlis: Analyzing using SPSS AMOS. *Journal of Advanced Research Design, 135*(1), 202–217. https://doi.org/10.37934/ard.135.1.202217

Weick, K. E., & Sutcliffe, K. M. (2007). Managing the Unexpected: Resilient Performance in an Age of Uncertainty. Jossey-Bass.

Yorio, P. L., Edwards, J., & Hoeneveld, D. (2019). Safety culture across cultures. *Safety Science, 120*, 402–410. https://doi.org/10.1016/j.ssci.2019.07.021

Zohar, D. (1980). Safety climate in industrial organizations: Theoretical and applied implications. Journal of Applied Psychology, 65(1), 96–102

# Appendix A: Questionnaire

In each of the following Sections A to D, please indicate your level of agreement with the sentences included using the following scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

## Section A: Communication

**COM1.** Safety-related information is communicated clearly within my organization.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

**COM2.** Technicians and supervisors exchange important maintenance information effectively.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

**COM3.** Employees are encouraged to report safety concerns without fear of negative consequences.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

**COM4.** Communication between management and maintenance personnel supports safe maintenance practices.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

## Section B: Training

**TR1.** The training provided by my organization adequately prepares employees for safe maintenance work.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

**TR2.** Safety training is regularly updated according to new procedures, technologies, or regulations.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

**TR3.** Human factors and maintenance error prevention are sufficiently covered in training programs.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

**TR4.** Training helps employees understand the safety consequences of maintenance errors.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

## Section C: Employee Involvement

**EI1.** Employees are encouraged to participate in safety-related discussions.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

**EI2.** Maintenance personnel can provide feedback on procedures that may affect safety.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

**EI3.** Employees are involved in identifying risks and suggesting improvements.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

**EI4.** The organization values the practical safety knowledge of frontline maintenance staff.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

## Section D: Safety Culture

**SC1.** Safety is treated as a core organizational value in my workplace.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

**SC2.** Employees in my organization prioritize safety even under time pressure.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

**SC3.** The organization learns from errors and uses them to improve safety practices.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

**SC4.** Overall, my organization has a strong safety culture.

1 ○ 2 ○ 3 ○ 4 ○ 5 ○

## Section E: Demographic Information

Please select the option that best describes you.

**1. Gender**

○Male

○Female

○Prefer not to say

○Other

**2. Age Group**

○18–25

○26–35

○36–45

○46–55

○56 and above

**3. Current Position**

○Aircraft maintenance technician

○Aircraft engineer

○Maintenance supervisor

○Quality manager

○Safety manager

○Other

**4. Years of Experience in Aircraft Maintenance**

○Less than 1 year

○1–5 years

○6–10 years

○11–15 years

○More than 15 years

**5. Type of Organization**

○Airline maintenance department

○MRO organization

○Military aviation maintenance

○Private aviation maintenance

○Other

**6. Level of Education**

○Secondary education

○Vocational/technical training

○Bachelor's degree

○Master's degree

○Doctorate

○Other

Author's Statement:

I hereby expressly declare that, according to the article 8 of Law 1559/1986, this dissertation is solely the product of my personal work, does not infringe any intellectual property, personality and personal data rights of third parties, does not contain works/contributions from third parties for which the permission of the authors/beneficiaries is required, is not the product of partial or total plagiarism, and that the sources used are limited to the literature references alone and meet the rules of scientific citations.