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Article

The Role of Environmental Factors in Shaping Safety Climate in U.S.-Based Aviation MRO Organizations: A Study Replicating Fogarty's Model

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Abstract.

This study investigates the influence of environmental factors on the safety climate within U.S.-based Maintenance, Repair, and Overhaul (MRO) organizations, utilizing Fogarty's (2005) Maintenance Environment Survey model. Key findings highlight that recognition, safety concerns, supervision, feedback, and training significantly shape perceptions of safety. Psychological strain, particularly stress and psychological distress, was shown to adversely impact maintenance errors and overall safety outcomes. The results strongly align with Fogarty's model, emphasizing the interplay between environmental factors, psychological strain, and organizational safety performance. Practical implications include recommendations for enhancing safety climate through targeted training, infrastructure improvements, and alignment with regulatory standards. This research underscores the importance of fostering a positive safety climate to reduce maintenance errors and improve operational efficiency, while providing a foundation for future studies in high-risk industries.

Keywords: Safety Climate, Environmental Factors, Maintenance, Repair, and Overhaul (MRO), Psychological Strain, Fogarty's Model.

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1. Introduction

Aviation safety is an essential component of the global transportation sector, with millions of passengers and substantial cargo depending on its dependability each day. Ensuring aviation safety necessitates the cohesive integration of diverse systems, procedures, and stakeholders, including pilots, air traffic controllers, ground workers, and Maintenance, Repair, and Overhaul (MRO) entities (Karunakaran et al., 2020). MRO businesses are tasked with maintaining aircraft to comply with stringent safety and operational requirements established by regulatory bodies like the Federal Aviation Administration (FAA) and the European Union Aviation Safety Agency (EASA). Numerous aircraft disasters have been linked to maintenance failures, emphasizing the vital role of MRO operations in maintaining the safety and dependability of the aviation sector. Preventing mistakes and ensuring safe operations requires a strong safety culture across MRO firms (Liangrokapart & Sittiwatethanasiri, 2023).

In MRO companies, a good safety atmosphere means that safety is prioritized above other demands, that people are encouraged to talk openly about safety, that they are encouraged to report safety problems, and that they are reinforced to follow safety rules (Farouk et al., 2024). Employees operating under a robust safety context are more inclined to recognize and mitigate possible hazards, adhere to safety protocols, and participate in proactive safety practices. Research repeatedly demonstrates that a robust safety atmosphere correlates with decreased accident rates, enhanced operational efficiency, and increased employee satisfaction (Nam et al., 2023). In the aviation sector, it may result in improved maintenance protocols, reduced occurrences of human error, and heightened adherence to regulatory standards. Aviation safety is contingent upon the efficient operation of MRO firms, and the safety atmosphere inside these entities significantly influences their safety results. Comprehending the impact of environmental elements on safety climate is crucial for improving safety performance in the aviation industry by introducing a climate model such as Fogarty's safety model (Farouk et al., 2024).

The aviation MRO sector is a critical part of the global aviation industry, but its safety culture is often underexplored. Fogarty's safety climate model, which has been used to understand safety climate, is being adapted to the U.S. aviation MRO context. This model provides a nuanced understanding of the interplay of organizational, individual, and environmental factors in fostering a strong safety culture (Siriwoharn et al., 2023). The model is essential for identifying sector-specific dynamics, regional differences, emerging challenges, and improved interventions. It also provides a framework for studying how technological advancements interact with organizational and individual factors to influence safety outcomes. Environmental factors, which encompass physical, operational, and regulatory conditions, are also underexplored in the aviation MRO sector (Richard Bueno & Mark Louie Martin, 2023). These factors can significantly impact worker performance, safety adherence, and perceptions of organizational commitment to safety. The study aims to bridge the gap by examining the interplay of organizational, individual, and environmental factors in shaping safety culture in MRO organizations. Key contributions include enhanced theoretical understanding, practical implications for MRO organizations, and policy development (Korba et al., 2023). The findings may inform regulatory bodies on the impact of environmental stressors on safety climate, enabling the creation of policies that support safety culture without imposing undue burdens on MRO organizations. Moreover, aircraft safety, dependability, and operational preparedness depend on aviation MRO firms. However, the safety climate in these institutions, especially in the US, is understudied.

This research replicates and extends Fogarty's safety climate model (Fogarty et al., 2024) for U.S. aviation MROs to fill this gap. This study aims to improve safety in this high-risk area via theoretical and practical advances. The research examines Fogarty's safety climate model's suitability for U.S. MROs' specific operating and regulatory environments. Fogarty's model, which integrates organizational, human, and environmental elements that affect safety perceptions and actions, is well-known. However, most of the previous research based on this theory has been undertaken in environments significantly distinct from the aircraft MRO industry in the United States. The research replicates the model in this scenario to examine its validity and applicability while obtaining insights into safety climate in one of the world's most regulated and complex aviation sectors. Another important goal of this study is to understand how environmental variables affect safety (Nam et al., 2023). Aviation MRO is notably affected by environmental elements such as working conditions, resource availability, workload, and regulatory requirements. These variables affect safety practices and perceptions via organizational and individual interactions. Environmental elements are understudied in safety climate research despite their relevance. This study addresses this gap by exploring how these components affect workers' safety perceptions, offering a more comprehensive view of safety climate dynamics (Nam et al., 2023). Another goal of the research is to find out what factors most impact the safety culture at aircraft MROs in the United States. The study tries to identify the main determinants of a good safety atmosphere by comparing organizational elements (leadership, communication, policies), person aspects (experience, motivation), and environmental circumstances. This analysis will prioritize safety initiatives and resources for optimal effect.

The research goes beyond theoretical investigation to provide MROs safety advice. The study identifies the characteristics that most affect safety climate, laying the groundwork for focused measures to enhance safety habits, minimize risks, and promote safety. Environmental considerations may indicate workplace improvements, job allocation changes, or regulatory compliance. Furthermore, the study adds to the larger body of literature on safety climates by developing and improving upon Fogarty's model. This study will improve our knowledge of aircraft MRO safety environment and influence its use in other high-risk sectors. This contribution is crucial because the safety climate continues to mitigate risks and prevent accidents in complicated organizational contexts. This research replicates and extends Fogarty's safety climate model to address U.S. aviation MRO businesses' particular concerns and dynamics. The study examines organizational, human, and environmental aspects to improve theoretical knowledge, give practical safety solutions, and promote safety climate research in high-risk sectors.

2. Literature Review

The safety environment, an essential component of organizational culture, profoundly influences safety in high-risk sectors like aviation, especially within MRO businesses. It encapsulates workers' collective views on safety rules and procedures, which are essential for guaranteeing aircraft dependability and airworthiness (Karunakaran et al., 2020). According to Bartulović, (2021), safety atmosphere is the degree of importance a company assigns to safety, influenced by visible actions and rules. The principal characteristics of safety climate include management's dedication to safety, efficient safety communication, employee engagement, thorough safety training, compliance with safety systems and protocols, and risk awareness. Studies (Gazzeh et al., 2022; Ghahremani, 2020; Richard Bueno & Mark Louie Martin, 2023) demonstrate that robust management commitment results in safer practices, while transparent communication cultivates trust and proactive behaviors. Employee engagement fosters accountability for safety results, while continuous training provides personnel with essential skills to reduce risks. Clearly established safety rules are vital for operational safety, and increased risk awareness among personnel is critical for accident prevention.

In aircraft MRO firms, a favorable safety atmosphere is essential for minimizing operational risks, assuring regulatory adherence, enhancing staff morale, decreasing human mistakes, promoting proactive safety practices, and fostering organizational resilience (Gill & Fay, 2024). Research (Ali et al., 1995; Korba et al., 2023) indicates that firms with robust safety cultures encounter fewer maintenance-related infractions and more employee satisfaction. MRO enterprises must prioritize safety climate to protect people and assets, highlighting its strategic significance in high-risk sectors among increasing (Fogarty et al., 2024; Khatib et al., 2021) were the researchers who carried out the present investigation. Following Bandura's reciprocal causation approach, Fogarty investigated the safety culture of aircraft maintenance groups. Understanding how workers' views of safety regulations and management commitment affect safety-related actions is crucial. Quantitative methods, like surveys, and qualitative ones, like interviews and document reviews, are both necessary for a thorough evaluation of safety atmosphere, as shown by Fogarty's study. This study provided a solid foundation for the present study's emphasis on MRO companies by highlighting the substantial correlation between perceptions of safety environment and actual safety performance.

Budiman et al., (2024) looked at the efficacy of a safety program in the construction business, which further demonstrated that Bandura's concept is applicable to the aviation setting. Employees' safety beliefs, management's commitment, and environmental variables all interact to impact safety actions, as their research showed. In line with the present study's goal of exploring these dynamics inside aircraft MROs, this research demonstrated the significance of psychological elements in developing safety culture and environment. Social cognition theory and Bandura's reciprocal causation model underpin this study, which also draws from aviation and non-aviation studies (Man et al., 2022). Researchers (Man et al., 2022; Priya et al., 2016) hope that by shifting the emphasis from safety culture to safety environment, they may better understand how workers' impressions of management's dedication to safety impact their actions on the job. The study is anticipated to add to the existing body of knowledge on workplace safety and guide procedures at aircraft MROs in the United States. By conducting an empirical examination of the safety climate inside aircraft MROs and delving into the reciprocal links among the aspects of person, behavior, and environment as described by Bandura's model, this study seeks to address a gap in the current literature (Sorensen et al., 2021). It is believed that the findings of this research would help enhance safety performance and culture in the aircraft maintenance industry, leading to safer workplaces for workers. Organizational culture and safety behavior in a variety of sectors have been analyzed using Fogarty's safety climate model. The problem is that when applied to aircraft MROs in the United States, it shows a lot of flaws (Chandola et al., 2023).

One major deficiency is that the model does not take into consideration the intricate regulatory landscape that is shaped by the FAA and other authorities and which impacts the organizational culture of MROs. Also, the model doesn't do a good enough job of considering how new technologies, like predictive maintenance, would affect safety measures (Korba et al., 2023). Another aspect that Fogarty's approach fails to take into account is workforce diversity, which includes a wide range of cultural and educational backgrounds. This variety may impact the efficacy of both training and communication. Safety procedures in MRO settings are also greatly affected by economic factors, such as efforts to decrease costs and shortages in the workforce (Liangrokapart & Sittiwatethanasiri, 2023). In addition, the model fails to take into account specific difficulties faced by the sector, such as limited time and dependence on outside contractors, and it fails to appropriately handle the issue of multi-level safety perceptions inside companies (Madzik & Suwannasap, 2023). Finally, the model does not take into account the effect of outside parties or the need of conducting longitudinal studies to record changing safety climates. A better safety atmosphere and improved operational efficiency may be achieved by adapting Fogarty's model to solve these highlighted weaknesses, making it more relevant and effective for aviation MRO firms.

3. Methodology

The research interviewed 134 workers from 200 US MRO facilities, which contribute $17.8 billion to the worldwide MRO business. The sample included 114 men and 17 women of various ages, with most men being married. Education was virtually rectangular, with 2 years of college being the most common. Overall, the mean experience was 16.8 years, with 9.5 years at their present MRO. High school graduates had the greatest experience, while graduate and 4-year degree holders had the least. The research examined airplane mechanic evaluations from 123 people. Airframe with Powerplant was the most common rating, followed by Unlicensed Avionics and Inspection Authorization. Hispanic, Caucasian, African American, and Asian were present. Most English-speaking participants were Hispanic. Multiple regression and structural equation modeling (SEM) were utilized. The resulting sample size was 134, six less than the minimum and 66 fewer than the recommended 200. When evaluating the study's SEM findings, the reader should evaluate the power of the data due to an insufficient sample size.

The Florida Institute of Technology's Institutional Review Board authorized the MRO worker data research. The Fluid Surveys website hosted the cognitive evaluation instrument AMSCS for four months. Fogarty's MES and Goldberg and Williams' GHQ were utilized in the research, which was simple. We used multiple regression to assess Bandura's (1977) model by examining how one dimension affects the other two (Schunk & DiBenedetto, 2023). The dimensions were Person, Environment, and Behavior. The population had a 75% to 99% likelihood of rejecting the null hypothesis. Data came from the Aviation Maintenance Safety Climate Survey (AMSCS). The AMSCS has three sections: Maintenance Environment Survey, General Health Questionnaire, and Background Information. The Maintenance Environment Survey (MES) assessed airline maintenance safety. The MES included seven dimensions: Recognition, Safety Concern, Supervision Standards, Feedback on Work Performance, Training Standards and Appropriateness, Workplace Stressors, and Maintenance Errors.

Aviation maintenance organizations' safety climates are measured by the MES. Higher scores indicate a favorable safety environment impression on a 5-point Likert scale. The MES was selected for its applicability to aviation maintenance, validation by professionals who maintain a large military helicopter fleet, and compatibility with Bandura's reciprocal causation model. For each subscale, the MES has Cronbach's alpha of.78,.72,.86,.73,.62,.84, and 82. The General Health Questionnaire (GHQ) evaluates psychological health with a.78 reliability value. The research examined MRO personnel factors using correlation and explanatory design. History, maturation, and testing threatened internal validity. History was an unexpected occurrence that may affect the dependent variable, whereas maturation was typical development. Participants were tested before and after therapy, which may have sensitized them. A function was activated to avoid pre-exposure, restricting participants' questionnaire progress. The trial was easy to execute and had no historical or maturation risks.

Although, the research confronted instrumentation, selection, mortality, selection-maturation, experimenter effect, subject effects, diffusion, and location hazards. Changes in instrument type, difficulty level, scorers, and test administration were instrumentation threats. The present research did not categorize individuals or conduct pre-assessments, therefore statistical regression threats did not apply. The research was conducted online via a host website, and 28.7% of the sample lost. Mortality hazards did not apply. Selection-maturation hazards did not apply since the research only included maintenance workers. The research was conducted online, therefore experimenter effects did not apply. No subject effects risks were relevant as the research was electronic. The research had one group and no treatment, thus diffusion hazards did not apply. Since the research was online, location risks were ignored. Thus, the treatment verification and fidelity ensure a study's procedures are correctly performed, protecting independent variables and boosting generalizability. This research addresses external validity by describing factors, collecting data, and analyzing data. Descriptive and inferential statistics with sample demographics were used to analyze data. Age, gender, marital status, race/ethnicity, highest education, total years' experience, and English as a second language were demographic factors.

4. Results and Discussions

This section will provide the result obtained. A total of 134 participants, with 13 considered outliers, formed the basis of the study's final dataset. For the purpose of evaluating Fogarty et al., (2024) model, subscales such as Training, Recognition, and Safety Concern were included in the dataset, even though they were required to be removed owing to poor reliability coefficients. Only exploratory analyses, not main ones, made use of the Training subscale. The dataset used for exploratory research does not include the Feedback subscale or demographic variables such as gender, marital status, or degree of education. Table 1 displays the outcomes of these analyses.

Testing Fogarty's model. SME was performed using AMOS version 23 to determine of the sample data obtained.

Table 1: Summary of Variable Status as A Result of Preliminary Data Screening

Dataset Used for Primary Analyses		
Initial Set of Factors	***Decision***[a]	***Reason/Rationale***[a]
Recognition	Kept in final model	□ = .68; near minimum threshold of .70
Safety concern	Kept in final model	□ = .69; near minimum threshold of .70
Supervision	–	–
Feedback[b]	Kept for SEM	Assumption not relevant to SEM
Training	Deleted from final model	□ = .60; less than minimum threshold of .70
Stress	–	–
Psychological distress	–	–
Maintenance errors	–	–
Dataset Used for Exploratory Analysis		
Recognition	Kept in final model	□ = .68; near minimum threshold of .70
Safety concern	Kept in final model	□ = .69; near minimum threshold of .70
Supervision	–	–
Feedback	Deleted from final model	Not correctly specified; failed assumption
Training	Kept in final model	□ = .60; close enough for exploratory use
Stress	–	–
Psychological distress	–	–
Age	–	–

Gender	Deleted from final model	Not correctly specified; failed assumption
Marital status	Deleted from final model	Not correctly specified; failed assumption
Years' experience	–	–
Years at current MRO	Deleted from final model	Not correctly specified; failed assumption
English is primary	Deleted from final model	Not correctly specified; failed assumption
Education level	Deleted from final model	Not correctly specified; failed assumption
Race/Ethnicity	Deleted from final model	Not correctly specified; failed assumption

Note. N = 134.

aDashed items (–) denote no action taken because the factor was compliant with the assumptions. although the Feedback subscale was not compliant with the correct specification of the IV assumption; it was included in the dataset used to test Fogarty's (2024) model because the assumption is not relevant to SEM. However, Feedback was excluded from the dataset used to test Bandura's (1977) model, which used multiple regression.

The maintenance errors factor of Fogarty's MES Survey is provided in Table 2.

Table 2: "Summary of Intercorrelations among the Subscales of Fogarty's (2005) Maintenance Environment Survey and Goldberg and Williams' (1998) General Health Questionnaire"

Scale[a]	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1. Recognition	—							
2. Safety Concern	.31	—						
3. Supervision	.51	.41***	—					
4. Feedback	.50	.43***	.61***	—				
5. Training	.35	.24**	.47***	.45***	—			
6. Stress	−.11	−.40***	−.07	−.11	−.16	—		
7. GHQ[b]	−.12	−.25**	.11	−.17*	−.28**	.43***	—	
8. Maintenance Errors	.14	−.26**	.04	−.06	−.24**	.41***	.39***	—

Note. N = 123. Correlations greater than |.20| are significant for □ = .05.

aScales 1–5 defined Safety Climate; Scales 6–7 defined Psychological Strain. bGHQ = Psychological Distress.

*p < .05. **p < .01. ***p < .001.

The preliminary data screening process for variables in both primary and exploratory analyses was conducted to assess their suitability based on criteria like internal consistency, model-specific assumptions, and the nature of the statistical methods applied. The dataset focuses on testing models with stringent assumptions, particularly regarding reliability (Cronbach's alpha ≥ 0.70). Recognition and Safety Concern were kept in the final model due to their Cronbach's alpha values being near the acceptable threshold (0.70), justifying their retention. Safety Concern was kept for Structural Equation Modelling (SEM) because it met the necessary assumptions and required no intervention. Feedback was kept for SEM but was deemed irrelevant for SEM. Training was retained for exploratory purposes due to its low reliability score (0.60), indicating inadequate reliability. Exploratory analyses have more relaxed criteria, often allowing for the inclusion of variables with lower reliability scores or less stringent assumptions. Most demographic variables were deleted from the final model due to their failure to meet the assumptions for correct specification or were not correctly defined, making them incompatible with the models being tested. Key considerations included reliability (Cronbach's Alpha), assumptions of statistical methods, nature of the analysis, and demographic factors. Primary analyses adhered to stricter standards, while exploratory analyses allowed for the inclusion of less reliable variables. This dual approach ensures that the models tested are both robust and open to broader exploration, balancing precision with flexibility.

Furthermore, Figures 1 and 2, show when Fogarty's (2005) model was tested using the current study's sample data obtained.

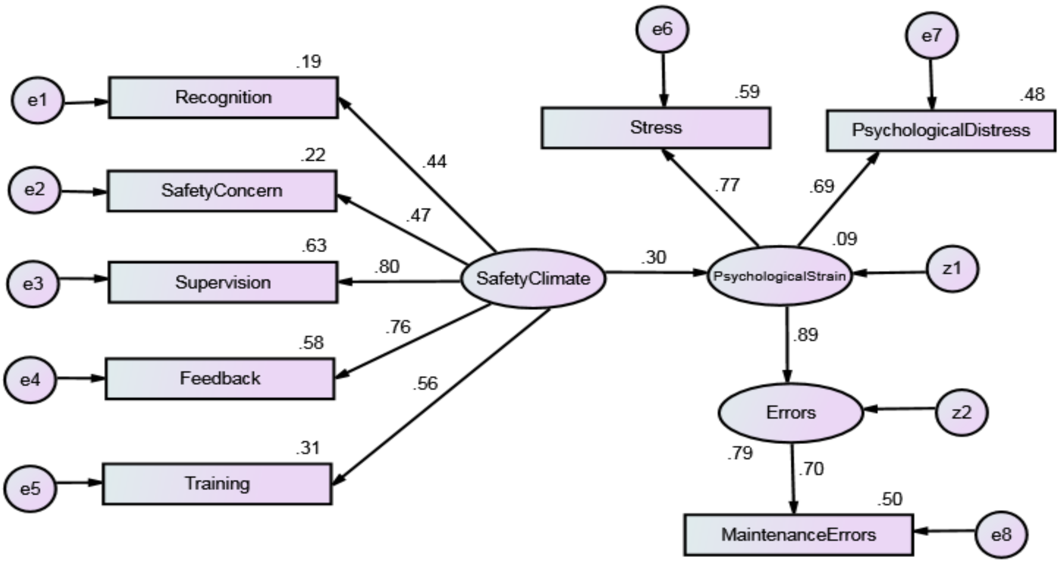

Figure 1: "Results of SEM Analysis of Initial Hypothesized Model (Standardized Estimates): Chi-square = 84.27, df = 19, p = .000".

The diagram is a structural equation model (SEM) that illustrates the relationships among workplace safety, psychological strain, and maintenance errors. It consists of five key components: Safety Climate, Psychological Strain, and Maintenance Errors. Safety Climate is influenced by five observed indicators: Recognition, Safety Concern, Supervision, Feedback, and Training. Psychological Strain is another latent construct influenced by two observed indicators: Stress and Psychological Distress. Maintenance Errors are a latent variable that leads to these errors. The relationship between Safety Climate and Psychological Strain is significant, with a negative impact on Psychological Strain. A positive safety climate reduces stress and psychological distress, while Psychological Strain strongly predicts errors, highlighting its critical role in causing maintenance errors. The strongest contributors to safety climate are supervision and feedback, suggesting effective leadership and communication play a significant role in fostering a positive safety climate. Psychological strain, consisting of Stress and Psychological Distress, measures the mental health and well-being of individuals in the work environment. A robust safety climate alleviates stress and distress among employees, while Psychological Strain directly contributes to the occurrence of maintenance errors. Maintenance Errors are a measurable outcome of latent Errors, with a high loading of 0.79. The direct and indirect effects of Safety Climate on Psychological Strain and Errors emphasize the importance of addressing workplace stress and mental health issues to improve operational reliability. Practical implications include enhancing key components of Safety Climate, particularly Supervision and Feedback, to create a safer and more supportive work environment. Addressing Psychological Strain through stress management programs and mental health support can significantly reduce errors and improve overall performance.

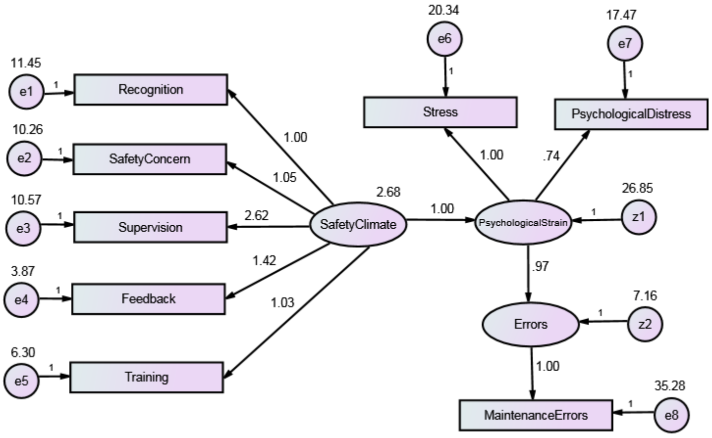

Figure 2: Results of SEM Analysis of Initial Hypothesized Model (Unstandardized Estimates): Chi-square = 84.27, df = 19, p = .000.

The updated SEM examines the relationships among Safety Climate, Psychological Strain, and Maintenance Errors, utilizing path coefficients and error variances for comprehensive analysis. Key features include error terms (e1–e8), which represent the unexplained variance in observed variables, and standardized path coefficients indicating the strength of relationships. For instance, the path coefficient from Safety Climate to Psychological Strain is 1.00, while the influence of Psychological Strain on Errors is 0.97. Safety Climate is defined by indicators such as Recognition, Safety Concern, Supervision, Feedback, and Training, with Supervision (2.62) and Safety Concern (1.05) being the most significant contributors. Psychological Strain is shaped by Stress and Psychological Distress, which exhibit high error variances, suggesting measurement improvements are needed. The model highlights that Psychological Strain directly affects Errors and Maintenance Errors, indicating mental health's critical role in operational outcomes. Practical implications suggest organizations should enhance supervision and address safety concerns to improve Safety Climate. Additionally, implementing stress management programs and psychological support can alleviate Psychological Strain, ultimately reducing maintenance errors. The model underscores the importance of leadership and employee well-being in fostering a safer workplace environment.

In addition, the SEM results of recognition and supervision on safety climate for standardized estimates is provided in Figures 3.

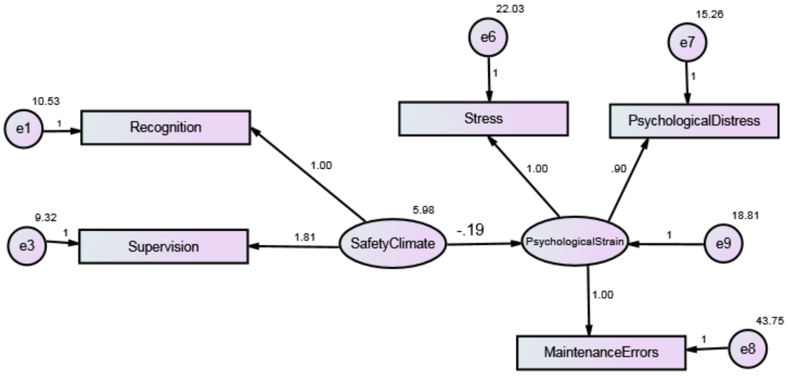

Figure 3: "Results of SEM analysis of modified hypothesized model in the absence of Safety Concern, Feedback, and Training (standardized estimates): Chi-square = 7.86, df = 5, p = 0.164".

From Figure 3, the key findings reveal that recognition and supervision significantly enhance safety climate, which modestly reduces psychological strain. Stress and psychological distress directly impact strain, leading to increased maintenance errors. The model emphasizes the importance of mental health and effective supervision in improving safety outcomes. However, high unexplained variance indicates the need for further research into additional influencing factors and potential moderators or mediators, advocating for a holistic approach to safety management in MRO settings. Furthermore, the model fit indices for analysis of modified hypothesized model in the absence of safety concern, feedback, and training based on standardized estimates is provided in Table 3.

Table 3: Indices of Model Fit

Index[a]	Recommended Thresholds[b]
$\chi^2(5) = 7.86, p = .164$	Nonsignificant, $p > .05$
GFI = .977	Greater than .90
CFI = .970	Greater than .90
RMSEA = .068	Less than .08
DELTA2 = .971	Greater than .90

[a] GFI = goodness-of-fit index, CFI = comparative fit index, RMSEA = root mean square error of approximation, and DELTA2 is the incremental fit index (IFI).

The table presents the model fit indices used to evaluate the adequacy of a structural equation model (SEM). The indices provide insights into how well the hypothesized model aligns with the observed data. The Chi-Square Test and Goodness-of-Fit Index (GFI) indicate a good fit, with a value of 0.977 indicating that the majority of observed variance and covariance is explained by the model. The Comparative Fit Index (CFI) measures how well the model performs compared to a null model, with a value of 0.970 indicating robust fit. The Root Mean Square Error of Approximation (RMSEA) value of 0.068 falls within the acceptable range, indicating that the model approximates the population covariance structure well. The Incremental Fit Index (DELTA2 or IFI) value of.971 reinforces the model's excellent fit. The results from the model fit indices suggest that the theoretical constructs used in the model are appropriate and effectively explain observed patterns in the data.

4.1 Discussion

This research examines the influence of environmental variables on the safety atmosphere in U.S.-based MRO firms. It cites numerous essential elements, including recognition, safety issues, oversight, feedback, and training, as crucial factors. Acknowledgment of workers' contributions to safety positively affects the safety atmosphere, suggesting that when employees feel recognized for their compliance with safety procedures, they are more inclined to participate in safety measures. Safety issues are intrinsically linked to workers' evaluation of the organization's overall safety atmosphere, underscoring the need of a proactive strategy for detecting and alleviating safety hazards. Effective supervision is seen as a crucial element affecting safety atmosphere, consistent with previous studies highlighting the importance of leadership in fostering safety habits. Consistent feedback on safety-related conduct is positively correlated with safety climate, enhancing individual performance and cultivating a feeling of shared responsibility for safety. Training is essential in influencing workers' safety views, especially in a high-risk setting such as MRO. These results highlight the complex role of environmental elements in influencing safety climate, indicating that MRO firms must comprehensively address these aspects to promote a safer work environment and minimize maintenance mistakes.

The results were assessed in accordance with Fogarty et al., (2024)'s (20) Safety Climate model, which highlights the interplay between safety climate, psychological strain, and maintenance faults. Multiple aspects of concordance and discord were identified, including acknowledgment, psychological stress and inaccuracies, training, and feedback. The results validate that Fogarty's Safety environment model is a solid foundation for comprehending safety environment in MRO organizations. The study's focus on training and feedback underscores possible areas for model enhancement. The model might be augmented to include training as a fundamental element and feedback systems, since consistent feedback loops facilitate ongoing improvement and bolster the overall safety culture. The disparity indicates that safety climate is contingent upon context and that industry-specific elements, such the high-risk nature of MRO businesses, may need modifications to current models. Future study should investigate these divergences to strengthen theoretical frameworks and provide customized treatments for improving safety climate.

4.2 Practical Implications

This study provides practical recommendations for enhancing the safety climate within U.S.-based MRO organizations. By addressing environmental factors that influence safety perceptions and aligning organizational practices with proven models, MROs can improve safety outcomes, reduce maintenance errors, and foster a culture of safety (Chandola et al., 2023). Recommendations include promoting employee recognition, strengthening safety training programs, enhancing supervisory practices, encouraging feedback culture, addressing psychological strain, improving infrastructure, upgrading facilities, enhancing safety systems, addressing hazardous areas, maintaining compliance with regulatory requirements, and integrating best practices (Wang et al., 2017).

Additionally, MRO organizations should invest in modern, ergonomically designed workspaces, install advanced safety systems, address hazardous areas, maintain compliance with federal and industry-specific safety regulations, conduct regular audits, and adopt industry best practices to strengthen the safety culture. Fostering a culture of continuous improvement involves using root cause analysis, establishing a safety committee, and leveraging data analytics to identify trends in safety performance (Rodrigues & Lavorato, 2016). Mitigating workforce challenges includes hiring additional personnel or cross-training employees, providing ongoing support for multicultural workforces, and leveraging technology like predictive maintenance tools and virtual reality simulations for immersive safety training (Ichou & Veress, 2023; Korba et al., 2023). By implementing these recommendations and strategies, MRO organizations can create a safer working environment that prioritizes employee well-being, aligns with regulatory standards, and minimizes maintenance errors. The integration of modern technologies and continuous improvement practices will ensure safety remains a central priority in the dynamic and high-risk environment of MRO operations.

5. Conclusion and Future Direction

The study reveals that environmental factors significantly impact the safety climate in U.S.-based MRO organizations. Key elements such as recognition, safety concerns, supervision, feedback, and training play critical roles in shaping perceptions of safety. Psychological strain, including stress and distress, also impacts employee performance and maintenance errors. The SEM approach demonstrated strong alignment between environmental factors and safety outcomes, underscoring the validity of Fogarty's (2005) Maintenance Environment Survey model. Environmental factors are interconnected elements that collectively define the safety climate within MRO organizations. Positive recognition and constructive feedback create a sense of value and accountability among employees, while effective supervision ensures consistent adherence to safety standards. Comprehensive training equips employees with the knowledge and skills necessary to navigate workplace hazards. Addressing psychological strain enhances mental well-being, which reduces errors and promotes a safer workplace.

Furthermore, the Fogarty's model provides a robust theoretical framework for understanding the interplay between environmental factors, psychological strain, and safety outcomes. Its replication in this study reinforces its applicability in aviation MRO settings, where safety is paramount. By adopting Fogarty's model, aviation MRO organizations can systematically address environmental challenges and psychological factors, leading to measurable improvements in safety performance and operational efficiency.

Future research should focus on expanding the scope of this study by exploring additional environmental factors, longitudinal studies, and comparative studies across different geographic regions and industries. With continued research and targeted interventions, the aviation industry can achieve its overarching goal of maintaining the highest safety standards while safeguarding the well-being of its workforce.

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