Challenges and Strategies in Workforce Development for Aircraft Maintenance Companies in Clark

ARJHON S. ACORDON[1], NOEL T. FLORENCONDIA[2], CHRISTOPHER M. LADIGNON[3]
[1] *Student, Graduate School, Nueva Ecija University of Science and Technology, Cabanatuan City, Philippines*
[2, 3] *Professor, Graduate School, Nueva Ecija University of Science and Technology, Cabanatuan City, Philippines*

Abstract- ***This study examines the significant obstacles and strategic approaches concerning workforce development within aircraft maintenance firms in Clark, Philippines. As the aviation sector continues to grow in the area, the need for proficient maintenance staff has escalated, revealing deficiencies in workforce preparedness, training facilities, and talent retention. Utilizing qualitative interviews and industry assessments, the research highlights critical challenges such as skill deficits, restricted access to specialized training, and elevated employee turnover rates. Additionally, it investigates the strategies adopted by companies to address these challenges, including collaborations with technical schools, upskilling initiatives, and attractive incentive programs. The results emphasize the necessity for cooperative efforts among industry participants and educational institutions to establish a sustainable talent pipeline. This research seeks to offer practical recommendations for policymakers, educators, and industry executives to improve the skills and resilience of the aircraft maintenance workforce in Clark.***

Indexed Terms- ***Aircraft Maintenance, Aviation, Maintenance and Repair Organization, Workforce Development***

I. INTRODUCTION

The aviation sector is crucial for worldwide transportation, economic growth, and global connectivity. In the Philippines, the Clark Freeport Zone has developed into a significant center for aviation activities, especially in maintenance, repair, and overhaul (MRO) services for aircraft. Due to its advantageous location, expanding infrastructure, and favorable regulatory framework, Clark has drawn many aircraft maintenance firms seeking to benefit from the rising demand for MRO services in the Asia-Pacific area.

Despite the available opportunities, workforce development continues to be a significant challenge for businesses in the region. The aircraft maintenance industry demands a workforce that is not only highly skilled but also certified to adhere to stringent international safety and technical standards. Numerous companies in Clark struggle with the recruitment, training, and retention of qualified staff, which negatively impacts their operational efficiency and service quality. These issues are further exacerbated by a lack of local training facilities, a disconnect between educational outcomes and industry requirements, and increasing competition for skilled labor on both national and global scales.

The objective of this research is to identify the primary challenges that aircraft maintenance companies in Clark face in terms of workforce development, as well as the methods they use to overcome these challenges. Through an analysis of industry practices, stakeholder perspectives, and workforce trends, the study aspires to deliver practical suggestions for bolstering the human capital framework of the local aviation maintenance sector. In the end, this research contributes to the larger dialogue on aligning workforce development with industry growth, particularly in specialized and high-demand areas like aircraft maintenance.

II. THE PROBLEM AND ITS BACKGROUND

A. Background of Study

The Clark Freeport Zone in the Philippines has emerged as a growing hub for aviation and aerospace activities, particularly in aircraft maintenance, repair,

and overhaul (MRO). With its strategic location, modern infrastructure, and government support, Clark has attracted both local and international MRO companies aiming to serve the increasing demand for aviation services in the Asia-Pacific region (DOTr, 2020). However, the rapid growth of the industry has brought about pressing workforce development challenges. A recurring issue faced by MRO firms in the area is the shortage of skilled and licensed aircraft maintenance personnel, which is critical to ensuring safety, efficiency, and compliance with international standards (CAAP, 2021). Contributing to this challenge is a limited pool of graduates with aviation-specific technical training, insufficient alignment between academic curricula and industry requirements, and a trend of skilled workers migrating abroad in search of higher-paying opportunities (TESDA, 2020).

In reaction to the evolving landscape, several companies have initiated collaborations with technical education institutions, established internal training programs, and developed strategies aimed at retaining employees. However, the overall effectiveness of these initiatives is not yet fully understood. This research aims to fill this knowledge gap by examining the fundamental challenges and proposing sustainable workforce development strategies that aircraft maintenance firms in Clark can implement to cultivate a robust and competitive labor force.

B. Objective of the Study

The aviation sector within the Clark Freeport Zone has emerged as a crucial element in the economic advancement of the Philippines, particularly through its involvement in aircraft maintenance, repair, and overhaul (MRO) services. With the ongoing increase in regional air travel, the necessity for dependable and high-quality aircraft maintenance has escalated, establishing Clark as a pivotal site for aviation-related investments. Nevertheless, despite the expansion of infrastructure and market prospects, workforce development has not progressed at a similar rate. Numerous aircraft maintenance firms in Clark face challenges due to a lack of qualified personnel, attributing this to factors such as restricted access to industry-specific training, a disconnect between academic curricula and practical skills needs, and the emigration of skilled workers. These challenges not only affect the operational efficiency of these companies but also hinder their ability to comply with international safety and regulatory standards. In response, several firms have launched internal training initiatives, collaborated with technical educational institutions, and implemented retention strategies to cultivate a more sustainable workforce. However, significant gaps persist in understanding which methods are the most effective. This research intends to investigate these challenges comprehensively and analyze the strategies currently in use, aiming to identify actionable solutions that can enhance the long-term growth and resilience of the aircraft maintenance workforce in Clark.

C. Significance of Study

This research is of considerable importance to various stakeholders in the aviation sector, especially regarding the increasing significance of the Clark Freeport Zone as a center for aircraft maintenance services. By investigating the specific workforce development issues encountered by Maintenance, Repair, and Overhaul (MRO) companies and the approaches they adopt to tackle these challenges, the study provides actionable insights that can aid decision-making at both organizational and policy levels. For industry executives, the results can enhance the formulation of more effective recruitment, training, and retention initiatives that cater to the distinct requirements of the local and global aviation labor market. For educational institutions and training organizations, the research offers essential guidance for aligning educational programs with industry needs, promoting stronger collaborations, and enhancing the employability of graduates. Furthermore, for governmental bodies and regulatory agencies, the findings can inform the creation of targeted support initiatives and policies that bolster the aviation workforce pipeline. Ultimately, this research contributes to the overarching objective of cultivating a sustainable, competitive, and future-ready workforce that underpins the long-term development of Clark's aircraft maintenance sector and the Philippines' standing in the international aviation arena.

D. Scope and Delimitation

This study focuses on identifying the challenges and evaluating the strategies related to workforce development specifically within aircraft maintenance companies operating in the Clark Freeport Zone. It examines key areas such as recruitment, training, certification, and employee retention practices, with particular attention to how these companies respond to skill shortages, training gaps, and labor mobility. The research includes data gathered through interviews with industry professionals, reviews of institutional practices, and relevant secondary sources. However, the study is delimited to aircraft maintenance firms within Clark and does not cover other aviation sectors such as flight operations, ground handling, or logistics. Additionally, the scope is limited to workforce-related concerns and does not extend to technical or operational aspects of aircraft maintenance itself. While the findings may offer insights applicable to other regions or sectors, they are primarily intended to reflect the unique economic, educational, and labor dynamics present in Clark. The study also does not account for post-pandemic workforce changes beyond the scope of data collected during the research period.

III. METHODOLOGY

A. Research Design

This research utilizes a qualitative methodology, which is considered the most suitable for investigating the intricate and context-dependent challenges and strategies associated with workforce development in aircraft maintenance firms located in Clark. The qualitative framework enables a thorough exploration of the experiences, perceptions, and strategies of key stakeholders in the industry, including company executives, human resources staff, training providers, and employees. Data collection will primarily occur through semi-structured interviews, promoting open-ended dialogue and allowing for the capture of nuanced insights into the workforce-related challenges and responses within the sector. Additionally, the study will incorporate a review of pertinent documents, such as training manuals, corporate reports, and industry publications, to enhance the interview data and provide further context to the research outcomes. A purposive sampling technique will be employed to select participants who are actively engaged in workforce management and training within aircraft maintenance companies in the Clark Freeport Zone. Thematic analysis will be applied to discern recurring patterns and themes within the data, which will subsequently be examined in relation to the identified challenges and strategies. This research design facilitates a thorough investigation of the workforce development issues specific to Clark's aircraft maintenance sector, thereby contributing to a more profound understanding of both the challenges and solutions currently being implemented.

B. Research Instrument

The main research tool for this investigation will be a semi-structured interview framework aimed at gathering in-depth insights from key stakeholders engaged in workforce development within aircraft maintenance firms in Clark. This framework will feature open-ended questions designed to delve into both the challenges faced and the strategies adopted by these companies to tackle workforce-related concerns. Critical areas of focus will encompass recruitment methods, skill deficiencies, employee retention, training and certification initiatives, and collaborations with educational institutions. Additionally, the questions will seek to understand the perspectives of industry leaders on the sufficiency of current workforce development programs and the perceived success of the strategies implemented by their organizations. To facilitate a thorough understanding, the instrument will also incorporate prompts that encourage participants to provide specific examples, share experiences, and offer suggestions for enhancement. The semi-structured format of the instrument permits adaptability during the interview process, allowing participants to address pertinent issues that may not have been foreseen in the initial questions. Alongside the interviews, an examination of pertinent company documents, training curricula, and industry reports will act as supplementary tools to enrich the context of the findings. Prior to the commencement of full data collection, the research instrument will undergo a pilot test with a select group of participants to ensure its clarity and relevance.

C. Sampling Technique

This research will utilize a purposive sampling method to identify participants who have direct expertise and

experience related to workforce development in aircraft maintenance firms located in Clark. The purposive sampling approach is particularly suitable for this study, as it facilitates the selection of individuals who serve as key informants, thereby enhancing the understanding of the challenges and strategies encountered by the industry. Participants will comprise company managers, human resource professionals, training coordinators, and employees actively engaged in recruitment, training, and development activities within Maintenance, Repair, and Overhaul (MRO) companies. This methodology guarantees that the sample consists of individuals who are optimally positioned to offer pertinent and insightful information regarding workforce-related matters. Furthermore, participants will be chosen based on specific criteria, including their years of industry experience, their roles in workforce management, and their awareness of current workforce development initiatives. The sample size will be established at the saturation point, where further interviews cease to provide new insights, which is typically anticipated to range from 10 to 15 participants. The selection process will strive for diversity concerning company size, operational scope, and the variety of workforce development strategies implemented, thereby offering a holistic perspective on the workforce challenges and solutions within the industry.

D. Research Questions

The research aims to investigate the challenges and strategies related to workforce development within aircraft maintenance companies in the Clark Freeport Zone. By focusing on the key factors influencing recruitment, training, certification, and employee retention, this study seeks to uncover the underlying issues and the responses implemented by companies to address these concerns. The following research questions will guide the study:

1. What are the key challenges faced by aircraft maintenance companies in Clark regarding workforce development?
- This question seeks to explore the main obstacles companies encounter in recruiting, training, and retaining skilled workers, as well as the specific issues related to certification and workforce certification standards

2. What are the key challenges faced by aircraft maintenance companies in Clark regarding workforce development?
- This question aims to identify the strategies employed by companies to bridge the gap between the available workforce and the specialized skills required for effective aircraft maintenance.

3. What workforce development strategies have been implemented by aircraft maintenance companies in Clark to enhance employee retention?
- This question examines the methods and incentives used to retain skilled employees, such as compensation packages, career advancement opportunities, and professional development initiatives

4. What role do partnerships between aircraft maintenance companies and educational institutions play in workforce development in Clark?
- This question investigates the effectiveness of collaboration between industry players and educational or training institutions, assessing whether these partnerships align training programs with industry needs.

5. How do the workforce development strategies employed by aircraft maintenance companies in Clark compared to those in other regions or international standards?
- This question aims to evaluate the competitiveness of Clark-based MRO companies in terms of workforce development and identifies best practices that could be adopted from other regions or global standards.

E. Statistical Method

Due to the qualitative nature of this research, the main emphasis will be on gathering and examining non-numerical data through interviews and document analysis. Nevertheless, to enhance the understanding of the challenges and strategies related to workforce development, the study will also include fundamental descriptive statistics to assess certain quantifiable elements of data. For example, demographic

information of the interviewees, including years of experience, educational qualifications, and company size, will be evaluated using frequency distributions and percentages to delineate the characteristics of the respondents. Furthermore, the research will apply basic cross-tabulation techniques to investigate the relationships between variables such as company size and the types of workforce development strategies employed, as well as the correlation between training practices and employee retention rates. These statistical approaches will complement the qualitative insights and provide a more comprehensive, data-informed perspective on workforce development challenges within the aircraft maintenance industry in Clark. The combination of qualitative and basic quantitative techniques will provide a comprehensive picture of the challenges and strategies in workforce development in this context, aligning with similar research that has successfully combined both methods for in-depth analysis (Creswell, 2014). This approach will help ensure that the study's conclusions are not only grounded in qualitative insights but also reinforced by data that captures trends and patterns within the industry.

IV. RESULTS AND DISCUSSION

This research highlighted various interconnected challenges and strategies in workforce development, as revealed through interviews with managers, HR officers, and training supervisors from aircraft maintenance companies in the Clark Freeport Zone. The subsequent discussion presents the main themes, supported by participant quotes and visual data representations

A. Skill Shortage and Talent Drain

All companies that took part acknowledged a critical lack of licensed and experienced aircraft maintenance technicians as their foremost challenge. This issue is predominantly caused by international labor migration, as skilled workers depart for higher-paying positions in foreign countries.

B. Training Limitations and Industry-Academia Gap

Participants voiced apprehension regarding the insufficient access to practical training programs and the disconnect between educational curricula and real-world MRO operations. Numerous companies indicated that they were compelled to begin anew when integrating recent graduates into their workforce.

C. Strategies for Workforce Development

In response to workforce challenges, organizations have identified a range of strategies:

- In-house technical training programs
- Partnerships with aviation and technical schools
- Retention incentives (e.g., housing allowances, skill premiums)

D. Role of Partnerships and Policy Support

Companies that actively partnered with educational institutions and governmental bodies experienced improved results in recruitment and training effectiveness. Nevertheless, such collaborations are still restricted and frequently informal.

V. TABLE

Table 1

Top Workforce Challenges Cited by Respondents (n = 12)

Challenge	Frequency Mentioned	Percentage (%)
Lack of certified technicians	11	91.7 %
High employee turnover	10	83.3 %
Inadequate training infrastructure	8	66.7 %
Curriculum mismatch with industry	7	58.3 %
Low local awareness of MRO careers	5	41.7%

Table 2

Common Strategies Employed by Companies

Strategy	No. of Companies Using it	Percentage (%)
In-house training programs	10	83.3 %
Industry-academe partnerships	8	66.7 %
Financial and career incentives	7	58.3 %
International certification support	5	41.7 %

VI. FIGURES

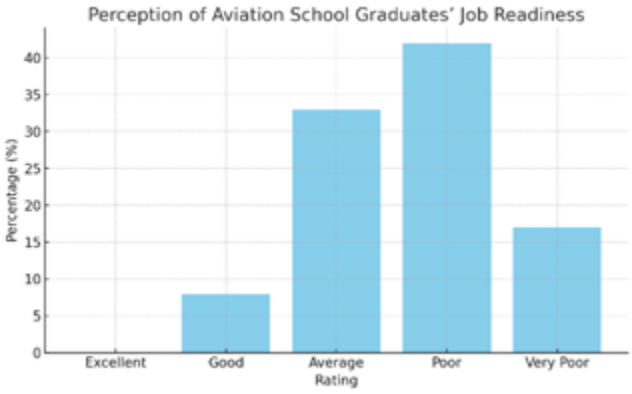

Fig. 1. *A Likert-scale summary showing ratings across 5 categories (Very Poor to Excellent), based on responses from 12 participants.*

VII. SUMMARY AND RESULTS

E. Summary

This study assessed the fundamental challenges and strategies associated with workforce development in aircraft maintenance enterprises situated in the Clark Freeport Zone. Employing qualitative research techniques, such as interviews with human resources managers, training coordinators, and operations leaders, the research uncovered both the persistent issues these firms face and the strategies they are adopting to address them. The analysis of data, supported by descriptive statistics, identified recurring themes related to skill shortages, training inadequacies, employee retention problems, misalignment between industry and academia, and global competition for skilled personnel. The findings underscore the urgent requirement for collaborative efforts among businesses, educational institutions, and government agencies to fortify the aviation maintenance workforce and ensure the sustained advancement of Clark as an international MRO (Maintenance, Repair, and Overhaul) center

F. Results

The main results of the study are categorized into challenges and strategies:

1. Challenges Identified:

- Lack of certified and experienced technicians 91.7% of respondents identified a lack of qualified staff as a significant obstacle to operational efficiency.
- High employee turnover and talent migration A significant 83.3% of organizations indicated challenges in employee retention, as numerous workers pursue more lucrative opportunities overseas.
- Inadequate training infrastructure and resources 66.7% of respondents indicated a deficiency in current, applicable training programs that align with industry standards.
- Misalignment between educational programs and industry needs 58.3% observed that aviation graduates often lacked practical, hands-on skills despite theoretical knowledge.
- Low public awareness of careers in aircraft maintenance 41.7% indicated a widespread disinterest or unawareness among youth regarding career opportunities in MRO.

2. Strategies Implemented:

- Development of in-house training programs 83.3% of organizations developed customized training programs to address operational needs.

- Partnerships with technical schools and aviation academies 66.7% developed linkages to offer practical training and internship experiences.

- Financial and career advancement incentives 58.3% of organizations utilized signing bonuses, promotional pathways, and various incentives to maintain employee retention.

- Support for international certification and standards compliance 41.7% supported employees in securing certifications that are esteemed on a global scale to advance their skills.

3. Supporting Data Visualization:

- A bar chart depicted the views of aviation school graduates regarding their job preparedness, indicating that most respondents classified it as “poor” or “average”.

The tables provided a detailed account of the frequency and percentage of challenges and strategies within the companies involved.

VIII. CONCLUSION AND RECOMMENDATIONS

A. Conclusion

This study analyzed the challenges and strategies involved in workforce development among aircraft maintenance companies in the Clark Freeport Zone. The findings indicate that while the region has strong potential to emerge as an aviation maintenance center, workforce-related issues, especially the shortage of certified workers, high turnover rates, and training deficiencies, propose substantial barriers to growth. These challenges are further aggravated by the lack of synchronization between academic training and industry requirements, along with the rising demand for skilled labor in the global aviation sector.

Despite the challenges faced, various firms have proactively implemented internal training programs, introduced retention incentives, and established collaborations with aviation schools. However, the application of these strategies is inconsistent across different organizations, especially when comparing large corporations to smaller businesses, and often lacks systemic backing. Therefore, while some progress is apparent, the current strategies do not sufficiently address the industry's future needs.

The research concludes that for sustainable workforce development in Clark's MRO sector, a more integrated and collaborative approach is essential, involving not just the companies but also academic institutions, local government units, and national agencies like TESDA and CAAP. Only through collective action can the region foster a resilient and future-ready aviation workforce.

B. Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. Strengthen Industry-Academe Collaboration Establish formal collaborations between Maintenance, Repair, and Overhaul (MRO) organizations and aviation educational institutions to guarantee the relevance of curricula, alignment of practical training, and the effectiveness of job placement initiatives.

2. Expand Access to Certification Programs Government and industry stakeholders must engage in subsidizing or co-developing initiatives that empower local workers to attain licenses and certifications that hold international recognition.

3. Develop Sector-Wide Retention Frameworks Implement standardized practices across the industry concerning benefits, career pathways, and incentives to effectively lower employee turnover and migration rates.

4. Institutionalize Workforce Planning Initiatives Establish comprehensive industry standards for employee benefits, career advancement opportunities, and incentives to mitigate workforce migration and turnover.

5. Promote MRO Careers to the Youth Initiate awareness strategies and school-based outreach programs aimed at attracting a larger student population to aircraft maintenance and engineering disciplines.

These guidelines are intended to encourage a competitive and well-supported workforce that will play a vital role in the sustainable progress of the aviation sector in Clark and beyond.

ACKNOWLEDGMENT

First and foremost, I give all glory and thanks to Almighty God, whose guidance, wisdom, and grace have sustained me throughout the course of this research. Without His blessings, strength, and provision, this study entitled *"Challenges and Strategies in Workforce Development for Aircraft Maintenance Companies in Clark"* would not have been possible.

I would like to extend my deepest gratitude to my research professor, Dr. Noel T. Florencondia, Ph.D. for his continuous support, insightful guidance, and valuable feedback. Your mentorship has been instrumental in refining the direction and depth of this work.

I am sincerely thankful to the aircraft maintenance companies in Clark who participated in this study. Your openness in sharing your time, experiences, and professional insights provided the essential foundation for this research.

Special thanks to the managers, supervisors, and technical personnel who contributed their perspectives through interviews and surveys. Your input brought depth and relevance to the study's findings.

I also wish to acknowledge the Department of Aeronautical Engineering at Holy Angel University for fostering an environment of academic excellence and for providing the resources necessary to pursue this endeavor.

To my family and friends, thank you for your encouragement, prayers, and unwavering support. Your belief in me has been a source of strength and motivation throughout this journey.

This research is the result of many hands and hearts working together, and to all who have been a part of this journey—thank you sincerely.

REFERENCES

[1] Air Transport Action Group, "Aviation: Benefits beyond borders," 2020. [Online]. Available: https://aviationbenefits.org/media/167152/abbb2020_full-report_web.pdf .

[2] Asian Development Bank, Aviation and Air Transport Infrastructure Development in Asia, Asian Development Bank, 2021. [Online]. Available: https://www.adb.org/publications/aviation-and-air-transport-infrastructure-development-asia

[3] Boeing, "Pilot and technician outlook 2022–2041," 2022. [Online]. Available: https://www.boeing.com/commercial/market/pilot-technician-outlook/

[4] Civil Aviation Authority of the Philippines, Annual Report, 2021. [Online]. Available: https://caap.gov.ph/annual-reports/

[5] Clark Development Corporation, Clark Freeport Zone Investment Brief, Clark Development Corporation, 2022. [Online]. Available: https://www.clark.com.ph.

[6] J. W. Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 4th ed., SAGE Publications, 2014

[7] Department of Transportation Philippines, Aviation Sector Modernization Program, Department of Transportation, 2020. [Online]. Available: https://dotr.gov.ph

[8] International Air Transport Association, "Asia-Pacific aviation outlook: Challenges and opportunities," 2022. [Online]. Available: https://www.iata.org/en/iata-repository/publications/economic-reports/asia-pacific-outlook-2022/

[9] Organisation for Economic Co-operation and Development, Workforce Development Policies for the Future of Work, OECD Publishing, 2019. [Online]. Available: https://doi.org/10.1787/9789264311800-en

[10] Technical Education and Skills Development Authority, National Technical Education and

Skills Development Plan 2020–2030, TESDA, 2020. [Online]. Available: https://tesda.gov.ph/About/TESDA/11248

[11] GACA Civil Aviation Training Center, “Aircraft maintenance engineering: Training and workforce development challenges,” Global Aviation Authority, 2020.

[12] Philippine Board of Investments (BOI), Investment Priority Plan: Aerospace and Aviation Sectors, 2022. [Online]. Available: https://boi.gov.ph/investment-priority-plan/

[13] A. B. I. Bernardo and N. B. Mendoza, “The impact of globalization on higher education curriculum in the Philippines,” Philippine Journal of Education, vol. 99, no. 1, pp. 12–25, 2020.

[14] Organisation for Economic Co-operation and Development, Workforce Development Policies for the Future of Work, 2019. [Online]. Available: https://doi.org/10.1787/9789264311800-en

[15] Airlines for America, “The State of the U.S. Aviation Industry: Workforce Challenges,” 2021. [Online]. Available: https://www.airlines.org/dataset/state-of-the-industry/