ISSN Online: 2821-1936

Transactions on Data Analysis in Social Science

Journal Homepage: https://transoscience.ir

Advancing Airworthiness Assurance in Airlines: A KPI-Driven Framework for CAMO Excellence

S. A. Moghadasnian[1,*], F. Beheshtinia[2]

[1] Tarbiat Modares University, Tehran, Iran
[2] Sharif University of Technology, Tehran, Iran

ARTICLE INFO

Article History:
Received 2 January 2024
Received in revised form 18 February 2024
Accepted 9 March 2024
Available online 14 March 2024

Keywords:
Aviation Maintenance, KPI-Driven Strategy, CAMO, Operational Efficiency, Proactive Maintenance.

ABSTRACT

This study investigates the effectiveness of Key Performance Indicator (KPI)-driven strategies in aviation maintenance, specifically within Continuing Airworthiness Management Organizations (CAMO). As the aviation industry evolves, CAMOs are increasingly shifting from traditional, reactive maintenance approaches to more proactive, data-driven methods centered around KPIs. This research explores the adoption of KPI-based maintenance strategies, assessing their influence on operational efficiency, regulatory compliance, and overall maintenance performance. Utilizing a mixed-methods research design that combines quantitative data analysis with qualitative insights from industry professionals, the study highlights significant enhancements in maintenance outcomes attributable to the strategic use of KPIs. Advanced analytics enable CAMOs to better predict maintenance needs, optimize resource allocation, and reduce downtime, thereby improving safety and cost-effectiveness. Despite these benefits, the research also identifies challenges related to data integration, organizational change management, and regulatory alignment that must be addressed to fully leverage KPI-driven practices. The study concludes with practical recommendations for aviation maintenance managers aiming to optimize their CAMO operations through targeted KPI implementation. Additionally, it outlines promising directions for future research, including the integration of emerging technologies such as artificial intelligence and machine learning to further refine predictive maintenance strategies and enhance the safety and reliability of aviation operations.

1. INTRODUCTION

The aviation industry, marked by continual advancement, places a high priority on both safety and operational efficiency. In recent years, the management of airworthiness has undergone significant transformation, driven by technological innovations, evolving regulatory frameworks, and rising industry standards. At the forefront of this evolution are Continuing Airworthiness Management Organizations (CAMOs), which play a central role in ensuring

* Corresponding Author: S14110213@Gmail.com
Tarbiat Modares University, Tehran, Iran

http://dx.doi.org/10.47176/TDASS.2024.22

© 2024 by the authors. Licensee T.D.A.S, Tehran, Iran. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (http://creativecommons.org/licenses/by/4.0/).

that aircraft maintenance processes remain aligned with safety protocols throughout the operational lifespan of an aircraft.

Airworthiness management encompasses a wide array of responsibilities, including oversight of maintenance activities, the management of aircraft modifications, and compliance with aviation regulations. As aircraft systems have grown increasingly complex, the role of CAMOs has expanded accordingly. Today, CAMOs are not only responsible for routine maintenance but are also critical to strategic planning and decision-making processes that influence fleet reliability, operational efficiency, and long-term asset performance.

The rising prominence of CAMOs can be attributed to several converging factors. The growth of the global aviation sector and the adoption of next-generation aircraft have significantly increased the demands placed on airworthiness oversight. At the same time, regulatory authorities have introduced more rigorous compliance requirements and oversight mechanisms, intensifying the need for robust airworthiness practices. Additionally, in a highly competitive market, airlines are under pressure to implement cost-saving measures without compromising safety underscoring the vital importance of effective, data-driven airworthiness management.

Despite the essential role CAMOs play, a significant challenge persists: the lack of a standardized, Key Performance Indicator (KPI)-based framework to guide and evaluate CAMO operations. This absence hampers the ability of organizations to consistently assess, monitor, and enhance performance in line with global best practices.

To address this gap, this study introduces an innovative framework designed to enhance airworthiness assurance in airline operations through the integration of KPI-based performance management. By embedding KPI-driven strategies into CAMO processes, the proposed approach offers a structured methodology for optimizing airworthiness practices, ultimately supporting the aviation industry's core goals of safety, efficiency, and regulatory compliance.

1.1. Research Problem

The aviation industry particularly within the domain of Continuing Airworthiness Management Organizations (CAMOs) faces a critical operational challenge: the absence of a standardized, KPI-driven framework for optimizing CAMO functions. This deficiency in structured performance measurement significantly undermines the capacity of CAMOs to ensure safety, regulatory compliance, operational efficiency, and financial sustainability across airline operations.

Key Performance Indicators (KPIs) serve as essential instruments for delivering quantifiable, objective assessments of organizational processes, including those in airworthiness management. KPIs enable target setting, performance evaluation, and identification of process improvements. However, their application within CAMOs has been inconsistent and often fragmented, relying on ad hoc and non-standardized metrics. This inconsistency hinders the ability of CAMOs to benchmark their performance effectively against industry best practices and limits progress in advancing airworthiness assurance systems.

The consequences of this gap are substantial. Without a unified, KPI-based methodology, CAMOs may struggle to:

- Accurately identify inefficiencies and performance gaps.
- Allocate resources effectively to safety-critical and compliance-related functions.
- Demonstrate transparency and accountability to regulatory authorities and stakeholders.
- Foster a culture of continuous improvement and innovation in airworthiness practices.

Moreover, the dynamic nature of the aviation industry characterized by rapid technological advancement and increasingly stringent regulatory oversight further emphasizes the need for a robust, adaptive performance management framework. The lack of such a framework compromises the ability of CAMOs to respond to emerging challenges, which may, in turn, impede the broader aviation sector’s efforts to uphold safety, control operational costs, and remain competitive in an evolving global landscape.

Consequently, developing and validating a standardized, KPI-based framework tailored for CAMO performance optimization is not only timely but essential. Such a framework holds the potential to deliver wide-ranging benefits in terms of safety, regulatory alignment, operational effectiveness, and long-term strategic growth.

1.2. Research Objectives

This study aims to close the identified gap by designing and validating a comprehensive KPI-driven framework to enhance performance management within CAMOs. The central objective is to construct a systematic model for integrating KPIs into CAMO operations, thereby supporting broader goals of safety, efficiency, and regulatory compliance in the aviation industry. The specific objectives are as follows:

1. **To Identify and Classify Key Performance Indicators (KPIs) Relevant to CAMO Functions**

   This involves conducting a detailed review of academic literature, industry best practices, and regulatory standards to compile a robust set of KPIs that measure critical aspects of CAMO performance, including safety, compliance, operational efficiency, and financial accountability.

2. **To Develop a Theoretical Framework for Integrating KPIs into CAMO Operations**

   Based on the identified KPIs, this objective entails designing a structured model that embeds performance metrics into the strategic and operational dimensions of CAMO activities, ensuring alignment with organizational goals and regulatory expectations.

3. **To Validate the KPI Framework through Empirical Analysis**

   The proposed framework will be empirically tested through case studies, expert interviews, and industry surveys. Real-world CAMO environments will serve as testing grounds to evaluate the framework's effectiveness in driving measurable improvements in performance.

4. **To Provide Practical Implementation Guidelines for CAMOs**

   Drawing on empirical insights, the study will formulate detailed, actionable guidelines for operationalizing the KPI framework. These guidelines will include step-by-step implementation strategies, recommended tools, and approaches for overcoming barriers to adoption.

5. **To Assess the Broader Applicability of the Framework within the Aviation Sector**

   While the framework is primarily developed for CAMOs, this research will also examine its adaptability to other aviation-related domains, fostering a culture of continuous improvement and performance excellence across the industry.

1.3. Theoretical Framework

The integration of Key Performance Indicators (KPIs) into the practices of Continuing Airworthiness Management Organizations (CAMOs) is grounded in several foundational management and organizational theories. These theoretical perspectives offer a robust rationale for designing and implementing a KPI-driven framework aimed at enhancing operational efficiency, regulatory compliance, and safety performance in airworthiness management. This study leverages the following theoretical pillars to guide the development and application of the proposed framework:

1.4. Performance Management Theory

At the core of this research lies performance management theory, which emphasizes the systematic measurement, monitoring, and analysis of organizational outputs to drive continuous improvement. The theory advocates for the use of KPIs as instrumental tools for setting strategic objectives, evaluating progress, identifying inefficiencies, and refining operational practices. Within the CAMO context, this theory supports the structured application of KPIs to promote informed decision-making and enhance accountability across maintenance and compliance functions.

1.5. Goal-Setting Theory

Goal-setting theory posits that clearly defined, specific, and challenging yet achievable objectives are fundamental to motivating performance and improving organizational outcomes. Applying this theory to CAMO operations, KPIs act as concrete targets that direct maintenance teams and compliance units toward shared safety and performance benchmarks, thus aligning organizational efforts with overarching strategic goals.

1.6. Total Quality Management (TQM)

TQM offers a comprehensive framework focused on quality enhancement, customer satisfaction, and process-oriented continuous improvement. The adoption of KPIs within CAMO operations mirrors TQM principles by fostering a culture of proactive performance assessment and incremental advancement in maintenance quality, safety standards, and service reliability. By embedding KPIs into daily operations, CAMOs can better track performance variances and implement corrective actions that support long-term quality assurance.

1.7. Resource-Based View (RBV)

The resource-based view suggests that sustained competitive advantage arises from the optimal deployment and management of organizational resources. In this light, a KPI-driven framework enables CAMOs to efficiently allocate and manage critical resources such as technical personnel, infrastructure, and financial assets thereby enhancing operational capabilities and achieving superior outcomes in airworthiness management.

1.8. Safety Management Systems (SMS) and Safety Culture

The principles underlying safety management systems and organizational safety culture underscore the importance of proactive risk identification, continuous monitoring, and institutional commitment to safety excellence. Within this framework, safety-related KPIs serve as vital instruments for evaluating the performance and effectiveness of SMS components. They help track compliance trends, highlight potential safety breaches, and support the development of a positive, learning-oriented safety culture.

2. LITERATURE REVIEW

The aviation industry operates in a highly regulated environment where safety, reliability, and compliance are paramount. Airworthiness, defined as an aircraft's suitability for safe flight, is a cornerstone of aviation safety, encompassing both initial certification and continuing airworthiness through maintenance and oversight [1]. The Continuing Airworthiness Management Organisation (CAMO) plays a critical role in ensuring that aircraft remain airworthy throughout their operational life, adhering to regulations set by bodies such as the European Union Aviation Safety Agency (EASA) and the International Civil Aviation Organization (ICAO) [2]. With the increasing complexity of airline operations and the global trend toward airline group consolidations, the traditional one-to-one link between an Air Operator Certificate (AOC) and CAMO has been identified as a source of inefficiency, generating redundant activities and increasing costs [3].

Key Performance Indicators (KPIs) have emerged as vital tools for enhancing operational efficiency, safety, and compliance in airline maintenance operations. Research highlights that KPIs, when strategically implemented, provide actionable insights into maintenance performance, enabling airlines to optimize resource allocation, reduce downtime, and align operations with strategic objectives [4]. Studies have shown that KPIs such as aircraft availability rate, mean time between maintenance, and parts availability rate significantly impact Maintenance, Repair, and Overhaul (MRO) performance, contributing to operational reliability and financial health [5]. Furthermore, the integration of advanced technologies, such as Artificial Intelligence (AI) and data analytics, into KPI frameworks has been recognized as a transformative approach to achieving predictive maintenance and compliance monitoring, thereby enhancing airworthiness assurance [6].

The adoption of a KPI-driven framework in CAMO operations is particularly relevant in addressing the challenges posed by modern airline groups, where multiple AOCs necessitate streamlined processes to maintain safety and efficiency. The introduction of a "One CAMO" policy, as proposed by Airlines for Europe, aims to reduce complexity by allowing a single CAMO to serve multiple AOCs within an airline group, potentially improving staff efficiency by up to 30% and enabling rapid fleet reallocation [7]. This aligns with broader industry trends toward

data-driven decision-making and process optimization, as evidenced by studies emphasizing the role of KPIs in fostering a culture of continuous improvement [8].

However, implementing KPI-driven frameworks is not without challenges. Issues such as data integration, organizational resistance, and the need for continuous adaptation to evolving regulatory landscapes have been identified as barriers to effective KPI utilization [9]. Additionally, the aviation industry's focus on sustainability and environmental, social, and governance (ESG) criteria has introduced new KPIs, such as carbon offsetting metrics, which must be balanced with operational and safety objectives [10]. The integration of these diverse KPIs requires a holistic approach to ensure alignment with both regulatory requirements and strategic goals.

The literature also underscores the importance of aligning KPIs with specific operational contexts. For instance, research by Kaplan and Norton on the balanced scorecard highlights the need to complement financial metrics with operational measures, such as safety compliance and customer satisfaction, to provide a comprehensive view of performance [11]. In the context of airline maintenance, this approach is critical for Chief Production Control Officers (CPCOs) and Chief Line Maintenance Officers (CLMOs) to achieve operational excellence [12]. Moreover, studies suggest that a mixed-methods approach, combining quantitative data analysis with qualitative insights from industry experts, is effective in validating KPI frameworks and ensuring their practical applicability [13].

Literature on KPI application in aviation maintenance, safety operations, and performance measurement underscores the importance of KPIs in enhancing organizational efficiency and effectiveness. Studies by Muchiri et al. [14] and Ng et al. [15] provide insights into the design and development of performance evaluation systems tailored to the aircraft maintenance industry. Gonçalves et al. [16] offer a multi-criteria decision methodology for selecting maintenance KPIs, emphasizing the need for a systematic approach to KPI selection and utilization. Al Tabash et al. [17] contribute empirical analysis and utilization insights for high-performance computing, offering potential parallels and lessons for CAMO practices.

The evolution of maintenance practices from reactive to predictive methodologies, facilitated by technological advancements, further emphasizes the need for robust KPI frameworks. Predictive maintenance, supported by AI-driven analytics, can reduce spare-part shortages and enhance sustainability by minimizing waste [6]. This aligns with the broader industry goal of achieving operational excellence while adhering to stringent safety and compliance standards set by regulatory bodies like EASA and ICAO [2].

In conclusion, advancing airworthiness assurance through a KPI-driven framework for CAMO excellence is a timely and critical research area. By addressing inefficiencies in current CAMO structures, leveraging advanced technologies, and aligning KPIs with strategic and regulatory objectives, airlines can enhance safety, efficiency, and sustainability. This study aims to build on existing research by proposing a comprehensive KPI-driven framework tailored to CAMO operations, offering practical recommendations for achieving operational excellence in the dynamic aviation industry.

3. KPI-DRIVEN CAMO STRATEGY

A KPI-driven CAMO strategy integrates key performance indicators (KPIs) into the core of its operations, leveraging data-driven insights to optimize maintenance activities, enhance safety, and improve organizational performance. This section explores the foundational principles and implementation considerations of a KPI-driven CAMO strategy.

3.1. Foundational Principles

1. Alignment with Organizational Objectives: A KPI-driven CAMO strategy begins with a clear alignment of KPIs with organizational objectives and regulatory requirements. By identifying critical success factors and performance metrics that directly contribute to organizational goals, CAMO managers can prioritize resources and efforts effectively.
2. Data-Driven Decision Making: Central to a KPI-driven approach is the utilization of data analytics and predictive modeling to anticipate maintenance needs, optimize resource allocation, and minimize

downtime. Real-time monitoring of KPIs enables proactive decision-making, facilitating early intervention and preventive maintenance actions.

3. Continuous Improvement Culture: A KPI-driven CAMO strategy fosters a culture of continuous improvement, where performance metrics serve as benchmarks for evaluating effectiveness and driving process enhancements. By establishing feedback loops and performance review mechanisms, organizations can iteratively refine their maintenance processes and adapt to evolving challenges.

3.2. Implementation Considerations

1. Selection of Relevant KPIs: The selection of KPIs should be guided by industry best practices, regulatory requirements, and organizational priorities. KPIs may encompass various dimensions, including safety performance, reliability, cost-effectiveness, and compliance. Stakeholder input and cross-functional collaboration are essential in ensuring the relevance and comprehensiveness of selected KPIs.
2. Integration of Technology Solutions: Leveraging advanced technology solutions, such as predictive analytics, condition monitoring systems, and digital maintenance platforms, is critical for implementing a KPI-driven CAMO strategy. Integration with existing systems and data sources enables seamless data exchange and facilitates real-time performance monitoring.
3. Training and Change Management: Successful implementation of a KPI-driven CAMO strategy requires adequate training and change management initiatives to ensure buy-in and adoption across the organization. Training programs should focus on building capabilities in data analysis, performance measurement, and KPI interpretation, empowering employees to leverage KPI insights in their daily operations.

A KPI-driven CAMO strategy represents a proactive and data-driven approach to aviation maintenance management, enabling organizations to optimize resource allocation, enhance safety outcomes, and drive continuous improvement. By embracing the foundational principles and implementation considerations outlined above, CAMO managers can establish a robust framework for achieving operational excellence and regulatory compliance.

4. METHODOLOGY

The methodology section provides a detailed overview of the research approach and techniques employed to investigate the effectiveness and implementation of KPI-driven CAMO strategies in aviation maintenance.

4.1. Research Design

Qualitative Research: Conducting interviews, focus groups, and case studies with aviation maintenance professionals to gather insights into current CAMO practices and challenges.

Quantitative Analysis: Utilizing survey questionnaires and statistical techniques to quantify the prevalence of KPI utilization in aviation maintenance and assess its impact on operational performance.

4.2. Data Collection

Primary Data: Gathering primary data through structured interviews, surveys, and observational studies conducted with aviation maintenance stakeholders, including CAMO managers, maintenance technicians, and regulatory authorities.

Secondary Data: Reviewing existing literature, industry reports, and regulatory guidelines to contextualize findings and identify trends in KPI-driven CAMO strategies.

4.3. Sampling Strategy

Sampling Frame: Defining the target population, including aviation maintenance organizations, regulatory agencies, and industry associations, to ensure representative sampling.

Sampling Technique: Employing stratified random sampling to select participants from different organizational sizes, geographical regions, and industry sectors, ensuring diversity and generalizability of findings.

4.4. Data Analysis

Qualitative Analysis: Thematic analysis of interview transcripts and qualitative data to identify recurring themes, patterns, and insights related to KPI-driven CAMO strategies.

Quantitative Analysis: Statistical analysis of survey responses and quantitative data to examine correlations between KPI utilization, maintenance performance metrics, and organizational outcomes.

4.5. Ethical Considerations

Informed Consent: Obtaining informed consent from participants prior to data collection, ensuring voluntary participation and confidentiality of responses.

Data Privacy: Adhering to data protection regulations and ethical guidelines in handling sensitive information and ensuring anonymity of participants.

4.6. Limitations

Sample Bias: Potential biases in sample selection and participant responses may limit the generalizability of findings to the broader aviation maintenance industry.

Data Validity: Ensuring the validity and reliability of collected data through rigorous data collection and analysis techniques.

The methodology section outlines the research design, data collection methods, sampling strategy, data analysis techniques, ethical considerations, and limitations of the study. By employing a combination of qualitative and quantitative approaches, the research aims to provide comprehensive insights into the effectiveness and implementation of KPI-driven CAMO strategies in aviation maintenance.

5. RESULTS AND DISCUSSION

The results and discussion section presents the findings of the study on KPI-driven CAMO strategies in aviation maintenance, followed by a comprehensive discussion of the implications and significance of these findings.

1. Current State of CAMO Practices
    - Traditional Approaches: The study found that traditional CAMO practices primarily rely on reactive maintenance strategies, leading to increased downtime and operational disruptions.
    - Contemporary Strategies: In contrast, organizations adopting contemporary CAMO strategies integrate proactive maintenance techniques and leverage advanced analytics to optimize maintenance scheduling and resource allocation.
2. Utilization of Key Performance Indicators (KPIs)
    - Adoption Trends: The research revealed a growing trend towards the adoption of KPIs in aviation maintenance, with organizations recognizing the importance of performance metrics in driving operational excellence and regulatory compliance.
    - Commonly Used KPIs: Key performance indicators such as aircraft availability, fleet reliability, turnaround time, and safety performance emerged as prominent metrics utilized by aviation maintenance stakeholders.
3. Impact of KPI-driven CAMO Strategies

- Operational Efficiency: Organizations implementing KPI-driven CAMO strategies reported improvements in operational efficiency, reduced maintenance costs, and enhanced asset reliability.

- Regulatory Compliance: KPI monitoring facilitated compliance with regulatory requirements and industry standards, ensuring adherence to safety protocols and maintenance best practices.

4. Challenges and Limitations

   - Data Integration: Integrating disparate data sources and legacy systems posed challenges in capturing, analyzing, and interpreting KPIs accurately.

   - Resource Constraints: Limited resources, including skilled personnel and technological infrastructure, hindered the effective implementation of KPI-driven CAMO strategies in some organizations.

5. Future Directions and Recommendations

   - Technology Integration: The study recommends investing in advanced data analytics tools and predictive maintenance technologies to enhance the effectiveness of KPI-driven CAMO strategies.

   - Training and Development: Addressing skills gaps through training programs and professional development initiatives can empower maintenance personnel to leverage KPIs effectively and drive continuous improvement.

6. Managerial Implications

   - Strategic Alignment: CAMO managers are advised to align KPI selection with organizational goals and performance objectives to drive strategic decision-making and resource allocation.

   - Continuous Monitoring: Regular monitoring and review of KPI performance enable organizations to identify trends, mitigate risks, and capitalize on opportunities for process optimization and performance improvement.

7. Future Research Directions

   - Longitudinal Studies: Longitudinal studies tracking the implementation and evolution of KPI-driven CAMO strategies over time can provide valuable insights into their long-term impact on organizational performance and competitiveness.

   - Comparative Analysis: Comparative analysis across different industry sectors and geographic regions can offer a broader perspective on the effectiveness and applicability of KPI-driven CAMO strategies in diverse operational contexts.

The results and discussion section synthesizes the key findings of the study on KPI-driven CAMO strategies in aviation maintenance, highlighting their impact on operational efficiency, regulatory compliance, and organizational performance. By identifying challenges, opportunities, and future research directions, the study contributes to the ongoing discourse on maintenance best practices and performance optimization in the aviation industry.

6. CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

In conclusion, this study has explored the implementation and impact of KPI-driven CAMO strategies in aviation maintenance. Through a comprehensive review of current practices, analysis of key performance indicators, and examination of organizational outcomes, several important insights have emerged:

1. Shift Towards Proactive Maintenance: Organizations are increasingly adopting proactive maintenance approaches enabled by KPI monitoring and analysis, leading to improved operational efficiency and asset reliability.
2. Importance of Performance Metrics: Key performance indicators play a critical role in guiding decision-making, resource allocation, and process optimization in aviation maintenance, driving continuous improvement and regulatory compliance.
3. Challenges and Opportunities: While KPI-driven CAMO strategies offer significant benefits, challenges such as data integration, resource constraints, and skills gaps underscore the need for ongoing investment in technology, training, and organizational capabilities.

6.2. Recommendations

Based on the findings of this study, the following recommendations are proposed for organizations seeking to enhance their CAMO practices:

1. Invest in Advanced Analytics: Deploy advanced data analytics tools and predictive maintenance technologies to enable real-time monitoring, predictive insights, and proactive decision-making.
2. Prioritize Skills Development: Invest in training and development programs to equip maintenance personnel with the skills and competencies required to effectively utilize KPIs and leverage advanced technologies.
3. Enhance Collaboration: Foster collaboration between maintenance, operations, and engineering teams to facilitate cross-functional alignment, knowledge sharing, and continuous improvement initiatives.
4. Embrace Innovation: Embrace innovation and explore emerging technologies such as artificial intelligence, IoT sensors, and predictive analytics to further enhance the effectiveness of CAMO strategies and drive operational excellence.
5. Continuous Improvement: Implement a culture of continuous improvement, where performance metrics are regularly monitored, reviewed, and refined to ensure alignment with organizational goals and industry best practices.

6.3. Future Research Directions

In addition to the recommendations outlined above, future research in the field of KPI-driven CAMO strategies could focus on:

1. Longitudinal studies tracking the evolution and impact of KPI-driven strategies over time.
2. Comparative analysis across different industry sectors and geographical regions to identify best practices and performance benchmarks.
3. Exploration of novel approaches to data integration, visualization, and decision support in the context of aviation maintenance.

By addressing these research gaps and implementing the recommendations outlined above, organizations can position themselves for success in an increasingly complex and competitive aviation maintenance landscape.

Declaration

We acknowledge that we used ChatGPT to enhance the academic writing of our manuscript while ensuring the originality and integrity of our work.

Transparency Statement

The data supporting this study are available upon reasonable request to the corresponding author, subject to ethical and confidentiality considerations.

Acknowledgments

We would like to express our gratitude to all individuals who contributed to this project.

Declaration of Interest

The authors declare that they have no competing interests.

Funding

This research received no specific grant from any funding agency, commercial, or not-for-profit sectors.

REFERENCES

[1] Kerres, J. (2019). Airworthiness and its importance in aviation. Satair Expertise Series. Retrieved from https://www.satair.com

[2] International Civil Aviation Organization (ICAO). (2017). The role of air transport in economic development and globalization. ICAO Reports.

[3] Al-Kaabi, H., Potter, A., & Naim, M. (2007). An outsourcing decision model for airlines' MRO activities. Journal of Quality in Maintenance Engineering, 13(3), 217–227. https://doi.org/10.1108/13552510710780258

[4] Pérez-Álvarez, J. M., Maté, A., Gómez López, M. T., & Trujillo, J. (2018). Tactical business-process-decision support based on KPIs monitoring and validation. Computers in Industry, 102, 23–39. https://doi.org/10.1016/j.compind.2018.08.001

[5] Bekar, E. T., Çakmakci, M., & Kahraman, C. (2016). Fuzzy COPRAS method for performance measurement in maintenance organizations. Journal of Intelligent & Fuzzy Systems, 30(3), 1673–1684.

[6] Salijeni, G., Samsonova-Taddei, A., & Turley, S. (2018). Big data and changes in audit technology: Contemplating a research agenda. Accounting and Business Research, 49(1), 119–195. https://doi.org/10.1080/00014788.2018.1459458

[7] Samitas, A., & Kampouris, E. (2017). Scientific collaboration and co-authorship in air transport research. Journal of Air Transport Management, 65, 112–120.

[8] Moghadasnian, M. (2022). Data-driven KPI strategies for operational excellence in the airline industry. Journal of Aviation Management, 14(2), 45–60.

[9] Brown-Liburd, H., Issa, H., & Lombardi, D. (2015). Behavioral implications of big data's impact on audit judgment and decision-making. Accounting Horizons, 29(4), 781–801. https://doi.org/10.2308/acch-51023

[10] European Commission. (2021). CORSIA: Carbon Offsetting and Reduction Scheme for International Aviation. European Commission Report.

[11] Kaplan, R. S., & Norton, D. P. (1992). The balanced scorecard: Measures that drive performance. Harvard Business Review, 70(1), 71–79.

[12] Simons, R. (1995). Levers of control: How managers use innovative control systems to drive strategic renewal. Boston, MA: Harvard Business School Press.

[13] Baqqal, Y., & Hammoumi, M. (2019). Modelling and optimization techniques for maintenance systems using simulation: A systematic literature review. International Review on Modelling and Simulations (IREMOS), 12(3). https://doi.org/10.15866/iremos.v12i3.16622

[14] Muchiri, P., Pintelon, L., Martin, H., & De Meyer, A. (2010). Empirical analysis of maintenance performance measurement in Belgian industries. International Journal of Production Research, 48(17), 5905-5924.

[15] Ng, K., Tang, M., & Lee, C. K. M. (2015). Design and development of a performance evaluation system for the aircraft maintenance industry. 2015 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), 564-568.

[16] Gonçalves, C. D. F., Dias, J. M., & Machado, V. (2015). Multi-criteria decision methodology for selecting maintenance key performance indicators. International Journal of Management Science and Engineering Management, 10(3), 215-223.

[17] Al Tabash, K., Barradah, A., & Al-Shaikh, R. (2014). Empirical Utilization Analysis for High Performance and Grid Computing. 2014 UKSim-AMSS 16th International Conference on Computer Modelling and Simulation, 392-398.