European Economic Letters
ISSN 2323-5233
Vol 13, Issue 3 (2023)
https://doi.org/10.52783/eel.v13i3.603
http://eelet.org.uk

Analyzing the Statistical Impact of Supply Chain Management on Aircraft Maintenance Turnaround Time within the MRO Industry

[1]Deepak Chandra Chandola*, [2]Seema Verma, [3]Kamal Jaiswal, [4]Rajendra Prasad Kholiya, [5]Preeti Chandola, [6]Charan Singh

[1]Ph.D. Student, Banasthali , Banasthali Vidyapith University, Tonk, Rajasthan, India.
Email: Deepak.chandola@outlook.com;
LinkedIn: https://www.linkedin.com/in/deepakchandrachandola/
Corresponding Author.
[2]Professor, Dean School of Aviation, Banasthali Vidyapith University, Tonk, Rajasthan, India.
Email: seemaverma3@yahoo.com
LinkedIn: https://www.linkedin.com/in/dr-seema-verma-29231515/
[3]Lecturer, Department of Aircraft Maintenance, Higher Colleges of Technology, Abu Dhabi, United Arab Emirates.
Email: kjaiswal@hct.ac.ae
LinkedIn: https://www.linkedin.com/in/dr-kamal-jaiswal-5956177a/
[4]DBA Student, Swiss Business School, Kloten, Switzerland.
Email: rajendrrakholliya@outlook.com
LinkedIn: https://www.linkedin.com/in/rajendrra-kholliya/
[5]Ph.D. Student, Banasthali , Banasthali Vidyapith University, Tonk, Rajasthan, India.
Email: preeti.chandola@outlook.com;
LinkedIn: https://www.linkedin.com/in/preetichandola/
[6]Ph.D. Student, Banasthali Vidyapith University, Tonk, Rajasthan, India.
Email: charansinghphdbanasthali@gmail.com

Abstract. In the context of the aircraft Maintenance Repair and Overhaul (MRO) industry, Supply Chain Management (SCM) is paramount, as timely aircraft release per contractual agreements is imperative. Nevertheless, adhering to agreed-upon schedules remain a formidable challenge for MRO operations due to SCM-related issues, primarily delays in procuring aircraft components and inventory management complexities. This research paper is primarily dedicated to investigating two core aspects: the first one is the management, and the second one is the implementation of innovative tools in the supply chain domain, encompassing a broad spectrum of concerns. The findings of this study assess the impact of SCM on aircraft maintenance turnaround time, employing statistical analysis as the primary methodology.

Keywords: aircraft maintenance organization; supply chain management; MRO management; aircraft maintenance; turnaround time; aviation

1. Introduction

The Airline and commercial air transport sector heavily relies on aircraft maintenance, primarily entrusted to Maintenance, Repair, and Overhaul (MRO) organizations (Liangrokapart & Sittiwatethanasiri, 2023). These entities are responsible for a broad spectrum of aircraft base maintenance activities, encompassing major maintenance operations, C-Checks, D-Checks, substantial modifications, cabin enhancements, avionics upgrades, and other aircraft improvements (Chang & Kora, 2014). The successful execution of these activities necessitates access to hangar facilities, approved technical documentation, skilled personnel, authorized materials, and approved tools (Alomar & Jackiva, 2023). In this context, Supply Chain Management (SCM) assumes a pivotal role, as it oversees the procurement and management of authorized materials and tools, which can incur substantial costs depending on their type (Al-Momani et al., 2020). Furthermore, sourcing such items demands considerable effort, especially in the post-COVID-19 business landscape, marked by heightened demand and a relatively limited supplier pool. Given these challenges, there is a compelling need to explore new management paradigms and incorporate innovative tools into the operational framework.

European Economic Letters
ISSN 2323-5233
Vol 13, Issue 3 (2023)
https://doi.org/10.52783/eel.v13i3.603
http://eelet.org.uk

1.1 Objective

This research endeavor aims to underscore the critical role of supply chain management in reducing aircraft maintenance turnaround time, thereby contributing to enhanced financial sustainability and profitability.

1.2 Need of Study

As technologies continue to advance, the aircraft maintenance sector is compelled to optimize its supply chain management to enhance productivity and profitability. Prior research has delved into various strategies for inventory optimization and cost reduction. Nonetheless, a notable gap exists in the absence of a statistically proven model that can predict the effects of such improvements on aircraft maintenance turnaround time. This research paper accentuates the pivotal role of supply chain management in addressing this deficiency.

1.3 Scope of Study

This investigation has been propelled by exhaustive scrutiny of peer-reviewed research articles, publicly available official documents from aviation regulatory bodies, periodicals from reputable publishers, and extensive dialogues with aviation industry experts. The primary aim of this research endeavour is to perform a thorough study of the impact of supply chain management on aircraft maintenance turnaround time.

1.4 Limitation

This research paper delves into the domain of supply chain management within the specific context of aircraft maintenance, focusing on its significant ramifications for turnaround times within the MRO industry in the Asian region.

1.5 Background of Study

A fundamental facet of the aviation industry lies in recognizing the intricate complexity of sizeable commercial airliner aircraft, each boasting an intricate network of over one million individual components, which notably exhibit an extended physical lifespan, as meticulously analysed by (Keivanpour & Kadi, 2019) in their comprehensive 2019 investigation. This intricate web of components underscores the compelling need for a well-orchestrated and seamlessly functioning supply chain process, which, interestingly, is the keystone for the aviation sector and the broader manufacturing and service industries (Najmon et al., 2019). In the context of our contemporary global landscape, it becomes readily apparent that there is a burgeoning demand for highly adept and streamlined supply chain models (Dichter et al., 2017). This demand has been especially accentuated in the wake of the global COVID-19 pandemic, a period when the entire world seemed to grind to a halt. Astonishingly, however, the supply chain industry operated at an elevated capacity, diligently ensuring the reliable and timely delivery of a myriad of goods and commodities to consumers while adhering to the most stringent of standards (Dinis et al., 2019). Aircraft maintenance is mainly divided into two parts based on the capability and nature of work. Both of them have distinguished work capabilities, as mentioned in figure 1. This division is known as line maintenance and base maintenance (Chandola et al., 2023).

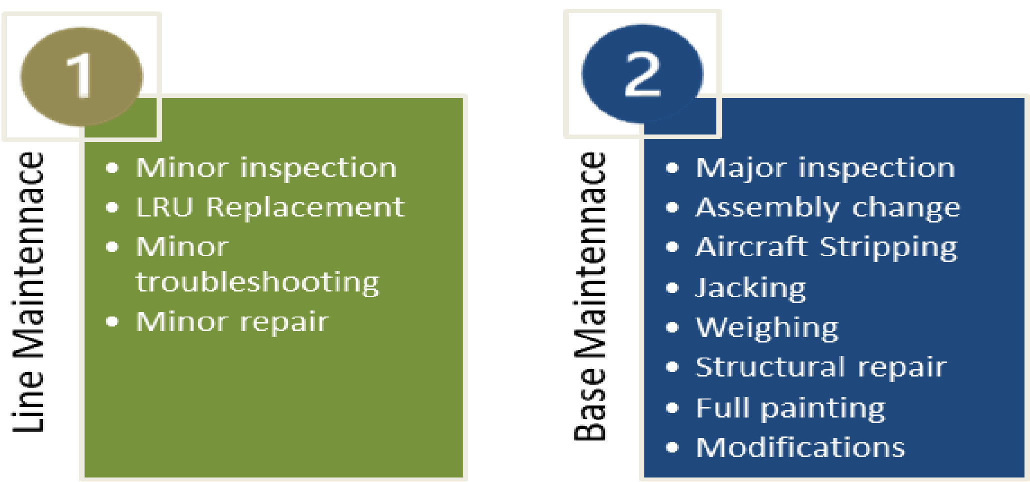

Figure 1 - Aircraft maintenance capabilities

European Economic Letters
ISSN 2323-5233
Vol 13, Issue 3 (2023)
https://doi.org/10.52783/eel.v13i3.603
http://eelet.org.uk

Line maintenance primarily encompasses minor tasks such as routine inspections, the replacement of line replaceable units (LRUs), and basic troubleshooting of defects, as highlighted in the works of Shanmugam and Robert (2015) and Chen et al. (2012). In contrast, base maintenance assumes the majority of aircraft maintenance duties (Chandra Chandola et al., 2023). A substantial portion of the supply chain inventory is dedicated to fulfilling the requisites of aircraft base maintenance activities, constituting a significant proportion of the allocated budget. Consequently, it becomes imperative to meticulously monitor the movement of aircraft materials and their sourcing to mitigate the potential risks associated with part shortages or delays (Karunakaran et al., 2020).

2. Literature review

The timely availability of aircraft spare parts, ranging from consumables to expendables and tools, coupled with the implementing of a sophisticated inventory management infrastructure, unquestionably assumes a position of paramount importance within aircraft maintenance engineering organizations (Şahin et al., 2022). This pivotal role is underscored by its profound impact on aircraft fleets' serviceability, availability, and operational efficiency, as extensively elucidated in the research conducted by (Tracht et al., 2013).

Inadequately managed supply chains have the potential to trigger significant disruptions in the aircraft release process, resulting in extended delays. Recent global challenges like the pandemic have brought the aviation industry to a standstill. However, the post-recovery growth of the aviation industry has been constrained by the closure of numerous aircraft parts suppliers due to business constraints, placing substantial pressure on the MRO industry. Sourcing parts and tools has become increasingly challenging, affecting MRO productivity. It is essential to formulate policies at both governmental and organizational levels to ensure effective disaster management and a seamless recovery process following such events (Chandola, 2021).

One recurring observation from these endeavours is that establishing and maintaining an advanced inventory management system can often entail substantial financial investments, a daunting prospect for organizations of varying scales. This challenge can make establishing a dedicated supply chain management function within smaller aircraft maintenance engineering entities appear insurmountable. In response to this complex challenge, innovative cooperative strategies and inventory pooling mechanisms have been deployed, as cogently discussed by (Keivanpour & Kadi, 2019) in their influential 2019 study. These strategies have proven instrumental in effectively and efficiently addressing this predicament, offering viable solutions to the intricate logistics and financial constraints such organizations face (Iwata & Mavris, 2013).

Within the purview of supply chain management, critical elements require attention, including the categorization of inventory into consumable (non-repairable), repairable, rotable, and commercial items (Figure 2), as well as the efficient management of spare parts inventory (Bhalla et al., 2021) (Dichter et al., 2017). Effective inventory management plays a pivotal role in the overall operational functions of a company, encompassing its procurement, sales, and logistical processes (J. Chen et al., 2019) (Erkoc & Ertogral, 2016).

This critical discipline revolves around the strategic handling of stock, comprising raw materials, work-in-progress good, and finished products, with the primary objective of maintaining an adequate supply while mitigating the costs associated with overstocking and understocking (Chandola et al., 2022). In the contemporary context, logistics entails the comprehensive management of products throughout their entire lifecycle, from production inception to customer satisfaction, ultimately enhancing a company's profitability (Keiser et al., 2023).

Figure 2 - Five categories of inventory within aircraft maintenance domain

European Economic Letters
ISSN 2323-5233
Vol 13, Issue 3 (2023)
https://doi.org/10.52783/eel.v13i3.603
http://eelet.org.uk

In the realm of inventory management, data from diverse sources, including suppliers, must be meticulously evaluated in alignment with the organization's predetermined inventory management objectives. Achieving these objectives often requires advanced data analytical tools like Python, Numpy, Microsoft BI, and Azure (Kumar et al., 2023). In term of technology, inclusion of Radio Frequency Identification (RFID) enabled inventory verification devices helps organization to improve their workforce productivity (Chandra Chandola et al., 2023). Additionally, as the aviation industry faces delays in parts availability and constrained manufacturing by original equipment manufacturers (OEMs), 3-D printing and additive manufacturing technologies could offer a potential solution (Najmon et al., 2019). Conversely, the regulatory complexities surrounding these technologies present challenges in their widespread adoption. Establishing OEM and aviation regulator-controlled 3D printing and additive manufacturing facilities could play a crucial role in improving aircraft parts availability (Oyesola et al., 2020). Airline operators, particularly aircraft maintenance organizations, heavily depend on components repair shops for repairable items and expects swift and reliable repair turnaround times (TAT), as suppliers' shops lead times often exceed their operational tolerance (Chandola, Chandola, et al., 2023) (D. Chen et al., 2012). Long-term planning and future forecasting models can be enhanced with the integration of artificial intelligence, incorporating comprehensive constraints to generate pragmatic predictive models (Chandra Chandola, 2019). Marginal analysis emerges as a prominent method for identifying high-performing suboptimal solutions by evaluating various inventory configurations. The optimization of turnaround times within aircraft maintenance organizations (AMO) can be enhanced by integrating advanced supply chain tools and methodologies, emphasizing a commitment to operational efficiency excellence (Hu et al., 2021; Yang & Yang, 2012).

3. Research methodology

The research methodology employed in this study encompasses a sequential process consisting of five distinct stages, as depicted in Figure 3. It initiates with the formulation of the problem statement, progresses through a comprehensive review of literatures, proceeds to the design and implementation of a survey, and culminates with the collection and subsequent analysis of data, utilizing the IBM SPSS statistical data analytics tool.

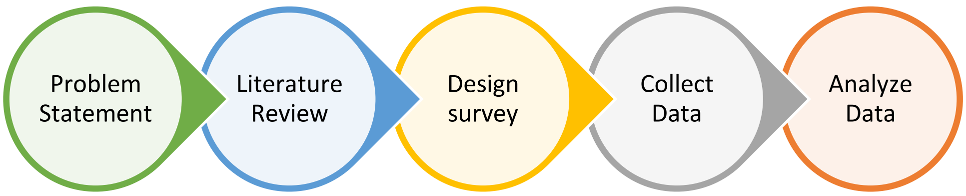

Figure 3 - Five-staged research methodology

An extensive analysis of the impact of supply chain management on aircraft maintenance turnaround times is conducted in this study, with a particular focus on their temporal aspects. Variables are identified through findings based on the literature review, a set of dependent and independent variables were identified (as presented in Table 1), and three primary research questions were formulated concerning these variables and three demographic inquiries. In total, the survey instrument consisted of six questions.

Table 1 - List of identified variables

SN	*Description of Variables*	*Variables*
1	Reduction of turnaround time	Dependent
2	Supply chain management concerns	Independent
3	Incorporation of innovative supply chain tools	Independent

This study aimed to evaluate supply chain management variables associated with aircraft maintenance turnaround time reduction within the maintenance repair and overhaul industry using quantitative research methods. The research survey was administered to a group of MRO professionals. The survey questions were constructed using a linear scale to assess

European Economic Letters
ISSN 2323-5233
Vol 13, Issue 3 (2023)
https://doi.org/10.52783/eel.v13i3.603
http://eelet.org.uk

dependent and independent variables. Additionally, the questionnaire included demographic inquiries, adopting a mixed-scale approach. The data analysis process encompassed multiple regression (stepwise) analysis using SPSS, which generated descriptive statistics, a model summary, an ANOVA summary, and a coefficient summary.

Table 2. Statistics of the research study questionnaire

SN	Research Material	
	Type of Material	*Quantity*
1	The overall number of questions integrated into the survey questionnaire	7
2	Survey distributed to MRO professionals	1500
3	Total responses received from MRO professionals	1299
4	Percentage of responses received	86.6%

This study's sample size of 1,056 respondents was determined using standard sampling calculation techniques. This sample size was determined by considering a Confidence Level of 95.00%, a Population Proportion of 0.5, a Marginal Error of 3.0%, and a Population Size of 100,000. Table 2 presents a summary of statistics related to the questionnaire and its distribution.

4. Investigation results

Upon obtaining the requisite responses to the questionnaire, data underwent a meticulous analysis process following a structured framework depicted in Figure 4. This data analysis comprises five distinct and sequential stages, as outlined below.

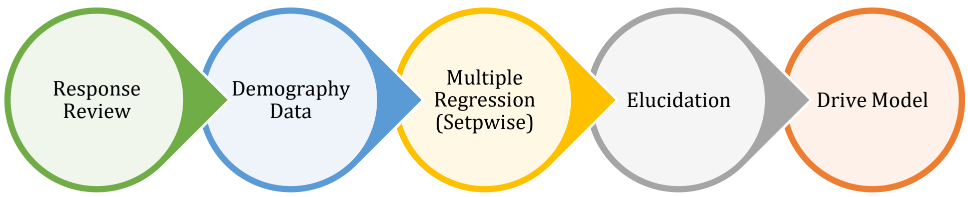

Figure 4 - Five-stage process followed in data analysis

Figure 5 illustrates the demographic profile of the survey respondents, indicating the active involvement of male and female participants who hold diverse hierarchical positions within the MRO industry. Nevertheless, a notable disparity in the number of respondents of each gender underscores the prevailing gender imbalance within the aircraft maintenance sector.

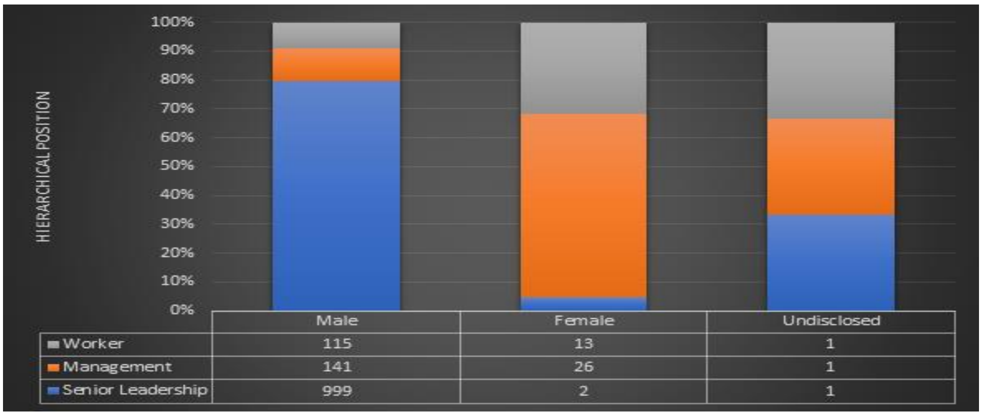

Figure 5 - Hierarchical positions and gender of respondents

European Economic Letters
ISSN 2323-5233
Vol 13, Issue 3 (2023)
https://doi.org/10.52783/eel.v13i3.603
http://eelet.org.uk

The demographic information further discloses that the participants occupy distinct hierarchical positions within the MRO industry, with most respondents holding senior leadership positions. While collecting and analyzing data, professional ethical standards were adhered to strictly. Figure 6 provides a visual representation indicating that a significant majority, 80% of the respondents employed within the MRO industry, possess substantial work experience ranging from 16 to 30 years. This observation serves as a testament to the authenticity and practicality of the responses. Such a robust and substantial response rate significantly contributes to the author's ability to draw meaningful conclusions from the research.

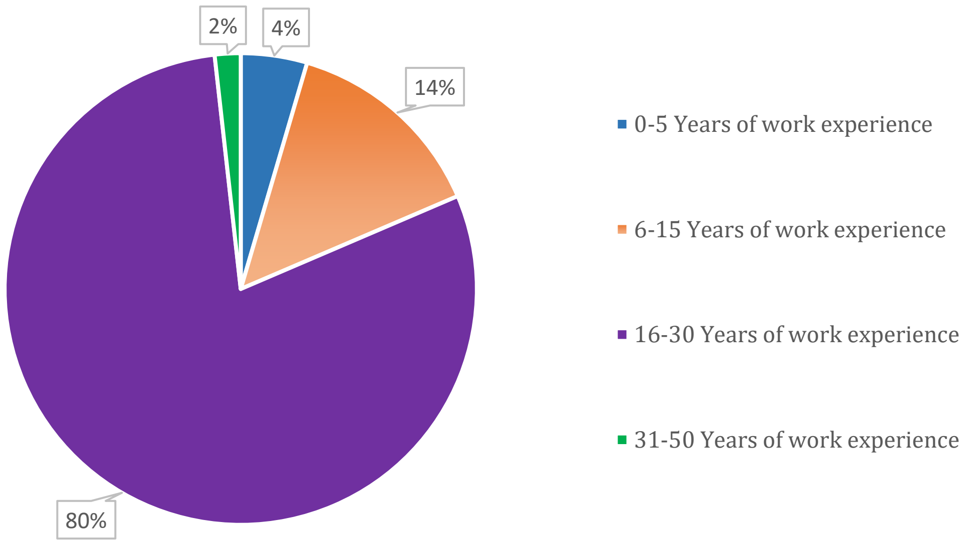

Figure 6 - Work experience of survey respondents

The data analysis involved multiple regression (stepwise) utilizing the stepwise method, conducted through the SPSS tool. Table 3 represents descriptive statistics furnishing the mean, standard deviation, and number of cases (N) used in the study. Author choose to use stepwise regressions to implement solely statistical criteria (Field, 2009).

Table 3 - Descriptive statistics

	Mean	Std. Deviation	N
Reduction of aircraft maintenance turnaround time	4.64	.820	1299
Supply chains that are poorly managed can cause extensive delays in the release of aircraft.	4.90	.411	1299
AMO's turnaround time may be reduced even more by incorporating innovative supply chain tools.	4.82	.530	1299

Detailed review of Table 4, it became evident that only one of the two independent variables was included in the analysis during the stepwise multiple regression procedure.

Table 4 - Variables Entered/ Removed[a]

Model	Variables Entered	Variables Removed	Method
1	AMO's turnaround time may be reduced even more by incorporating innovative supply chain tools.	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a. Dependent Variable: Reduction of aircraft maintenance turnaround time

Upon closer examination of Table 5, the second independent variables excluded from the study and not included into the final model based on the statistical values ot posses.

European Economic Letters
ISSN 2323-5233
Vol 13, Issue 3 (2023)
https://doi.org/10.52783/eel.v13i3.603
http://eelet.org.uk

Table 5 - Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance
1	Supply chains that are poorly managed can cause extensive delays in the release of aircraft.	.028[b]	.899	.369	.025	.530

a. Dependent Variable: Reduction of aircraft maintenance turnaround time
b. Predictors in the Model: (Constant), AMO's turnaround time may be reduced even more by incorporating innovative supply chain tools.

Table 6, displayed below, offers a model summary that assesses the model's suitability. An adjusted R-squared value of 0.319 signifies that integrating innovative supply chain tools accounts for 31.9% of the variance in reducing aircraft maintenance turnaround time, a statistically significant contribution. Additionally, the model demonstrates high significance, as indicated by an F-change value of 608.639, with a probability lower than 0.001 (Field, 2009). Furthermore, a detailed examination of the Durbin-Watson statistic (1.544) revealed minimal discrepancies in successive error terms, indicating the absence of autocorrelation. This finding aligns with the commonly accepted range for the Durbin-Watson statistic, falling within the range of 1.5 to 2.5.

Table 6 - Model Summary[b]

					Change Statistics					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.565[a]	.319	.319	.676	.319	608.639	1	1297	.000	1.544

a. Predictors: (Constant), AMO's turnaround time may be reduced even more by incorporating innovative supply chain tools.
b. Dependent Variable: Reduction of aircraft maintenance turnaround time

Table 7 - ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	278.498	1	278.498	608.639	.000[b]
	Residual	593.476	1297	.458		
	Total	871.974	1298			

a. Dependent Variable: Reduction of aircraft maintenance turnaround time
b. Predictors: (Constant), AMO's turnaround time may be reduced even more by incorporating innovative supply chain tools.

Moreover, an examination of the ANOVA results, as presented in Table 7, underscores the considerable significance of the model produced in this study. With an F-value of 608.639 and a significance value of 0.000 ($p < .001$), the model exhibits a high level of statistical significance. Considering the outcome of model summary and ANOVA, our model is a good-fit.

Table 8 - Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
Model		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	.435	.172		2.538	.011	.099	.772

European Economic Letters
ISSN 2323-5233
Vol 13, Issue 3 (2023)
https://doi.org/10.52783/eel.v13i3.603
http://eelet.org.uk

	AMO's turnaround time may be reduced even more by incorporating innovative supply chain tools.	.873	.035	.565	24.671	.000	.804	.943

a. Dependent Variable: Reduction of aircraft maintenance turnaround time

A detailed review of coefficient summary as per Table 8 helped author to formuate an equation model consideing the B-values. Here B-value of dependentvariable revel that as impletation of innovative supply chain tools increases by one unit, reduction in the turnaround time couyld be achived by 0.873 units. It helped author to formulate Equation 1.

$$y = 0.87x_1 + 0.44 \qquad \text{- Equation 1}$$

Here x_1 represents incorporation of innovative supply chain tools by the supply chain management.

5. Discussion and recommendations

A multiple-regression (stepwise) operated between the dependent and independent variables to weigh the significance of supply chain management against the reduction of aircraft maintenance turnaround time considering the two independent variables. The outcome of the study showcases the significance of implementing innovative tools and techniques in the supply chain management domain within the maintenance repair and overhaul (MRO) industry. Organization leader must take immediate steps to identify the tools as per their operational need and start incorporating them throughout their supply chain process.

6. Conclusion

This research endeavor was committed to examining and accentuating the pivotal role of supply chain management in reducing aircraft maintenance turnaround time within the MRO industry. This research paper introduces a model that assesses this significance and furnishes incontrovertible evidence. The findings of this study underscore the practical implementation of novel and innovative tools throughout the supply chain process, presenting a substantial potential to minimize aircraft maintenance turnaround times within the MRO industry notably.

7. Future scope

As a result of this study, the author acknowledges that the widespread implementation of innovative tools and technologies throughout the supply chain process within the MRO industry will necessitate comprehensive workforce training. Nevertheless, the feasibility and the extent of implementation of such training programs warrant further exploration. Additionally, types of innovative tools and their effectiveness could be explored, benefiting the industry.

Disclosure Statement

This research paper's author(s) affirm that they do not possess any pertinent or substantial financial interests in the research elucidated in this paper.

Acknowledgment

The research was conducted with unwavering and continual assistance from Banasthali Vidyapith University (India). The researchers extend heartfelt gratitude for the invaluable support extended by each Subject Matter Expert (SME) and aviation professional who participated in the study.

Author Contributions

Deepak Chandra Chandola developed the theoretical formalism, performed the analytic calculations, and performed the numerical simulations. Rajendra Prasad Kholiya, helped in writing literature review. Preeti Chandola helped in writing research methodology. Charan Singh contributed in proofreading the article. Seema Verma and Kamal Jaiswal helped supervise the project and contributed to the interpretation of the results. All authors contributed to the final version of the manuscript and provided critical feedback and helped shape the research, analysis, and manuscript.

1. **References**

2. Al-Momani, H., Al Meanazel, O. T., Kwaldeh, E., Alaween, A., Khasaleh, A., & Qamar, A. (2020). The efficiency of using a tailored inventory management system in the military aviation industry. *Heliyon*, *6*(7). https://doi.org/10.1016/j.heliyon.2020.e04424
3. Alomar, I., & Jackiva, I. Y. (2023). DIGITALIZATION IN AIRCRAFT MAINTENANCE PROCESSES. *Aviation*, *27*(2), 86–94. https://doi.org/10.3846/aviation.2023.18923
4. Bhalla, S., Alfnes, E., Hvolby, H. H., & Sgarbossa, F. (2021). Advances in spare parts classification and forecasting for inventory control: A literature review. *IFAC-PapersOnLine*, *54*(1), 982–987. https://doi.org/10.1016/j.ifacol.2021.08.118
5. Chandola, D. C. (2021). Key Aspects of Disaster Management. *7th IAA Planetary Defense Conference*, 1–5. https://az659834.vo.msecnd.net/eventsairwesteuprod/production-atpi-public/18d326f545ac43b48b472aa26f23941d
6. Chandola, D. C., Chandola, P., Verma, S., & Jaiswal, K. (2023). An Exploratory Study to Evaluate Significance of Maintenance Planning in Reducing Aircraft Maintenance Turnaround Time Within Airlines Industry. *Proceedings of 3rd IEEE International Conference on Computational Intelligence and Knowledge Economy, ICCIKE 2023*, 402–407. https://doi.org/10.1109/ICCIKE58312.2023.10131888
7. Chandola, D. C., Jaiswal, K., Verma, S., & Singh, B. (2022). Aviation MRO: A comprehensive review of factors affecting productivity of Aircraft Maintenance Organization. *2022 Advances in Science and Engineering Technology International Conferences, ASET 2022*. https://doi.org/10.1109/ASET53988.2022.9734808
8. Chandola, D. C., Verma, S., Jaiswal, K., Chandola, P., Goyat, M., & Narvekar, N. (2023). An exploratory study on the significance and challenges of aircraft base maintenance engineering in the aviation industry. *Proceedings of 3rd IEEE International Conference on Computational Intelligence and Knowledge Economy, ICCIKE 2023*, 420–425. https://doi.org/10.1109/ICCIKE58312.2023.10131844
9. Chandra Chandola, D. (2019). Reducing Cost Through Long Term Schedule Maintenance Planning in Aircraft Maintenance Industry. *RESEARCH JOURNAL IN ADVANCED ENGINEERING AND TECHNOLOGY (IRJAET) E-ISSN*, *5*, 2454–4744. https://doi.org/http://www.irjaet.com/Volume5-Issue-5,6/paper4.pdf
10. Chandra Chandola, D., Verma Professor, S., Jaiswal, K., Singh Associate Professor, B., Singh Student, C., Prasad Kholiya, R., & Chandola Student, P. (2023). Statistical Analysis of Production Planning Impact on Aircraft Maintenance Turnaround Time by Exploring Challenges During Work Package Preparation. In *Tuijin Jishu/Journal of Propulsion Technology* (Vol. 44, Issue 2).
11. Chang, H.-M., & Kora, A. (2014). The Operation Management Model of Aircraft Maintenance, Repair and Overhaul (MRO) Business. *III, Issue II Index Copernicus J-Gate and Academic Journal Database*, *III*(II), 21–28.
12. Chen, D., Wang, X., & Zhao, J. (2012). Aircraft maintenance decision system based on real-time condition monitoring. *Procedia Engineering*, *29*, 765–769. https://doi.org/10.1016/j.proeng.2012.01.038
13. Chen, J., Gusikhin, O., Finkenstaedt, W., & Liu, Y. N. (2019). Maintenance, repair, and operations parts inventory management in the era of industry 4.0. *IFAC-PapersOnLine*, *52*(13), 171–176. https://doi.org/10.1016/j.ifacol.2019.11.171
14. Dichter, A., Sørensen, A. J., & Saxon, S. (2017). Buying and flying: Next generation airline procurement. In *Travel, Transport & Logistics* (Issue April 2017).
15. Dinis, D., Barbosa-Póvoa, A., & Teixeira, Â. P. (2019). Valuing data in aircraft maintenance through big data analytics: A probabilistic approach for capacity planning using Bayesian networks. *Computers and Industrial Engineering*, *128*, 920–936. https://doi.org/10.1016/j.cie.2018.10.015
16. Erkoc, M., & Ertogral, K. (2016). Overhaul planning and exchange scheduling for maintenance services with rotable inventory and limited processing capacity. *Computers and Industrial Engineering*, *98*, 30–39. https://doi.org/10.1016/j.cie.2016.05.021
17. Field, A. P. (2009). *Discovering statistics using SPSS : (and sex and drugs and rock "n" roll)*. SAGE Publications.
18. Hu, Y., Miao, X., Zhang, J., Liu, J., & Pan, E. (2021). Reinforcement learning-driven maintenance strategy: A novel solution for long-term aircraft maintenance decision optimization. *Computers and Industrial Engineering*, *153*. https://doi.org/10.1016/j.cie.2020.107056

19. Iwata, C., & Mavris, D. (2013). Object-oriented discrete event simulation modeling environment for aerospace vehicle maintenance and logistics process. *Procedia Computer Science*, *16*, 187–196. https://doi.org/10.1016/j.procs.2013.01.020
20. Karunakaran, C. S., Babu, J. A., & Sheriff, J. K. (2020). Indian MRO industry: Business retention and development opportunities pre COVID-19. *Materials Today: Proceedings*, *37*(Part 2), 1865–1868. https://doi.org/10.1016/j.matpr.2020.07.451
21. Keiser, D., Schnoor, L. H., Pupkes, B., & Freitag, M. (2023). Life cycle assessment in aviation: A systematic literature review of applications, methodological approaches and challenges. *Journal of Air Transport Management*, *110*. https://doi.org/10.1016/j.jairtraman.2023.102418
22. Keivanpour, S., & Kadi, D. A. (2019). The effect of "Internet of things" on aircraft spare parts inventory management. *IFAC-PapersOnLine*, *52*(13), 2343–2347. https://doi.org/10.1016/j.ifacol.2019.11.556
23. Kumar, N., Chandola, D. C., Sakiul, M. D., Sudman, I., Hajoary, D., Singh, E. V., & Prakash, E. R. (2023). Exploring the Use of AI in Autonomous Vehicles, Drones, and Robotics for Perception, Navigation and Decision-Making. In *Tuijin Jishu/Journal of Propulsion Technology* (Vol. 44, Issue 3).
24. Liangrokapart, J., & Sittiwatethanasiri, T. (2023). Strategic direction for aviation maintenance, repair, and overhaul hub after crisis recovery. *Asia Pacific Management Review*, *28*(2), 81–89. https://doi.org/10.1016/j.apmrv.2022.03.003
25. Najmon, J. C., Raeisi, S., & Tovar, A. (2019). Review of additive manufacturing technologies and applications in the aerospace industry. In *Additive Manufacturing for the Aerospace Industry* (pp. 7–31). Elsevier Inc. https://doi.org/10.1016/B978-0-12-814062-8.00002-9
26. Oyesola, M. O., Mpofu, K., Mathe, N. R., & Daniyan, I. A. (2020). Hybrid-additive manufacturing cost model: A sustainable through-life engineering support for maintenance repair overhaul in the aerospace. *Procedia Manufacturing*, *49*, 199–205. https://doi.org/10.1016/j.promfg.2020.07.019
27. Şahin, M., Eldemir, F., & Turkyilmaz, A. (2022). Inventory Cost Minimization of Spare Parts in Aviation Industry. *Transportation Research Procedia*, *59*, 29–37. https://doi.org/10.1016/j.trpro.2021.11.094
28. Tracht, K., Von Der Hagen, F., & Schneider, D. (2013). Applied repairable-item inventory modeling in the aviation industry. *Procedia CIRP*, *11*, 334–339. https://doi.org/10.1016/j.procir.2013.07.020
29. Yang, Z., & Yang, G. (2012). Optimization of Aircraft Maintenance plan based on Genetic Algorithm. *Physics Procedia*, *33*, 580–586. https://doi.org/10.1016/j.phpro.2012.05.107

Author Biography

Deepak Chandra Chandola boasts 15+ years as an aviation professional, excelling in aircraft maintenance management within airlines and MRO industry. Presently a Ph.D. student at Banasthali Vidyapith University, Rajasthan, India, his research centres on optimizing aircraft maintenance turnaround time. He's an M. Tech. Graduate from Manipal Academy of Higher Education (MAHE), Dubai, and holds dual bachelor's degrees in production engineering and mechanical Engineering from the Institution of Engineers India (IEI). Additionally, he's an Aircraft Maintenance Engineer (AME) licensed by the Ministry of Civil Aviation India and has authored several research articles, which are published in reputed journals and IEEEXplore-published Scopus-indexed digital library.

Seema Verma obtained her Master of Technology (M. Tech.) and Ph.D. degree from Banasthali Vidyapith University, Rajasthan, India in 2003 and 2006 respectively. Presently, she is working as dean of school of aviation at Banasthali Vidyapith University, India. Her research areas are aviation, aircraft maintenance management, airlines management, VLSI Design, communication Networks and signal processing. She has published more than 100 research articles in several reputable journals.

Kamal Jaiswal is a passionate aviator from both the engineering and operations discipline. He works with Higher Colleges of Technology as Lecturer and resides in Abu Dhabi, United Arab Emirates. He has over 12 years of experience in aviation engineering, safety management, technical training, flight operations, and research. He holds a PhD in aviation management. He is a research-focused individual interested in exploring new avenues of research. He has published several research papers in reputed journals and IEEEXplore-published Scopus-indexed digital library.

European Economic Letters
ISSN 2323-5233
Vol 13, Issue 3 (2023)
https://doi.org/10.52783/eel.v13i3.603
http://eelet.org.uk

Rajendra Prasad Kholiya is a DBA student at the Swiss Business School, Kloten, Switzerland. His research interests focus on business management and strategy development. Till date, he has co-authored several papers, which are publish in reputed journals.

Preeti Chandola is a Ph.D. candidate at Banasthali Vidyapith University, Rajasthan, India. She is a research-focused individual interested in exploring new avenues of research. Till date, she has co-authored several papers, which are publish in reputed journals and IEEEXplore-published Scopus-indexed digital library.

Charan Singh is a Ph.D. student at the Banasthali Vidyapith University, Rajasthan, India. His research interests focus on business management. Till date, he has co-authored several research papers, which are publish in reputed journals.