

Analyzing the Critical Factors in Aircraft Maintenance That Affect Low-Cost Airlines in Thailand

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Abstract

This study offers an in-depth examination of salient factors pivotal to aircraft maintenance management. Through a rigorous statistical methodology, critical variables—namely, flexibility, cost control, and service quality and delivery—were discerned as cardinal elements in efficacious management within this domain.

The constructed model demonstrated formidable statistical validity, solidifying its utility as a potent instrument for both evaluation and strategic guidance within the aviation milieu. The relative weights ascribed to each variable shed light on their hierarchical significance, furnishing actionable insights for organizations in their quest for operational enhancement. For the rigorous scrutiny and validation of such statistical models, a repertoire of goodness-of-fit indices is paramount. To this end, the current study leveraged a myriad of indices including the Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Root Mean Square Error of Approximation (RMSEA), Normed Fit Index (NFI), Incremental Fit Index (IFI), and Root Mean Square Residual (RMR).

Nonetheless, it is prudent to recognize the potential variances in the weightages and salience of these variables across diverse organizational landscapes and contexts. This underscores the necessity for bespoke adaptations to cater to unique organizational exigencies. Cumulatively, this investigation augments the existing corpus of knowledge on aircraft maintenance management, proffering a robust quantitative scaffold for aviation entities to streamline operations, institute cost efficiencies, and uphold service excellence.

Keywords: aircraft maintenance, statistical modeling, flexibility, cost control, service quality, goodness-of-fit indices, organizational adaptation

1. Introduction

Air transportation contributes to economic value creation by connecting cities and opening new markets, which leads to increased infrastructure investment. This in turn results in foreign investment in various cities, economic consolidation, and an impact on economic output expansion. A study by Frost & Sullivan (2018) shows that the rise of low-cost airlines in Thailand is a major factor driving the country's aviation market.

In the context of intense competition and changes in consumer behavior emphasizing frugality, Thai low-cost airlines such as Thai AirAsia, Nok Air, Thai Lion Air, and Thai Vietjet Air have adapted their service models and marketing strategies to meet consumer needs. This has led to the growth of the aviation market in Thailand.

The tendency of Thai consumers to seek quality products and services at economical prices has greatly fueled the growth of low-cost airlines in Thailand over the past year. The revenue of Thailand's low-cost airlines surged by 20% in 2019 compared to the previous year (Centre for Aviation, 2020). These airlines have played a significant role in expanding the tourism market and investment in Thailand.

By connecting major cities and key tourist destinations throughout the country, they have effectively responded to the growth of Thailand's tourism industry. With this strategy, low-cost airlines have not only bolstered the Thai economy but also continuously expanded their customer base (Ministry of Transport, Thailand, 2018). Aircraft maintenance

management is a critical aspect that every airline must perform efficiently and safely. Especially for low-cost airlines, it is vital to have standard maintenance management, whether it is short-term maintenance, long-term maintenance, complex maintenance, or in-service maintenance. Effective aircraft maintenance can help low-cost airlines create differentiation in the aviation business and provide satisfaction to customers (Phanusak Sawangbun, 2015; Isaraporn Saralee, 2013).

The maintenance of low-cost airlines must adhere to the set standards to ensure safe travel (Phatrawut Srimuang, 2011) and assist airlines in operating according to schedule, reducing the risk of accidents, and instilling confidence in the service users. This will strengthen the aviation business of low-cost airlines in Thailand (Supri Srisamran, 2017).

Present-day aircraft maintenance management must be scrutinized and performed with caution to maintain travel safety and the stability of the aviation business (Thammarak Moenjaj, 2012). External and internal factors that can affect aircraft maintenance management include the economy, society, technology, management system, and the organization's internal personnel (Rattana Tipsuwannakorn, 2015).

Therefore, it is essential for low-cost airlines in Thailand to manage aircraft maintenance carefully in order to maintain business stability and trust from service users. While still providing high-quality services at a reasonable price, developing, and improving the efficiency of aircraft maintenance is crucial. Low-cost airlines must continuously learn and improve to maintain competitiveness in the aviation market.

Objective

The objective of this research is to analyze and confirm the key factors in aircraft maintenance that impact low-cost airlines in Thailand.

2. Method

This study sought to systematically analyze the crucial factors in aircraft maintenance that significantly influence low-cost airlines operating in Thailand. The methodology adopted was both quantitative and qualitative in nature.

2.1 Population and Sample

The target population for this investigation is derived from aircraft maintenance experts possessing the Aircraft Maintenance Engineer License (AMEL) in accordance with the Aviation Act B.E. 2497. This encompasses a total of 1,287 licensed professionals. These individuals are pivotal, having the jurisdiction to inspect, validate, and ensure the compliance of safety standards across various aspects of aircraft maintenance—encompassing the aircraft's structural integrity, propulsion systems, and other vital flight systems. To ascertain the sample size for this research, the Structural Equation Modeling (SEM) methodology was adopted, in alignment with the recommendations by Hair and et al. (2014). This mandates that the sample size range between 10 to 20 times the quantity of parameters. Given that the research incorporates 26 parameters, it necessitates a sample size ranging from 260 to 520 respondents. Employing the Proportionate Stratified Sampling approach, the sample pool was segmented into four strata, corresponding with the four budget airlines operating within the nation. Subsequently, maintenance professionals from each stratum were indiscriminately chosen through the Simple Random Sampling technique, utilizing a lottery-based selection mechanism.

Table 1. Proportion of Sample Groups for Component Analysis

No.	Low-Cost Airline	Population (N)	% N	Sample Size (n)
1	Thai Lion Air	435	33.80	176
2	Thai Air Asia, Thai Air Asia X	495	38.46	200
3	Nok Air	251	19.50	101
4	Thai Viet Jet	106	8.24	43
Total		1287	100.00	520

2.2 Data Collection

The data collection instrument employed in this study is a questionnaire devised by the researcher. The methodology for the construction of this questionnaire is delineated below:

To comprehend the intricacies of organizational context, managerial dynamics, internal resource management, and competitive prowess within organizations, an exhaustive examination was conducted on scholarly articles, academic research, and documents sourced both domestically and internationally. For this study, the researcher anchored the investigative trajectory in the realm of aircraft maintenance management pertaining to the budget airline sector in Thailand. This focus finds its theoretical foundation in Harold's conceptual framework on organizational management, denoted as POSDC, which emphasizes planning, organizing, staffing, directing, and controlling. Additionally, the study delved into the 8M Resource Management paradigm, as posited by Samuel & Trevis, (2006). This paradigm encapsulates essential

resource dimensions: manpower, money, materials, methods, machinery, marketing, motivation, and minutes. Complementing these primary frameworks, the study integrates theories from Alireza et al., (2007) on Organizational Context and Environment, insights from Seyyed et al. regarding competitive acumen in aircraft maintenance, and the renowned service quality (SERVQUAL) model formulated by Parasuraman, Zeithaml & Berry (1988). These theoretical constructs collectively inform the variables underpinning this research.

This research entails the analysis of data and the creation of a questionnaire, delving into the factors that influence aircraft maintenance management within the commercial aviation sector of Thailand. The methodology encompasses: 1) Objective Definition: Outlining clear research aims and goals. 2) Issue Segmentation: Identifying core concerns and related sub-issues. 3) Questionnaire Formulation: Questions are constructed using a 5-level Likert scale, categorized as: "most," "much," "moderate," "little," and "least."

Upon completion of the questionnaire draft, rigorous verification is conducted to align each question with the prescribed research objectives. This meticulous alignment is integral for subsequent data collection, particularly for the exploratory factor development phase. The survey aims to collate opinions from the sample group regarding various elements affiliated with aircraft maintenance management in Thailand's commercial aviation domain. The study encompasses a total of 146 variables, spread across four primary management facets. These can be further categorized into 23 preliminary components, detailed as follows:

Context and Environment: This includes 6 components: 1) Economic conditions 2) Aviation rules and standards 3) Government aviation policy 4) Organizational policy 5) Availability and 6) Aircraft maintenance capabilities.

Management Dynamics: This comprises 5 components: 1) Planning 2) Organizing 3) Human resource management 4) Directing and 5) Controlling.

Resource Allocation: These spans 8 components: 1) People 2) Financial capital 3) Raw materials, parts, components 4) Procedural mechanisms 5) Machinery and equipment 6) Market outreach 7) Incentives and motivational strategies and 8) Operational timelines.

Competitive Capabilities: This is segmented into 4 components: 1) Cost-effectiveness 2) Flexibility in operations 3) Delivery precision and 4) Quality of service.

To ensure the content validity of the questionnaire, it was presented to three domain experts. They meticulously evaluated the relevance and pertinence of each question vis-à-vis the research objectives. Subsequently, the Index of Consistency (IOC) was computed, following the guidelines set by Surapong Khong-Sat and Theerachat Thammawong (2008). Questions with an IOC exceeding 0.6 were retained, bringing the final count to 133 variables. A pilot study of the questionnaire was conducted with a cohort of 30 ground technicians. The reliability of the instrument was assessed using the Cronbach's Alpha Coefficient, registering a remarkable reliability score (r) of 0.993 across the 133 variables.

3. Data Collection

Data for this research was gathered using a questionnaire administered to a sample group. The size of this group was determined through specific calculations. A total of 600 questionnaires were distributed, which equates to 115.38% of the anticipated sample size of 520 individuals (as presented in Table 2). Participants were proportionally selected using the simple random sampling technique, facilitated through a lottery draw method.

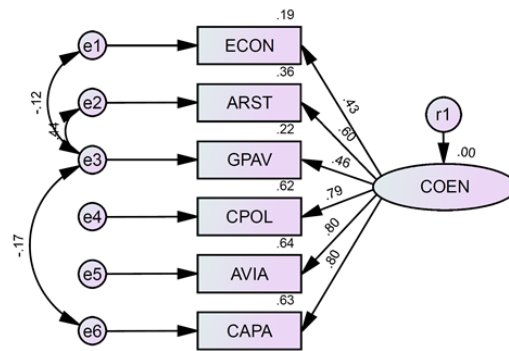
Table 2. Number of aircraft maintenance operators from the 4 low-cost airlines in the country

No.	Low-Cost Airline	Population (N)	Sample Size (n)	Collected
1	Thai Lion Air	435	176	197
2	Thai Air Asia, Thai Air Asia X	495	200	223
3	Nok Air	251	101	130
4	Thai Viet Jet	106	43	50
Total		1287	520	600

4. Data Analysis

The process involves validating the coherency of the causal relationship model and assessing the model's fit through Confirmatory Factor Analysis (CFA). The aim is to ensure a congruence between the hypothesized causal relationships and the empirical data. Statistical software is employed to analyze, verify, and refine the linear relationship model.

4.1 The Model of Context and Environmental Factors (COEN)



Chi-Square=11.784, df.=6, P-Value=.067 RMSEA=.040

The confirmatory factor analysis results for the factors related to context and environment, broken down by individual sub-aspects, demonstrated alignment with empirical data. This alignment is evident from the Chi-Square value, which was not statistically different from zero (Chi-Square = 11.784, df = 6, P-Value = 0.067). The model showed a Congruence Fit Index (CFI) of 0.996, a Goodness of Fit Index (GFI) of 0.994, an Adjusted Goodness of Fit Index (AGFI) of 0.977, a Root Mean Square Residual (RMR) of 0.007, and a Root Mean Square Error of Approximation (RMSEA) of 0.040.

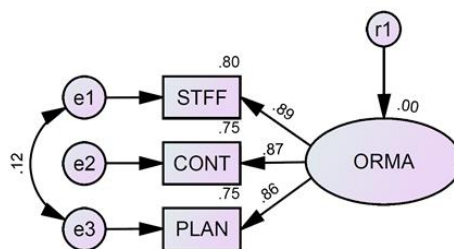
Upon analyzing the factor loadings of the indicators, it was found that all factor loadings were positive, with values ranging between 0.43 and 0.80. Notably, the variable "availability" (AVIA) emerged as the most significant, explaining 64% of the variance related to latent context and environmental factors. This was followed by "maintenance capability" (CAPA) accounting for 63% variance, "corporate policy" (CPOL) with 62% variance, "aviation rules and standards" (ARST) contributing to 36% variance, "government aviation policy" (GPAV) with 22% variance, and lastly, "economic situation" (ECON) explaining 19% of the variance. These details are further elaborated in Table 3.

Table 3. Results of the factor loadings analysis of the indicators of context and environmental factors

Observable Variables	Factor Loadings	Standard Error (SE)	Statistic (t)	Decision Coefficient (R ²)
ECON	0.43	-	-	0.19
ARST	0.60	0.20	9.06**	0.36
GPAV	0.47	0.25	7.43**	0.22
CPOL	0.79	0.21	10.01**	0.62
AVIA	0.80	0.23	10.06**	0.64
CAPA	0.80	0.21	10.03**	0.63

Chi-Square = 11.784, df = 6, P-Value = 0.067, CFI = 0.996, GFI = 0.994, AGFI = 0.977, RMR = 0.007, RMSEA = 0.040

4.2 Pattern of Organizational Management Factors (ORMA)



Chi-Square=6.930, df.=3, P-Value=.074, RMSEA=.047

The results from the confirmatory component analysis for organizational management factors, when classified by sub-aspects, align well with the quantitative data. Specifically, the Chi-Square value was found to be significantly different from zero (Chi-Square = 6.930, df = 3, P-Value = 0.074). The Comparative Fit Index (CFI) stood at 0.997, the Goodness of Fit Index (GFI) registered at 0.992, the Adjusted Goodness of Fit Index (AGFI) was noted at 0.985, the Root Mean Square Residual (RMR) was 0.014, and the Root Mean Square Error of Approximation (RMSEA) was 0.047.

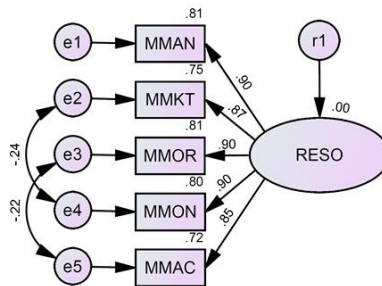
Upon analyzing the weightings of the indicators, it was observed that all component weights were positive, with values spanning from 0.89 to 0.86. Notably, "human resource planning and management" (STFF) was the most significant observable variable, explaining 80% of the variance related to the latent organizational management factor. This was closely followed by both "control" (CONT) and "planning" (PLAN), each accounting for 75% of the variance in the latent organizational management factor. Further details are provided in Table 4.

Table 4. Results of Component Weight Analysis of Indicators of Organizational Management Factors

Observable Variables	Factor Loadings	Standard Error (SE)	Statistic (t)	Decision Coefficient (R ²)
STFF	0.89	-	-	0.80
CONT	0.87	0.27	32.81**	0.75
PLAN	0.86	0.25	34.42**	0.75

Chi-Square = 6.930, df. = 3, P-Value = 0.074, CFI = 0.997, GFI = 0.992, AGFI = 0.985, RMR = 0.014, RMSEA = 0.047

4.3 Factor Structure of Resource Component (RESO)



Chi-Square=4.802, df.=3, P-Value=.187, RMSEA=.032

The results from the confirmatory factor analysis of the resource factor, when subdivided by sub-factors, demonstrate strong congruence with empirical data. This is evident from the Chi-Square value, which is statistically non-significant (Chi-Square = 4.802, df. =3, P-Value = 0.187). The Comparative Fit Index (CFI) stands at 0.999, the Goodness of Fit Index (GFI) is recorded at 0.997, the Adjusted Goodness of Fit Index (AGFI) is 0.984, the Root Mean Square Residual (RMR) is 0.003, and the Root Mean Square Error of Approximation (RMSEA) is 0.032.

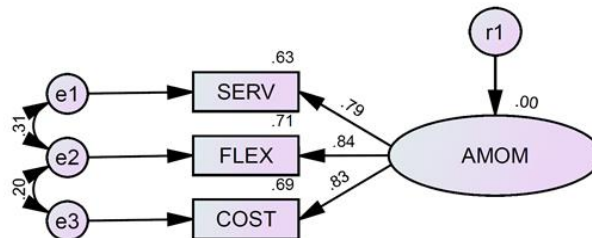
Upon further analysis of the component weights of the indicators, it is observed that all have positive values, with a range between 0.85 and 0.90. Notably, the most significant observable variable is "manpower" (MMAN), accounting for 81.3% of the variance with the latent resource variable. This is succeeded by "morale" (MMOR) with 80.5%, "money" (MMON) with 80.1%, "market" (MMKT) with 75.1%, and "machinery" (MMAC) with 72%, sequentially, as detailed in Table 5.

Table 5. Results of the Component Weight Analysis of the Indicators of the Resource Factor

Observable Variables	Factor Loadings	Standard Error (SE)	Statistic (t)	Decision Coefficient (R ²)
MMAN	0.90	-	-	0.81
MMKT	0.87	0.03	31.10**	0.75
MMOR	0.90	0.04	33.99**	0.81
MMON	0.90	0.04	33.66**	0.80
MMAC	0.85	0.03	29.78**	0.72

Chi-Square = 4.802, df. = 3, P-Value = 0.187, CFI = 0.999, GFI = 0.997, AGFI = 0.984, RMR = 0.003, RMSEA = 0.032

4.4 Component Factor Structure of Aircraft Maintenance Management (AMOM)



Chi-Square=2.855, df.=2, P-Value=.240, RMSEA=.027

The results from the confirmatory component analysis of the aircraft maintenance management factor, when subdivided by sub-aspects, exhibited strong congruence with empirical data. This was inferred from a chi-square value that was

statistically significant and different from zero (Chi-Square = 2.855, df. =2, P-Value = 0.240). The Comparative Fit Index (CFI) was recorded as 0.999, the Goodness of Fit Index (GFI) stood at 0.997, the Adjusted Goodness of Fit Index (AGFI) was 0.991, the Root Mean Square Residual (RMR) was 0.029, and the Root Mean Square Error of Approximation (RMSEA) was 0.027.

Upon further analysis of the indicator component weights, it was observed that all were positive and ranged between 0.79 and 0.84. Notably, the variable "flexibility" (FLEX) demonstrated the highest significance, accounting for 71% of the variance with the aircraft maintenance management latent variable. This was followed by "cost" (COST), which accounted for 69% variance, and "service quality and delivery" (SERV), which accounted for 63% variance with the aircraft maintenance management latent variable, as detailed in Table 6.

Table 6. Results of the component weight analysis of the indicators of the management factor

Observable Variables	Factor Loadings	Standard Error (SE)	Statistic (t)	Decision Coefficient (R^2)
SERV	0.79	-	-	0.63
FLEX	0.84	0.039	30.62**	0.71
COST	0.83	0.044	26.64**	0.69

Chi-Square = 2.855, df. = 2, P-Value = 0.240, CFI = 0.999, GFI = 0.997, AGFI = 0.991, RMR = 0.029, RMSEA = 0.027

5. Research Findings Summary

A confirmatory factor analysis was executed to authenticate the alignment between the theoretical causal relationship model and the observed empirical data. The analysis was facilitated using dedicated statistical software. The principal findings are as follows:

1. The outcomes derived from the confirmatory factor analysis pertaining to the context and environment factors, in conjunction with the component weights of the indicators, suggest the analyzed model's high acceptability. The model manifested a Chi-Square value that did not significantly deviate from zero (Chi-Square = 11.784, df. =6, P-Value = 0.067). Furthermore, the model displayed robust goodness-of-fit indices, including CFI, GFI, and AGFI, and reported minimal values for the Root Mean Square Residual (RMR) and the Root Mean Square Error of Approximation (RMSEA). In assessing variable significance, availability (AVIA) emerged with the highest prominence, sharing a 64% common variance with the latent context and environment variables. Subsequent variables in terms of significance were aircraft maintenance capability (CAPA), organizational policy (CPOL), aviation rules and standards (ARST), state policy in aviation (GPAV), and economic conditions (ECON).

Consequently, these findings underscore the development of a model that harmonizes with extant data, aptly positioning it for future predictions and analyses concerning the impact of diverse factors on the contextual and environmental dynamics within the specified study domain.

2. The outcomes of the confirmatory factor analysis pertaining to the organizational management factors, combined with the evaluation of the component weights of the indicators, ascertain the high acceptability of the model under consideration. The model exhibited a Chi-Square value that did not notably deviate from zero (Chi-Square = 6.930, df. = 3, P-Value = 0.074). Additionally, the model recorded commendable goodness-of-fit indices, namely CFI, GFI, and AGFI, and maintained minimal values for the Root Mean Square Residual (RMR) and the Root Mean Square Error of Approximation (RMSEA).

Among the variables assessed, staffing and human resource planning (STFF) emerged as the most significant, sharing an 80% common variance with the latent organizational management variables. This was sequentially followed by control (CONT) and planning (PLAN).

In light of the above, the findings illuminate the formulation of a model that resonates with the extant data. This model is adeptly positioned for forthcoming predictions and in-depth analyses concerning the influence of assorted organizational management factors within the delineated research scope.

3. The outcomes derived from the confirmatory factor analysis concerning the resource factors, coupled with the evaluation of the component weights of the indicators, reinforce the commendable acceptability of the model under examination. The model demonstrated a Chi-Square value that does not notably differ from zero (Chi-Square = 4.802, df. =3, P-Value = 0.187) and boasts robust goodness-of-fit indices, namely CFI, GFI, and AGFI. Furthermore, it registered minimal values for the Root Mean Square Residual (RMR) and the Root Mean Square Error of Approximation (RMSEA). Among the assessed variables, manpower (MMAN) stood out as the most pivotal, registering an 81.3% common variance with the latent resource variables. Sequentially, morale and motivation (MMOR), financial assets (MMON), market influence (MMKT), and machinery (MMAC) follow in order of significance.

In light of the presented data, it is evident that the devised model harmoniously aligns with the prevailing data. The model is aptly primed for future predictions and detailed explorations, particularly regarding the ramifications of diverse resource factors within the designated research purview.

4. The outcomes of the confirmatory factor analysis concerning factors associated with aircraft maintenance management, delineated by specific sub-domains, are consistent with empirical findings. The statistical data reflects a Chi-Square value of 2.855 with $df. = 2$, yielding a P-Value of 0.240. Further examination of the component weights of the indicators reveals that all weights are affirmatively positive, oscillating between 0.79 and 0.84. Among the assessed variables, flexibility (FLEX) emerges as the predominant one, subsequently trailed by cost (COST) and service quality and delivery (SERV).

5. The results of the confirmatory factor analysis concerning organizational management factors, complemented by the analysis of component weights of indicators, demonstrate the high acceptability of the analyzed model. The Chi-Square value, statistically indistinct from zero (Chi-Square = 2.855, $df. = 2$, P-Value = 0.240), coupled with robust goodness-of-fit indices like CFI, GFI, and AGFI, and minimized error rates such as RMR and RMSEA, underscores this acceptability.

Among the evaluated variables, flexibility (FLEX) stands out, accounting for 71% of its variance with the aircraft maintenance management's latent variable. It is succeeded by cost (COST) and service quality and delivery (SERV).

Such findings suggest that the constructed model aligns closely with existing empirical data. This compatibility suggests its utility in predicting and analyzing the repercussions of the studied organizational management factors.

In totality, the empirical data's scrutiny through our structural equation model highlights the credibility and high consistency of this aircraft maintenance management model. This assertion is backed by test indices—CFI, GFI, AGFI, RMSEA, NFI, IFI, RMR—that meet all prescribed criteria, attesting to the model's adequacy in explicating the interrelations among the specified variables.

The analysis underscores the significance of flexibility (FLEX), cost control (COST), and quality of service and delivery (SERV) within the domain of aircraft maintenance management. These findings provide invaluable insights for strategizing and formulating an efficacious aircraft maintenance management plan. Notably, the seven index values evaluated align harmoniously with the empirical data. This congruence reaffirms the statistical acceptance of the structural equation model for aircraft maintenance management, encompassing variables pertinent to context and environment, organizational management, resources, and the core topic of aircraft maintenance management. Furthermore, the model adheres to the established value criteria, denoting its validity—thus affirming its satisfactory fit within the framework of confirmatory analyses.

6. Discussion

Several critical aspects arise from the discussion of the research findings.

1. Model Fit and Statistical Validation:

Primarily, the results underscore that the postulated model possesses an exemplary fit, suggesting it mirrors the intrinsic phenomena under examination aptly. Such a commendable fit is further ratified by multiple statistical indicators: Chi-Square, CFI, GFI, AGFI, RMSEA, NFI, IFI, and RMR, all of which align with the benchmarks of a well-fitted model.

2. Significance of Variables:

The analysis accentuates three dominant factors: flexibility (FLEX), cost control (COST), and service quality and delivery (SERV), with their significance descending in the aforementioned order. Their prominence indicates they are cardinal pillars in aircraft maintenance management and warrant meticulous attention in both strategic and operational arenas.

3. Analyzing the Dominant Variables:

- Flexibility (FLEX): This variable's paramount significance infers that within aircraft maintenance management, the capacity to acclimatize to evolving scenarios and recalibrate strategies is indispensable. Such an inference might be tethered to the aviation sector's ever-evolving landscape, where technological shifts, regulatory amendments, and market flux can profoundly influence maintenance paradigms.
- Cost Control (COST): Its prominence resonates with the intricate financial matrix enveloping aircraft maintenance. Elevated expenditures can erode margins, necessitating efficacious oversight and stringent control mechanisms.
- Service Quality and Delivery (SERV): Its significance underscores the imperativeness of punctual, high-caliber service delivery in aviation. Maintenance delays or subpar services could culminate in operational hitches or compromise safety, amplifying this variable's criticality.

4. Implications for the Aviation Sector:

These elucidations furnish invaluable insights for aviation stakeholders, especially entities immersed in aircraft maintenance. By channeling their efforts towards these pivotal factors, they can potentially augment their management paradigms, fostering heightened operational efficacy and bolstering profitability.

5. Contextual Relevance of Findings:

Nevertheless, it's prudent to acknowledge the potential contextual specificity of these insights. Dimensions like organizational architecture, regional regulatory scaffolds, and nuanced industry dynamics might modulate the salience of the variables delineated in this investigation.

7. Recommendations

Based on the analytical outcomes, the following recommendations are posited:

1. **Prioritize Flexibility:** The model underscores flexibility as paramount. It is, therefore, imperative for organizations to embed flexibility within their aircraft maintenance management paradigms. Potential initiatives could encompass:

- Dedicated training programs, enhancing the adaptability of personnel to the evolving nuances of the aviation sector.
- Leveraging maintenance systems and technologies that are inherently scalable and malleable to fluctuating industry dynamics.

2. **Sharpen the Lens on Cost Control:** The salience of cost control within the model necessitates robust fiscal strategies. Organizations should:

- Strategically negotiate contracts for components and services, ensuring optimal financial terms.
- Harness technology to optimize maintenance procedures, aiming for efficiency.
- Formulate and implement strategies targeting waste minimization and productivity enhancement.

3. **Champion Service Quality and Timeliness:** The emphasis on service quality and delivery suggests a two-pronged focus: impeccable maintenance standards and adherence to timelines. To actualize this:

- Quality assurance mechanisms should be strengthened, fostering a culture of excellence.
- Uphold rigorous training benchmarks, ensuring personnel are equipped with requisite competencies.
- Employ reliable technological platforms guaranteeing punctual maintenance completions.

4. **Instill a Culture of Continuous Re-evaluation and Refinement:** The model's inherent robustness positions it as an evaluative instrument. Organizations should:

- Periodically employ the model for introspective assessments, gauging their efficacy across identified pivotal domains.
- Utilize insights derived from such evaluations as directional guides, refining their aircraft maintenance strategies and operational modalities.

By assimilating these recommendations, aviation entities can architect a trajectory towards enhanced operational precision, fiscal prudence, and service distinction.

8. Conclusion

This research undertook a meticulous exploration of aircraft maintenance management, delineating paramount factors—namely flexibility, cost control, and service quality and delivery—as its foundational pillars. The resultant model, characterized by its rigor and compelling fit, stands as a reliable matrix to steer management strategies within this domain.

The compelling statistical corroboration of the model reinforces its aptitude to elucidate the intricate interplay between these designated variables. Consequently, this model emerges as an indispensable asset for stakeholders in the aviation sector, equipping them with a structured paradigm to decipher and augment their performance metrics across pivotal domains.

However, a word of caution is in order: while the research underscores the salience of these variables, their respective weights and significance might exhibit variability across distinct organizational landscapes and contexts. As such, aviation entities should perceive this model as a foundational scaffold, necessitating bespoke adaptations in accordance with their unique operational contours and imperatives.

In essence, this investigative endeavor enriches the academic discourse on aircraft maintenance management, proffering a quantitatively robust framework that empowers organizations to streamline operations, optimize expenditures, and consistently deliver premium services. The distilled insights and the propounded recommendations stand poised to inform

strategic decision-making, shaping the trajectory of aircraft maintenance management.

For future scholarly pursuits, this research lays the groundwork, inviting deeper dives into the nuanced dimensions of these variables, probing potential ancillary factors, and gauging the model's resonance across varied backdrops and niches within the expansive canvas of the aviation industry.

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In summation, the completion of this research was contingent upon the collaborative endeavors of all stakeholders. We remain deeply indebted for their invaluable contributions and convey our enduring gratitude. In summation, the completion of this research was contingent upon the collaborative endeavors of all stakeholders. We remain deeply indebted for their invaluable contributions and convey our enduring gratitude.

Authors contributions

In the formulation of the research concept and methodology, Dr. Tawan Thianthong was the primary lead. Both Asst. Prof. Dr. Paitoon Raklua and Asst. Prof. Dr. Nipont Tanthong made pivotal contributions in terms of data analysis and were integral in the drafting of the manuscript. As the corresponding author, Dr. Kritsana Lakkhongkha rendered substantial contributions in the interpretation of the study's results and the subsequent revisions of the manuscript. Additionally, Dr. Saran Phinijphara undertook the overarching supervision of the research project and imparted invaluable feedback, enhancing the quality of the manuscript.

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Competing interests

All contributing authors declare that there are no existing conflicts of interest related to this publication. Furthermore, it is affirmed that no significant financial backing was received for this research that might have biased its results or conclusions.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Redfame Publishing.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

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Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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References

- Alireza, P. L., Barakat, S., Cumberlidge, A. M., Lonzarich, G., Nakamura, F., & Maeno, Y. (2007). Developments on Susceptibility and Magnetization Measurements under High Hydrostatic Pressure. *J. Phys. Soc. Jpn.*, 76, 216.
- Centre for Aviation. (2020). *Thailand's low-cost carrier market: resilient despite obstacles*. Sydney: CAPA.
- Frost & Sullivan. (2018). *Thailand's Booming Aviation Industry*. Bangkok: Frost & Sullivan.
- Hair Jr, J. F., Sarstedt, M., Hopkins, L., & G. Kuppelwieser, V. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European Business Review*, 26(2), 106-121. <https://doi.org/10.1108/EBR-10-2013-0128>
- Isaraporn Saralee. (2013). *Airplane Maintenance Management*. Bangkok: Ramkhamhaeng University Press.
- Ministry of Transport, Thailand. (2018). *Annual Report 2018*. Bangkok: Ministry of Transport, Thailand.
- Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). Servqual: A multiple-item scale for measuring consumer perc. *Journal of Retailing*, 64(1), 12.
- Phanusak, S. (2015). *Service Quality of Airline Maintenance*. Bangkok: King Mongkut's Institute of Technology Ladkrabang.
- Phatrawut, S. (2011). *The study of problems and guidelines for development of aviation maintenance in Thailand*. Bangkok: Thammasat University.
- Rattana, T. (2015). *Internal and External Factors Affecting Aviation Maintenance Management*. Bangkok: Silpakorn University.
- Samual, S. C., & Trevis, C. S. (2006). *Modern management: International edition*. USA: Person.
- Supri, S. (2017). *Study of the problems and solutions in the heavy maintenance of aircraft*. Bangkok: King Mongkut's Institute of Technology Ladkrabang.
- Surapong Kongsat and Theerachart Thammawong. (2008). *Assessment of the Index of Item-Objective Congruence (IOC)*. Retrieved March 10, 2023, from <https://www.mcu.ac.th/article/detail/14329>
- Thammarak, M. (2012). *Aviation Maintenance Management*. Bangkok: Kasetsart University Press.