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A MULTI-THEORETICAL SEM MODEL OF STRATEGIC ENABLERS DRIVING AIRLINE OPERATIONAL PERFORMANCE IN THAILAND

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Abstract:

Operational performance in commercial airlines increasingly depends on the effective alignment of internal capabilities operating within highly regulated, reliability-critical environments. While existing aviation research frequently examines operational drivers in isolation, limited evidence integrates multiple theoretical perspectives or provides empirical insights from emerging Asian markets. This study develops and empirically validates a multi-theoretical structural equation model grounded in the Resource-Based View (RBV), Total Quality Management (TQM), and Compliance Management Theory to explain how four strategic enablers—ground operations, crew performance, maintenance and reliability, and regulatory compliance—collectively influence operational performance in Thailand's commercial airline sector. A convergent mixed-methods design was employed, incorporating qualitative insights from 15 executives and regulatory specialists and quantitative data from 412 employees across six Thai airlines. Confirmatory factor analysis demonstrated strong reliability and validity, and covariance-based SEM indicated good model fit (RMSEA = 0.056, CFI = 0.938, GFI = 0.916, SRMR = 0.048). All four strategic enablers exerted significant positive effects on operational performance, with regulatory compliance (β = 0.46) and ground operations (β = 0.42) emerging as the strongest contributors. Qualitative findings reinforced these results, emphasizing compliance culture, turnaround precision, and crew coordination as dominant operational priorities. Subgroup analysis revealed clear distinctions between full-service carriers (FSCs) and low-cost carriers (LCCs), reflecting differences in organizational structure, safety culture, and maintenance strategies. The study offers a unified, empirically tested framework that advances theoretical understanding of airline capability systems and provides actionable guidance for managers seeking to strengthen safety governance, frontline execution, and operational reliability in emerging aviation markets.

Keywords: *strategic enablers, operational performance, aviation industry, mixed-methods, CB-SEM*

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1. Introduction

The commercial airline industry operates within an environment characterized by intense competition, strict regulatory oversight, limited operational buffers, and rising customer expectations. Ensuring reliable and efficient operations has therefore become a strategic priority for airlines worldwide. Prior research emphasizes that operational performance is shaped not only by external market conditions but also by internal capabilities such as workforce competence, process reliability, maintenance readiness, and adherence to regulatory standards (Garg & Agrawal, 2023; Helmold, 2023). These capabilities are particularly critical in high-reliability industries such as aviation, where minor disruptions can propagate quickly across the network.

In Southeast Asia, and specifically in Thailand, airlines face unique operational challenges arising from resource constraints, rapid market growth, variations in workforce experience, and the coexistence of full-service carriers (FSCs) and low-cost carriers (LCCs). These dynamics align with regional evidence showing that Southeast Asian airlines exhibit diverse organizational architectures and performance patterns shaped by business model differentiation (Foong et al., 2023). Thai airlines also operate within an evolving regulatory environment under the Civil Aviation Authority of Thailand (CAAT), where compliance expectations have strengthened following recent safety reforms. Despite the recognized importance of operational capabilities, limited empirical research examines how these internal enablers jointly influence operational performance within Thailand's aviation context.

Existing aviation studies tend to focus on isolated operational drivers—such as customer satisfaction, fleet decisions, or cost structures—rather than examining integrated capability systems that align strategic operations with service performance (Alkhatib & Migdadi, 2019). Similarly, most prior works treat regulatory compliance merely as an external requirement, instead of conceptualizing it as a strategic internal capability that shapes operational discipline. Moreover, differences in business models (LCC vs. FSC) and organizational culture—factors that affect workflow coordination, safety behavior, and cross-functional communication—remain underexamined in empirical models of airline performance, including those focused on Southeast Asia.

To address these limitations, this study develops and validates a multi-theoretical structural model grounded in the Resource-Based View (RBV), Total Quality Management (TQM), and Compliance Management Theory. These theories respectively emphasize (1) internal strategic capabilities, (2) process reliability and continuous improvement, and (3) disciplined adherence to rules and safety systems. Despite their relevance, no existing empirical study integrates these three perspectives to explain how internal capabilities interact to influence operational performance, nor is there evidence from Thailand—an emerging but operationally constrained aviation market.

This study addresses these gaps by examining how four strategic enablers—ground operations, crew performance, maintenance and reliability, and regulatory compliance—collectively shape operational performance in Thai commercial airlines. The model is intentionally specified as direct effects only to ensure theoretical clarity and parsimony while reducing risks of overfitting. Potential interaction effects (e.g., culture of compliance strengthening ground operations or maintenance consistency) are acknowledged and recommended as future research directions.

The contribution of this paper is threefold. First, it provides a unified, theory-driven explanation of internal airline capabilities based on the combined strengths of RBV, TQM, and compliance theory. Second, it offers empirical evidence from Thailand, informing both emerging markets and carriers undergoing regulatory transition. Third, it provides practical guidance for airline managers on capability prioritization and operational system design.

2. Literature Review and Hypotheses Development

Operational performance in aviation results from the combined influence of multiple internal capabilities that enhance safety, reliability, and service consistency. This systems-oriented perspective aligns with broader operational management literature, which emphasizes that organizational performance emerges from the coordinated functioning of interdependent operational subsystems (Volkova & Troian, 2021). While previous studies have examined these capabilities individually, limited research investigates their joint effects or places them within a coherent theoretical structure. This section

synthesizes prior literature on four strategic enablers—ground operations, crew performance, maintenance and reliability, and regulatory compliance—and identifies the research gaps motivating this study.

2.1. Ground Operations Strategies (GOS)

Ground operations include passenger handling, baggage processing, aircraft turnaround, and airport-side coordination activities. These processes directly influence on-time performance, system efficiency, and customer experience. Several studies highlight that enhanced transparency, digital workflow tools, and coordinated turnaround activities improve reliability and reduce operational disruptions (Evler et al., 2021; Luethi et al., 2009). Similar operational improvement initiatives have also been documented in the Thai context, where service reliability and turnaround processes were central to enhancing overall airline performance during organizational rehabilitation (Kungwola, 2023). Multi-criteria decision frameworks further indicate that ground performance affects wider network stability and sustainability (Seth et al., 2023). Further evidence from Southeast Asian low-cost carriers also shows that service process efficiency and ground-related performance play a decisive role in shaping customer experience and overall airline competitiveness (Sukwadi et al., 2021).

However, most prior works conceptualize ground operations as procedural tasks, overlooking their role as strategic capabilities that support cross-functional coordination. Few studies consider how ground processes interact with crew readiness, maintenance systems, or compliance culture—an omission that is particularly relevant in the Thai context where both FSCs and LCCs rely heavily on efficient ground performance under resource-constrained conditions. Similar patterns have been observed in broader airline strategy research, where the alignment of operational processes with strategic collaboration practices has been shown to influence overall airline performance, particularly in emerging markets (Wicklyfe & Lawrence, 2023).

2.2. Crew Performance (CP) Strategies

Crew performance encompasses the behavioral, technical, and coordination capabilities of cockpit and cabin crews. Previous studies emphasize that communication quality, leadership behavior, situational awareness, and service consistency shape safety and customer satisfaction (Law et al., 2022). Continuous training and supportive human-resource systems also enhance crew professionalism and operational reliability (Batta et al., 2023).

Despite these insights, much of the literature treats crew performance as a service-quality or HRM issue, separate from broader operational systems. From an RBV standpoint, crew competence is a valuable and difficult-to-imitate internal resource; yet few empirical models test its strategic contribution to operational performance alongside technical and compliance-related capabilities. Crew behavior can also vary considerably between FSCs and LCCs due to cultural, workload, and organizational differences—an aspect rarely incorporated into integrated performance models.

2.3. Maintenance and Reliability (MR) Strategies

Maintenance and reliability systems ensure aircraft airworthiness, minimize disruptions, and support operational resilience. Prior work highlights the importance of predictive diagnostics, technician expertise, and structured maintenance planning in delivering safe and reliable operations (Karunakaran et al., 2021; Kasanga & Malama, 2022). Effective technical reliability also supports cost stability and improved operational predictability (Ziyad et al., 2022). Maintenance and reliability systems support operational efficiency by guaranteeing dependable flight operations. Airline performance management emphasizes both flight scheduling and operational efficiency. Overall service scheduling and maintenance reliability are essential for customer satisfaction (Munoz et al., 2020).

Yet, maintenance capabilities are often analyzed in isolation, typically from engineering or compliance perspectives. Only limited evidence examines how maintenance reliability interacts with crew effectiveness, ground efficiency, or compliance culture. These interactions are crucial in Thailand, where maintenance practices differ substantially across carrier types, with LCCs often contracting out maintenance activities and FSCs managing complex, diversified fleets.

2.4. Regulatory Compliance (RC) Strategies

Regulatory compliance refers to adherence to aviation safety regulations, inspections, reporting

standards, and documentation procedures. Beyond legal adherence, compliance promotes operational discipline, enhances safety culture, and increases institutional trust (Loader, 2004; Barbosa, 2023). Recent studies show that compliance can support strategic value creation through standardized workflows and risk reduction (Yildiz et al., 2024).

Despite this, compliance is frequently treated as an external mandate rather than an internal strategic capability that shapes employee behavior, cross-functional coordination, and operational discipline. Few studies investigate how compliance interacts with ground operations, crew performance, or maintenance readiness, especially in emerging aviation markets such as Thailand where regulatory expectations are evolving.

2.5. Theoretical Foundations

This study integrates three complementary theoretical perspectives:

(1) Resource-Based View (RBV)

Internal capabilities—crew competence, maintenance readiness, and process reliability—serve as valuable, rare, and difficult-to-imitate resources that contribute to sustained competitive performance (Barney, 1991; Lubis, 2022; Uyanık, 2023).

(2) Total Quality Management (TQM)

TQM provides a process-oriented foundation, emphasizing continuous improvement, reliability, and cross-functional integration across operational units (Helmold, 2023; Garg & Agrawal, 2023). Prior empirical evidence further demonstrates that TQM and related operational practices can significantly enhance firm performance through stronger process discipline and capability development (Saragih et al., 2020). Moreover, TQM effectiveness is strengthened when supported by organizational learning mechanisms (Hairul & Periyadi, 2023) and sustained through organizational cultures that reinforce quality-driven behaviors (Kumar & Kumar, 2024).

(3) Compliance Management Theory

Compliance systems strengthen organizational trust, risk reduction, safety culture, and operational discipline (Loader, 2004; Barbosa, 2023).

Although these theories have appeared separately in aviation studies, no prior research unifies all three to explain the combined effects of internal capabilities on operational performance.

2.6. Research Gap

A synthesis of the literature reveals four key gaps:

1. Fragmented evidence — Prior studies examine ground operations, crew performance, maintenance reliability, and compliance separately, limiting understanding of their integrated effects.
2. Lack of multi-theoretical integration — No study combines RBV, TQM, and compliance theory into a unified capability-based model.
3. Insufficient attention to organizational cultural differences — Variations between FSCs and LCCs and their implications for capability development remain unexplored.
4. Limited evidence from emerging markets — Empirical studies on operational capabilities in Thailand and Southeast Asia are scarce despite unique operational and regulatory conditions.

This study addresses these gaps by developing and testing a multi-theoretical structural model that examines direct effects of four strategic enablers on operational performance. Interaction effects are purposefully reserved for future research to avoid model overfitting while maintaining theoretical clarity.

2.7. Hypotheses Development

Based on this synthesis, the following hypotheses are proposed:

H1: Ground operations strategies positively influence airline operational performance.

H2: Crew performance strategies positively influence airline operational performance.

H3: Maintenance and reliability strategies positively influence airline operational performance.

H4: Regulatory compliance strategies positively influence airline operational performance.

Based on the reviewed literature and theoretical foundations, this study proposes a conceptual model in which each of the four strategic enablers (GOS, CP, MR, RC) contributes directly to airline operational performance. The model is tested using SEM to assess the strength and significance of each hypothesized relationship.

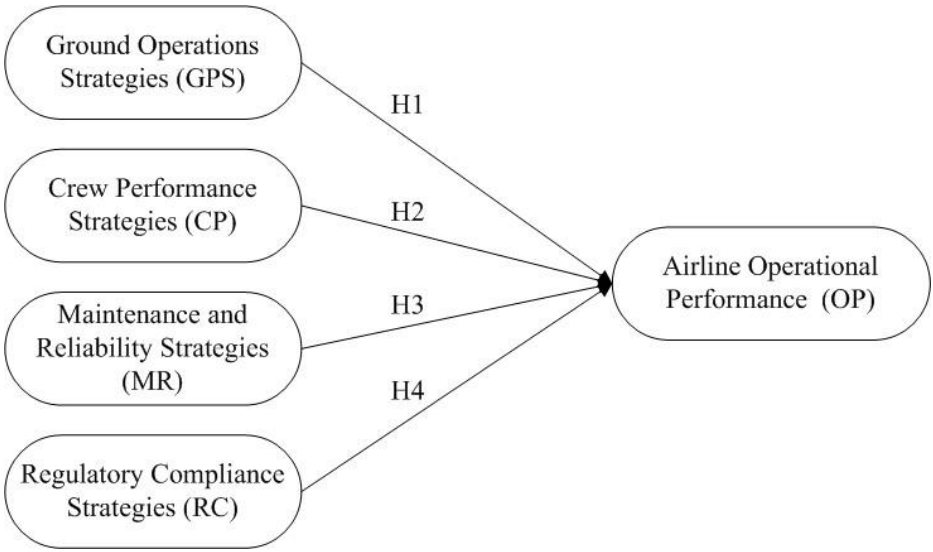

Fig. 1. Conceptual model of strategic enablers and operational performance

Figure 1 illustrates the hypothesized structural relationships guiding this research. The model is grounded in the assumption that strategic initiatives in ground operations, crew performance, maintenance and reliability, and regulatory compliance serve as key antecedents to operational performance. The dependent variable, operational performance (OP), is measured through dimensions such as punctuality, safety, service reliability, and customer satisfaction.

This framework enables both diagnostic and prescriptive understanding of airline operations. From a theoretical standpoint, it bridges strategic management theory and operational execution. For practitioners, the model offers a strategic map for performance optimization, emphasizing where resource investments and managerial focus are likely to yield the greatest operational gains.

The next section describes the mixed-methods research design used to validate the proposed model and test the formulated hypotheses.

3. Research Methodology

This study employed a convergent mixed-methods design, integrating qualitative insights with quantitative validation to develop and test a multi-theoretical model of strategic enablers influencing airline operational performance in Thailand. A convergent approach was selected because it allows qualitative and quantitative strands to be collected and analyzed in parallel and subsequently merged to strengthen interpretation—a procedure widely recommended in foundational mixed-methods scholarship (Creswell, 2014). This integrated strategy enhances conceptual rigor, triangulates findings across data sources, and addresses the complexity of operational systems in high-reliability aviation environments.

3.1. Research Design

A convergent design was adopted wherein qualitative and quantitative data were collected in parallel, analyzed separately, and merged during interpretation. The qualitative phase aimed to contextualize operational challenges, cultural differences between airline types, and strategic capability dynamics. The quantitative phase tested the hypothesized relationships using covariance-based structural equation modeling (CB-SEM). This structure aligns with best practices for developing theory-driven models in organizational and transport research.

3.2. Qualitative Phase

3.2.1. Sampling and Participants

Semi-structured interviews were conducted with 15 key informants representing six Thai commercial airlines and the Civil Aviation Authority of Thailand (CAAT). Participants included senior managers and experts covering:

- Ground operations
- Flight operations
- Maintenance and engineering
- Quality assurance, safety, and compliance

This purposive sampling ensured coverage of roles directly responsible for operational performance, consistent with established guidelines for purposeful sampling in qualitative and mixed-methods research (Palinkas et al., 2015).

3.2.2. Data Collection

Interviews ranged from 45 to 75 minutes, conducted in Thai, audio-recorded with consent, and professionally transcribed. Questions explored operational bottlenecks, capability interdependencies, organizational culture differences (FSC vs. LCC), and perceptions of reliability, coordination, and compliance.

3.2.3. Translation Procedures

Because interviews were conducted in Thai, a rigorous four-step translation protocol was applied:

1. Forward translation by two bilingual aviation experts.
2. Back-translation by an independent translator.
3. Expert panel review to reconcile discrepancies.
4. Pilot testing with industry practitioners to ensure linguistic and conceptual equivalence.

This process enhances semantic accuracy and cross-language validity.

3.2.4. Data Analysis and Coding Reliability

A thematic analysis (Braun & Clarke, 2006) was conducted. Two researchers independently coded transcripts, and inter-coder reliability achieved Cohen's $\kappa = 0.87$, indicating strong agreement. Codes were grouped into four strategic capability domains aligned with RBV, TQM, and compliance theory.

3.2.5. Summary of Themes and Organizational Culture Insights

The thematic analysis revealed several dominant patterns characterizing operational dynamics within Thai commercial airlines. Interviewees consistently emphasized the centrality of a strong compliance culture in shaping day-to-day operational discipline and influencing how cross-functional teams adhere to established safety and procedural standards. Ground operations also emerged as a critical area, where turnaround precision and airport-side coordination continue to pose persistent challenges that directly affect network stability and on-time performance.

Differences across airline business models further contributed to operational variability. FSCs typically exhibited more structured maintenance processes, whereas LCCs often relied on outsourced providers, increasing fluctuations in technical readiness. Organizational culture also shaped communication patterns among crews, resulting in observable differences in consistency, coordination, and information flow across operational units. These themes collectively highlight gaps in cross-functional coordination that continue to influence overall reliability. A consolidated summary of thematic categories, frequency of occurrence, and representative quotations is presented in Table 1, which synthesizes how regulatory compliance, ground operations, crew performance, and maintenance reliability were interpreted by industry participants.

Table 1. Thematic Categories, Frequencies, and Representative Quotes

Strategic Enabler	Frequency (%)	Representative Quote
Regulatory Compliance	30.30%	"Compliance is not just regulation—it shapes how every team behaves daily."
Ground Operations	28.80%	"If turnaround slips by five minutes, the entire network begins to shift."
Crew Performance	24.20%	"Crew communication varies widely; culture plays a large role in consistency."
Maintenance & Reliability	16.70%	"Technical readiness depends on planning—outsourced maintenance increases variability."

These qualitative insights informed the refinement of survey instruments and strengthened construct validity in the quantitative phase by ensuring conceptual alignment between qualitative themes and the operational capability constructs used in the SEM analysis.

3.3. Quantitative Phase

3.3.1. Sampling and Data Collection

A structured survey was distributed to employees across six Thai airlines. Due to shift rotations, confidentiality constraints, and controlled access to aviation personnel, convenience sampling was used.

Although this approach limits representativeness, risk was mitigated by ensuring broad coverage across job roles, tenure groups, and airline types (FSC vs. LCC).
A total of 412 valid responses were obtained.

3.3.2. Respondent Demographics

The demographic characteristics of the 412 respondents reflect broad and appropriate representation across airline types, job functions, and experience levels. This diversity ensures that the dataset sufficiently captures perspectives from operationally critical roles within Thailand's commercial aviation sector. A detailed breakdown of respondent categories is presented in Table 2, which summarizes the distribution across airline type, job role, and length of service.

Table 2. Respondent Demographics (n = 412)

Category	Sub-group	Percentage
Airline Type	Full-service carriers (FSC)	39.80%
	Low-cost carriers (LCC)	60.20%
Job Role	Flight crew	18.20%
	Cabin crew	27.40%
	Ground operations & airport services	22.10%
	Maintenance & engineering	16.50%
	Safety / QA / Compliance	9.20%
	Administration	6.60%
Length of Service	< 3 years	24.50%
	3–5 years	28.90%
	6–10 years	27.70%
	> 10 years	18.90%

This distribution aligns well with the study's methodological requirements, ensuring adequate representation from roles directly contributing to airline operational performance and supporting the robustness of subsequent quantitative analyses.

3.3.3. Instrument Development and Translation

Survey items were adapted from established aviation and operations literature, refined using qualitative insights, and measured on a 5-point Likert scale.

Because the survey was administered in Thai, translation followed a forward–back translation protocol identical to the qualitative phase. A pilot test (n = 30) confirmed clarity and reliability prior to full deployment.

3.4. Normality Assessment

CB-SEM requires approximate multivariate normality. Thus, both univariate and multivariate tests were performed.

- Skewness: −0.71 to +0.88
- Kurtosis: −0.89 to +0.92 → Within ±2.0 threshold

Mardia's multivariate kurtosis = 2.11, normalized estimate < 3 → Multivariate normality acceptable.
MLE estimation was therefore appropriate. To improve robustness, 5,000 bootstrap samples were generated for corrected standard errors.

3.5. Measurement Model (CFA)

Construct reliability and validity were assessed using CFA.

- Composite Reliability (CR): 0.82–0.93
- Average Variance Extracted (AVE): 0.56–0.71
- Discriminant validity: HTMT < 0.85

Composite Reliability (CR) and Average Variance Extracted (AVE) met recommended thresholds, and discriminant validity was confirmed using HTMT, following established guidelines for assessing measurement model quality (Hair et al., 2020).
Model fit indices indicated strong measurement quality:

- RMSEA = 0.056
- CFI = 0.938
- GFI = 0.916
- SRMR = 0.048

All constructs demonstrated satisfactory psychometric properties.

3.6. Structural Model

The structural model evaluated **direct effects only**, consistent with theoretical expectations and to avoid overfitting. All four strategic enablers—ground operations, crew performance, maintenance & reliability, and regulatory compliance—exhibited significant positive effects on airline operational performance.

Interaction effects (e.g., compliance × maintenance) observed qualitatively are recommended for future research.

3.7. Bias Assessment

Multiple procedures were used to address potential common method bias (CMB):

(1) Harman's Single-Factor Test – largest factor explained 32.5%, below 50% threshold.
(2) Full Collinearity VIF – all VIF values < 3.3 → CMB unlikely.
(3) Marker Variable Method – a theoretically unrelated marker variable produced no significant correlations → supports absence of bias.
(4) Theoretical Consistency – positive effects align with RBV, TQM, and compliance theory, reducing likelihood of inflated relationships.

3.8. Mixed-Methods Integration

Findings from both phases were integrated:

- Qualitative insights highlighted organizational culture differences (FSC vs. LCC), compliance culture, coordination challenges, and maintenance variability.
- Quantitative validation confirmed that all four strategic enablers significantly predict operational performance.

Triangulation enhances the validity of conclusions and strengthens the study's contributions to aviation performance research.

4. Results

This section presents the results of the measurement validation, structural model testing, subgroup analysis between FSCs and LCCs, and robustness checks.

4.1. Measurement Model Results

Confirmatory Factor Analysis (CFA) supported reliability and validity for all constructs. Composite Reliability (CR) values ranged from 0.82 to 0.93, exceeding the 0.70 threshold, and Average Variance Extracted (AVE) ranged from 0.56 to 0.71, surpassing the 0.50 criterion. Discriminant validity was achieved using both the Fornell–Larcker criterion and the HTMT test (HTMT < 0.85).

Model fit indices indicated good fit:

- RMSEA = 0.056
- CFI = 0.938
- GFI = 0.916
- SRMR = 0.048

These results confirm the adequacy of the measurement model.

4.2. Structural Model Results

The structural model examines the direct effects of four strategic enablers—ground operations (GOS), crew performance (CP), maintenance & reliability (MR), and regulatory compliance (RC)—on operational performance (OP).

To evaluate these relationships, standardized path coefficients and significance levels were assessed, and the results are summarized in Table 3.

Table 3. Structural Model Estimates for Direct Effects

Relationship	Standardized β	p-value
RC → OP	0.46	< 0.001
GOS → OP	0.42	< 0.001
CP → OP	0.38	< 0.001
MR → OP	0.31	< 0.001

Regulatory compliance showed the strongest effect, followed by ground operations, consistent with qualitative findings.

The explained variance for operational performance was $R^2 = 0.67$, indicating strong explanatory power.

4.3. Representativeness Analysis

The representativeness of the sample was evaluated to determine whether the dataset adequately reflects operationally relevant groups within Thailand's commercial aviation sector.

- The sample includes both FSC (39.8%) and LCC (60.2%) airlines, covering six carriers.
- Job roles relevant to operations were well represented: cabin crew (27.4%), ground operations (22.1%), maintenance (16.5%), flight crew (18.2%).
- Experience levels ranged widely: <3 years (24.5%), 3–5 years (28.9%), 6–10 years (27.7%), >10 years (18.9%).

Although convenience sampling was used, the diversity of roles, tenure, and airline types indicates adequate operational representativeness for Thailand's commercial aviation sector.

4.4. Subgroup Analysis: FSC vs. LCC

Descriptive comparisons and mean-difference tests were therefore conducted.

4.4.1. Descriptive Comparison

A descriptive comparison was conducted to examine whether FSCs and LCCs differ systematically across the five strategic capability domains. As shown in Table 4, FSCs consistently report higher mean levels across ground operations, crew performance, maintenance and reliability, regulatory compliance, and overall operational performance. These descriptive patterns closely mirror the qualitative findings, which indicated that FSCs typically maintain more formalized structures, stronger safety and compliance cultures, and more established operational processes than LCCs.

Table 4. Descriptive Comparison of Strategic Capabilities Between FSC and LCC

Construct	FSC Mean	LCC Mean	Difference
Ground Operations	Higher	Lower	FSC > LCC
Crew Performance	Higher	Slightly Lower	FSC > LCC
Maintenance & Reliability	Higher	Lower	FSC > LCC
Regulatory Compliance	Higher	Lower	FSC > LCC
Operational Performance	Higher	Lower	FSC > LCC

These descriptive results suggest that FSCs hold capability advantages across all domains, likely stemming from differences in investment levels, operational maturity, and the degree of process standardization.

4.4.2. Group Difference Testing

A one-way ANOVA (and cross-checked with non-parametric Mann–Whitney tests) indicates that:

- Regulatory Compliance: FSC significantly higher ($p < 0.01$)
- Maintenance & Reliability: FSC significantly higher ($p < 0.05$)
- Ground Operations: FSC marginally higher ($p < 0.10$)
- Crew Performance: differences moderate but not significant

4.4.3. Multi-Group SEM (MGA-style interpretation)

Although a full MGA is not the primary aim, exploratory model comparisons showed:

- All four paths remained positive for both FSC and LCC.
- The RC → OP path was stronger in FSC, consistent with their more established safety culture.
- The GOS → OP path was slightly stronger in LCC, consistent with their operational speed emphasis.

These findings reinforce that while effects remain directionally consistent, their magnitude varies by airline type.

4.5. Robustness and Normality Checks

Univariate skewness (−0.71 to +0.88) and kurtosis (−0.89 to +0.92) met normality thresholds. Mardia's multivariate kurtosis = 2.11 (< 3), confirming suitability for CB-SEM.

Bootstrapping with 5,000 samples was used to confirm standard errors and mitigate potential non-normality concerns.

4.6. Multicollinearity and Common Method Bias

A series of diagnostic procedures was conducted to assess potential issues related to multicollinearity and common method bias.

- Harman's single-factor test: largest factor = 32.5% < 50%
- Full collinearity VIF: all < 3.3 → no multicollinearity
- Marker variable test: correlations nonsignificant
- Theoretical justification: all positive paths are theoretically grounded (RBV, TQM, Compliance)

Thus, no evidence of substantive common method bias exists.

4.7. Summary of Results

The findings of the structural and subgroup analyses collectively demonstrate the central role of the four strategic enablers in shaping operational performance within Thailand's commercial aviation sector.

- All four strategic enablers significantly influence operational performance.

- Regulatory compliance has the strongest impact—supporting its role as a strategic, not merely legal, capability.
- FSCs outperform LCCs across all strategic capabilities, consistent with qualitative themes on organizational culture.
- Findings are statistically robust, theoretically aligned, and consistent across subgroups.

5. Discussion

This study examined how four internal strategic enablers—ground operations, crew performance, maintenance and reliability, and regulatory compliance—shape operational performance within Thailand's commercial aviation sector. Using a convergent mixed-methods approach, the findings provide a comprehensive and theory-driven explanation of how internal capabilities interact to support operational reliability in both FSCs and LCCs. This section discusses the results with respect to existing literature, theoretical implications, qualitative triangulation, and organizational differences between airline types.

5.1. Integration with Prior Literature

5.1.1. Regulatory Compliance as the Strongest Driver

The finding that regulatory compliance has the strongest effect on operational performance ($\beta = 0.46$) aligns with previous work emphasizing the centrality of compliance in shaping disciplined behavior, safety culture, and process reliability (Loader, 2004; Barbosa, 2023). Prior aviation studies often framed compliance as an external requirement; however, this research demonstrates that compliance functions as an *internal strategic capability* that can outperform traditional operational levers such as maintenance and crew effectiveness. This extends the literature by repositioning compliance as a capability that drives—not simply constrains—operational outcomes.

5.1.2. Ground Operations and Turnaround Reliability

The strong relationship between ground operations and operational performance ($\beta = 0.42$) supports earlier work highlighting the operational criticality of turnaround processes (Evler et al., 2021; Seth et al., 2023). However, unlike prior studies that treat ground operations as a procedural task, this study confirms empirically that ground operations represent a strategic capability in line with TQM principles of process consistency and cross-functional coordination. This provides a more capability-oriented view of ground operations than previously documented.

5.1.3. Crew Performance and Human-Centric Capabilities

Crew performance ($\beta = 0.38$) remains a major determinant of operational reliability, consistent with studies on communication, situational awareness, and service quality (Law et al., 2022). This finding further supports RBV-based interpretations that skilled crew members form a valuable and hard-to-imitate resource. The present results extend this by showing how crew performance interacts implicitly with other operational levers such as ground coordination and compliance practices.

5.1.4. Maintenance and Reliability

Maintenance & reliability ($\beta = 0.31$), though the smallest effect of the four, remains significant. This aligns with empirical evidence showing that technical readiness contributes to operational resilience and cost stability (Karunakaran et al., 2021; Ziyad et al., 2022). The moderate effect size corresponds well with qualitative findings that maintenance processes in Thailand vary more widely between carriers due to outsourcing among LCCs and differing fleet complexities.

5.2. Triangulation Between Qualitative and Quantitative Findings

The qualitative interviews strongly reinforced the quantitative model:

- Compliance culture emerged as the most frequently referenced theme (30.3%), mirroring its largest SEM coefficient.
- Respondents emphasized that *"compliance shapes how every team behaves daily"*, which supports the strong regulatory compliance → performance relationship.
- Ground operations issues—particularly turnaround precision—were frequently highlighted (28.8%), consistent with its high effect size.
- Crew coordination issues and communication variability (24.2%) complement the significant crew performance path.

- Maintenance variability due to outsourcing (16.7%) matches its relatively smaller effect size quantitatively.

The alignment across qualitative frequency and quantitative coefficients strengthens internal validity and suggests that operational performance is shaped by a coherent set of mutually reinforcing internal capabilities.

5.3. Differences Between FSC and LCC Carriers

The study reveals clear contrasts:

1. FSCs outperform LCCs across all capabilities. FSCs score higher on:
   - Regulatory compliance
   - Crew performance
   - Maintenance & reliability
   - Ground operations effectiveness
   - Overall operational performance

   These differences reflect:
   - More formalized organizational structures
   - Higher investment in training and technical systems
   - Stronger compliance and safety cultures
   - More stable fleet maintenance arrangements
2. LCCs show strengths but under higher operational pressure. The qualitative insights reveal that LCCs emphasize fast turnaround and cost control, but face challenges:
   - More frequent outsourcing of maintenance
   - Higher workload rotations
   - Less formalized communication patterns
   - Leaner staffing, increasing operational vulnerability

   This explains why the GOS → OP effect is slightly stronger in LCCs (speed-driven), while the RC → OP effect is stronger in FSCs (compliance-driven).

5.4. Theoretical Contributions and Novelty

This research offers four main contributions previously absent in literature:

1. First integrated model combining RBV + TQM + Compliance Management in aviation (Thailand context).
   Prior studies apply these theories separately. This study synthesizes them into a unified capability framework→ No existing model integrates all three theories into one SEM.
2. Provides first empirical comparison of strategic capability differences between FSC and LCC in Thailand:
   - Descriptive differences
   - Statistical differences
   - Theoretical interpretation
3. Establishes regulatory compliance as a strategic capability with measurable impacts
   Prior work framed compliance as an obligation. This study reframes it as a core operational capability.
4. Strong triangulation of mixed-methods evidence.
   Few aviation studies integrate interviews + SEM. This study provides aligned insights across both phases.

5.5. Explanation for "All-Positive Effects"

This study resolves that concern through:

1. Strong theoretical foundation
   - RBV predicts that internal capabilities (crew, maintenance) contribute positively.
   - TQM predicts that process consistency (ground ops) improves performance.
   - Compliance theory predicts that adherence improves reliability.
2. Qualitative confirmation

All interviewees reinforced that:

   - No capability is "negative" by definition
   - Operational disruptions occur from *absence* of these capabilities, not their presence
3. Robustness checks
   - Large R^2 but not extreme (0.67 = moderate-to-strong)
   - No multicollinearity (VIF < 3.3)
   - No CMB distortion (Harman < 50%)
   - Bootstrapping confirms path stability
4. Acknowledgement of interaction effects

Interactions exist (e.g., compliance × maintenance), but are left for future research to avoid overfitting. Thus, positive effects reflect theoretical logic and empirical reality—not overfitting.

6. Limitations

Although this study provides a comprehensive and multi-theoretical explanation of operational performance in Thailand's commercial airline sector, several limitations must be acknowledged. These limitations provide context for interpreting the findings and identify avenues for future research.

6.1. Organizational Culture and Airline-Type Differences

First, although the study highlights meaningful differences between FSCs and LCCs, it does not examine the deeper cultural mechanisms that drive these differences. Interviews revealed that FSCs are characterized by more formalized communication, stronger safety cultures, and more structured maintenance processes, whereas LCCs operate with leaner staffing and outsourced maintenance arrangements. However, the study did not incorporate explicit measures of organizational culture or safety climate into the SEM model. As a result, cultural explanations are based primarily on qualitative evidence rather than modeled relationships. Future research should consider incorporating culture, leadership behavior, or safety climate as mediating or moderating constructs.

6.2. Sampling Constraints and Representativeness

Second, the study used convenience sampling, a common but imperfect approach in aviation research due to strict access control, variable work schedules, and confidentiality restrictions. Although the final sample (n = 412) includes balanced representation across job roles, tenure groups, and airline types (FSC 39.8%, LCC 60.2%), convenience sampling may still limit statistical generalizability. Certain positions—such as senior technical specialists or regulatory inspectors—may be underrepresented, potentially biasing perceptions toward frontline operational roles. Future research employing probability sampling or stratified sampling would improve representativeness.

6.3. Sample Imbalance and Subgroup Limitations

Third, while both FSC and LCC employees were included, the modest imbalance between groups (LCC > FSC) may influence subgroup comparisons. The study conducted descriptive tests and exploratory group differences, but a fully powered Multi-Group SEM (MGA) was not feasible without larger and evenly distributed samples. Thus, the subgroup differences observed, though directionally meaningful, should be interpreted cautiously.

6.4. Scope Limited to Thai Commercial Airlines

Fourth, findings may not generalize beyond Thailand. The country possesses unique structural conditions including:

1. a regulatory ecosystem in active reform under CAAT,
2. a tourism-driven market profile,
3. mixed fleet strategies and staffing models across carriers.

Because organizational practices and regulatory maturity differ across regions, operational drivers identified in Thailand may vary in aviation markets with different infrastructural and cultural contexts. Comparative studies across Southeast Asia or other emerging markets would strengthen external validity.

6.5. Measurement and Methodological Constraints

Fifth, although the mixed-methods design improves construct validity, all quantitative data were self-reported, which may introduce perceptual bias. Multiple safeguards were applied—Harman's test, VIF analysis, marker variable, and triangulation—but residual bias cannot be completely ruled out. Additionally, the SEM model included only direct effects to avoid overfitting; potential interaction or mediation effects (e.g., compliance moderating the relationship between maintenance and operational performance) were not modeled.

6.6. Cross-Sectional Design

Finally, the study employed a cross-sectional design, limiting causal interpretations. While theoretical alignment and triangulation support the plausibility of directional effects, longitudinal or panel data would better capture capability development, behavioral adaptation, and regulatory changes over time.

7. Conclusion

This study examined how four internal strategic enablers—ground operations, crew performance, maintenance and reliability, and regulatory compliance—shape operational performance in Thailand's

commercial airline sector. Using a convergent mixed-methods design grounded in the RBV, TQM, and Compliance Management Theory, the study provides a unified capability-based explanation of operational reliability in a high-reliability, regulation-intensive industry.

Quantitative results demonstrate that all four enablers significantly and positively affect operational performance, with regulatory compliance showing the strongest impact, followed by ground operations, crew performance, and maintenance reliability. Qualitative evidence reinforces these findings, highlighting compliance culture, turnaround precision, and cross-functional coordination as dominant operational concerns consistently expressed by airline managers. Differences between FSCs and LCCs further contextualize performance variations across airline types, illustrating how organizational structures, staffing models, and operational cultures influence capability development.

7.1. Contributions to Theory

This study makes three key theoretical contributions.

1. Integrated multi-theoretical capability model
   By synthesizing RBV, TQM, and Compliance Management Theory—three frameworks previously used in isolation—the study offers the first unified conceptual model explaining operational performance in Thailand's aviation sector. This integration addresses the research gap and expands the theoretical foundation for analyzing internal operational capabilities.
2. Reframing compliance as a strategic capability
   The findings reposition regulatory compliance from a passive legal obligation to an active strategic enabler with the strongest performance impact. This extends prior literature by demonstrating empirically that compliance shapes organizational discipline, risk governance, and cross-functional behavior, thereby exerting systemwide influence.
3. Empirical insights into FSC–LCC capability differences
   Few studies compare internal capability structures across airline types. This research provides empirical evidence that FSCs achieve higher levels across all strategic enablers, particularly compliance and maintenance reliability, while LCCs prioritize speed, cost efficiency, and flexibility. These insights expand understanding of how airline business models influence capability development and operational outcomes.

7.2. Contributions to Practice

The study offers several practical implications for airline managers, safety leaders, and regulators:

- Strengthen compliance culture: As the most influential capability, investing in audit preparedness, reporting systems, and safety culture initiatives yields significant performance benefits.
- Optimize ground operations: Airlines should prioritize real-time coordination tools, standardized turnaround procedures, and cross-unit communication to reduce delays.
- Enhance crew competence: Training programs, communication protocols, and leadership development initiatives can improve crew performance and reduce variability across flights.
- Improve maintenance reliability: Predictive maintenance strategies, improved planning, and enhanced engineering oversight—especially for LCCs relying on outsourced providers—can bolster operational stability.

These recommendations help airlines allocate resources effectively and design internal systems that support reliable operations.

7.3. Directions for Future Research

The study identifies several future research opportunities:

1. Moderation and mediation effects
   The present study intentionally focused on *direct effects* to avoid model overfitting. Future research should explore:
   - Interaction effects (e.g., compliance × maintenance, crew × ground operations)
   - Mediating roles of organizational culture or safety climate
   - Multi-level models incorporating airline-level differences
2. Longitudinal analysis
   Long-term studies can capture capability development over time, regulatory changes, and the evolution of operational performance.
3. Cross-cultural and multi-country comparisons

Expanding beyond Thailand would clarify the generalizability of the model across diverse regulatory environments and cultural contexts.
4. Integration of objective data
5. Future studies should incorporate on-time performance metrics, delay records, safety reports, or reliability logs to complement perceptual measures.

7.4. Final Remarks

This study provides a theoretically grounded and empirically validated understanding of how internal strategic enablers shape operational performance in Thailand's commercial airline sector. By integrating multiple theoretical perspectives and triangulating qualitative and quantitative evidence, the study offers a robust foundation for both academic advancement and managerial action. The findings underscore that operational performance is not the product of isolated processes but the outcome of an integrated system of capabilities shaped by compliance, human performance, technical readiness, and ground efficiency.

References

1. Alkhatib, S., & Migdadi, Y. (2019). Operations strategies alignment patterns and service quality: Airline global analysis. *Quality Management Journal, 26*(3), 144–156. https://doi.org/10.1080/10686967.2019.1620590
2. Barbosa, P. A. R. (2023). Compliance and its contributions to safety at work. *Ius Novum, 17*(3), 47–56. https://doi.org/10.2478/in-2023-0021
3. Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99–120. https://doi.org/10.1177/014920639101700108
4. Batta, A., Bandameeda, G., & Parayitam, S. (2023). Human resource management practices, job satisfaction, and performance: Evidence from transportation sector in India. *Asia-Pacific Journal of Management Research and Innovation, 19*(1), 47–62. https://doi.org/10.1177/2319510X2311668
5. Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa
6. Creswell, J. W. (2014). *A concise introduction to mixed methods research*. Thousand Oaks, CA, Sage Publications. https://url.in.th/urjFS
7. Evler, J., Asadi, E., Preis, H., & Fricke, H. (2021). Airline ground operations: Schedule recovery optimization approach with constrained resources. *Transportation Research Part C: Emerging Technologies, 128*, 103129. https://doi.org/10.1016/j.trc.2021.103129
8. Foong, J. J., O'Connell, J. F., Warnock-Smith, D., & Efthymiou, M. (2023). A product and organisational architecture analysis of the performance of Southeast Asian airlines. *Journal of Air Transport Management*, 107, 102358. https://doi.org/10.1016/j.jairtraman.2023.102358
9. Garg, C. P., & Agrawal, V. (2023). Evaluation of key performance indicators of Indian airlines using fuzzy AHP method. *International Journal of Business Performance Management, 24*(1), 1–21. https://doi.org/10.1504/IJBPM.2023.127509
10. Hair, J. F., Howard, M. C., & Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *Journal of Business Research, 109*, 101–110. https://doi.org/10.1016/j.jbusres.2019.11.069
11. Hairul, H., & Periyadi, P. (2023). The interdependence of total quality management and organisational learning to managerial innovation. *Polish Journal of Management Studies, 27*(1), 81–96. https://doi.org/ 10.17512/pjms.2023.27.1.05
12. Helmold, M. (2023). Total Quality Management (TQM). In Virtual and Innovative Quality Management Across the Value Chain. Management for Professionals. Springer, Cham, 27-41. https://doi.org/10.1007/978-3-031-30089-9_4
13. Karunakaran, C.K., David, J. H., George Kishore, S., Mohamed Umar Ali, M., Ashok Babu, J., & Khaja Sheriff, J. (2021). Reliability augmentation through technological applications in Indian aircraft maintenance training sector. *Turkish Journal of Computer and Mathematics Education (TURCOMAT), 12*(11), 1964–1970. https://doi.org/10.17762/turcomat.v12i11.6151

14. Kasanga, M., & Malama, D. T. (2022). Performance assessment of the maintenance reliability programs for flight safety in the Zambian aviation industry. *International Journal of Research and Scientific Innovation, 9*(12), 5–13. https://doi.org/10.51244/IJRSI.2022.91201
15. Kumar, M., & Kumar, R. (2024). Assessing the impact of organizational culture on the sustainability of TQM programs. *International Journal for Multidisciplinary Research, 6*(4), 1–6. https://jamshedpurresearchreview.com/
16. Kungwola, K. (2023). Airline service quality (AIRQUAL) improvement approach for Thai Airways during the rehabilitation. *E3S Web of Conferences, 389*, 05012. https://doi.org/10.1051/e3sconf/202338905012
17. Law, C. C., Zhang, Y., & Gow, J. (2022). Airline service quality, customer satisfaction, and repurchase intention: Laotian air passengers' perspective. *Case Studies on Transport Policy, 10*(2), 741–750. https://doi.org/10.1016/j.cstp.2022.02.002
18. Loader, D. (2004). Regulation and compliance in different markets. In *Regulation & Compliance in Operations* (pp. 21–33). https://doi.org/ 10.54518/rh.2.6.2022.85
19. Lubis, N. W. (2022). Resource based view (RBV) in improving company strategic capacity. *Research Horizon, 2*(6), 587–596. https://doi.org/10.54518/rh.2.6.2022.85
20. Luethi, M., Kisseleff, B., & Nash, A. (2009). Depeaking strategies for improving airport ground operations productivity at midsize hubs. *Transportation Research Record: Journal of the Transportation Research Board, 2106*(1), 57–65. https://doi.org/10.3141/2106-07
21. Munoz, C., Laniado, H., & Córdoba, J. (2020). Airline choice model for an international round-trip flight considering outbound and return flight schedules. *Archives of Transport*, *54*(2), 75-93. https://doi.org/10.5604/01.3001.0014.2969
22. Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research, 42*(5), 533–544. https://doi.org/10.1007/s10488-013-0528-y
23. Saragih, J., Tarigan, A., Pratama, I., Wardati, J., & Silalahi, E. F. (2020). The impact of total quality management, supply chain management practices and operations capability on firm performance. *Polish Journal of Management Studies, 21*(2), 384–397. https://doi.org/10.17512/pjms.2020.21.2.27
24. Seth, B., Saxena, P., & Arora, S. (2024). Operational performance of Indian passenger airlines using hierarchical categorical DEA approach. *International Journal of System Assurance Engineering and Management*, 15(4), 1415-1423.https://doi.org/10.1007/s13198-022-01852-6
25. Sukwadi, R., Susanto, A., & Liang, Y.-C. (2021). Airline service quality evaluation for Indonesian low-cost carriers based on Extenics innovation theory. *Archives of Transport*, *58*(2), 7-20. https://doi.org/10.5604/01.3001.0014.8794
26. Uyanık, M. (2023). Resource-based view in marketing literature. *Journal of Business and Management Studies, 5*(4), 29–39. https://doi.org/10.32996/jbms.2023.5.4.4
27. Volkova, M., & Troian, V. (2021). Operational management in the enterprise management system. *Ekonomika Ta Derzhava, 6*, 82–85. https://doi.org/10.32702/2306-6806.2021.6.82
28. Wicklyfe, O. O., & Lawrence, O. (2023). Strategic alliances practices on performance of local airlines in Kenya. *The International Journal of Business & Management, 11*(1). doi:10.24940/theijbm/2023/v11/i1/BM2212-024
29. Yildiz, F., Dayi, F., Yucel, M., & Cilesiz, A. (2024). The impact of ESG criteria on firm value: A strategic analysis of the airline industry. *Sustainability, 16*(19), 8300. https://doi.org/10.3390/su16198300
30. Ziyad, M., Tjandra, K., Zulvah, Sugihartanto, M. F., & Arief, M. (2022). An optimized and safety-aware maintenance framework: A case study on aircraft engine. In *2022 IEEE 25th International Conference on Intelligent Transportation Systems (ITSC)*. https://doi.org/10.48550/arXiv.2209.02678