Mission Command, Empowering Leadership, and Preparation Drive Adaptive Performance in Sustainable Indonesian Air Operations

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Abstract. Air operations increasingly unfold in volatile, uncertain, complex, and ambiguous conditions, making adaptability during execution critical for safe and sustainable outcomes. This study investigates whether mission command–style leadership improves adaptive performance primarily by elevating the quality of pre-mission preparation. Survey data were collected from personnel at Lanud Sultan Hasanuddin (Makassar), Indonesian Air Force (N = 140). Using partial least squares structural equation modelling with reflective measures on five-point Likert scales, measurement quality met recommended thresholds (loadings ≥ .76; composite reliability .91–.94; AVE .62–.67), and discriminant validity was established. Structural estimates showed that empowering leadership and mission command climate were positively associated with preparation (β = .41 and β = .36, respectively), preparation strongly predicted adaptive performance (β = .55), and direct links from leadership to adaptive performance were small or non-significant (empowering leadership β = .12; mission command climate β = .10). Mediation tests indicated partial mediation for empowering leadership and full mediation for mission command climate. The model explained substantial variance (R^2 = .52 for preparation; R^2 = .57 for adaptive performance) and exhibited predictive relevance ($Q^2 > 0$) with acceptable fit (SRMR = .06). Practically, the dominant lever is standardising and resourcing preparation routines—intent-anchored briefings, structured back-briefs, scenario-based rehearsals, checklist discipline, and explicit contingencies—complemented by empowering micro-behaviours. The findings demonstrate a governance-to-routines-to-outcomes pathway that links leadership to adaptable, resource-efficient air operations aligned with bluegreen sustainability goals.

Keywords: Mission Command, Empowering Leadership, Pre-mission Preparation, Adaptive Performance, Air Operations.

1 Introduction

Air operations increasingly take place in volatile, uncertain, complex, and ambiguous (VUCA) environments in which weather shifts rapidly, airspace and NOTAM restrictions evolve, air traffic control dynamics change in real time, and interoperability

M. Nohong et al. (eds.), *Proceedings of the 10th International Conference on Accounting, Management, and Economics (10th ICAME 2025)*, Advances in Economics, Business and Management Research 388,
https://doi.org/10.2991/978-94-6239-709-5_108

across squadrons and services is routine. Under such conditions, organisational adaptability becomes a primary determinant of mission success and operational sustainability, minimising safety incidents, resource waste, and environmental externalities associated with extended flight times and re-tasking. Mission command doctrine has been advanced as a governance logic suited to these contexts, emphasising clarity of commander's intent, devolved decision authority, disciplined initiative, prudent risk, and learning-oriented feedback [1, 2, 3, 4]. In practice, this governance logic is enacted through empowering leadership behaviours that grant discretion, share critical information, encourage participation, and coach personnel to align initiative with intent [5, 6, 7].

A central, yet often under-specified, link between leadership and performance in air operations is the quality of pre-mission preparation. Preparation encompasses planning completeness, briefing clarity, rehearsal of critical procedures, checklist discipline, verification of aircraft and equipment readiness, and explicit contingency design. Foundational guidance from aviation human factors and crew resource management (CRM) consistently foregrounds these routines as proximate drivers of safe, efficient performance [8, 9]. Aeronautical information standards require timely integration of NOTAMs and weather into mission planning [10], while evidence reviews show that structured debriefs and rehearsals produce meaningful performance gains [11, 12]. In a sustainability frame, high-quality preparation can translate into fewer aborted sorties and diversions, better fuel and airframe utilisation, and tighter coordination with joint/combined partners, outcomes aligned with resilient, resource-conserving operations.

Despite this consensus, empirical research that formally models how a mission command climate and empowering leadership behaviours translate into adaptive performance via preparation remains limited, particularly in air forces outside NATO contexts. Studies in military organisations frequently rely on narrative doctrine or descriptive accounts, making it difficult to identify the most effective policy levers, developing leader capability versus standardising and reinforcing pre-mission routines, when the goal is to raise adaptive performance during execution. Moreover, little evidence is available from Southeast Asian air operations where climatic volatility, archipelagic geography, and blue-economy interfaces (e.g., maritime surveillance, disaster response) amplify the premium on adaptive, sustainable practices.

Accordingly, this study investigates personnel at Lanud Sultan Hasanuddin (Makassar) and specifies a model in which empowering leadership and mission-command climate shape pre-mission preparation, which in turn enhances individual adaptive performance during execution. The purpose is to quantify these relationships using variancebased structural modelling and to determine whether preparation operates as the proximal mechanism linking leadership to adaptability in an operational air-base context. The contribution is threefold: (1) leadership style (empowering leadership) and leadership governance climate (mission command) are brought into a single framework to avoid construct conflation and to estimate distinct pathways; (2) preparation is theorised and tested as the immediate, practice-proximal mediator that integrates doctrine with CRM/SOP evidence; and (3) novel, contextually grounded evidence is provided from the Indonesian Air Force (TNI AU), extending external validity and informing leadership development and standard-operating-procedure reinforcement as complementary governance levers for safer, more resilient, and resource-efficient air operations.

2 Literature Review

Mission command has long been advocated as a governance logic for high-reliability operations because it privileges clarity of the commander's intent, devolved decision authority, disciplined initiative, trust, and prudent risk acceptance [1, 2, 3, 4]. Contemporary treatments position mission command not merely as a directive philosophy but as a climate—shared perceptions that intent is explicit, initiative is expected, and learning is institutionalised through back-briefs and after-action reviews [13]. In parallel, the organisational behaviour literature details empowering leadership as a set of enacted behaviours—information sharing, discretion granting, participative decision-making, coaching, and recognition—that develop competence and autonomous motivation [5, 6, 7]. Mission command climate (the governance context) and empowering leadership (leader behaviour) are theoretically related but conceptually distinct; treating them jointly helps avoid construct conflation and enables tests of their unique and combined effects on downstream practices and outcomes.

A persistent gap in defence and aviation management research concerns the proximal mechanism by which leadership logics translate into performance during execution. Aviation human-factors and crew resource management (CRM) scholarship converges on pre-mission preparation as the nearest-to-action driver of safe and effective sorties. Preparation encompasses planning completeness; briefing clarity; opportunities for questions and back-briefs; rehearsal of critical procedures; checklist discipline; verification of aircraft, equipment, and spares; and explicit contingency design, including communication fallbacks [8, 9]. Aeronautical information standards formalise the timely assimilation of NOTAMs and meteorology into planning cycles [10], and cumulative evidence indicates that structured rehearsals and debriefs produce meaningful improvements in subsequent performance [11, 12]. Leadership logics are expected to shape this preparatory "engine room": commander's-intent clarity and devolved decision rights reduce ambiguity and speed local adaptations; empowering coaching and early information sharing improve plan quality, resource checks, and branch/sequel thinking. Accordingly, the following relationships are posited between leadership constructs and preparation.

- H1. Empowering leadership is positively associated with pre-mission preparation.
- H2. Mission command climate is positively associated with pre-mission preparation.

Performance during execution in VUCA settings depends on adaptive performance—the capacity to adjust behaviours, priorities, and coordination patterns under time pressure, novel problems, and shifting constraints [14]. Later operationalisations emphasise rapid learning, problem solving, cross-team coordination, and proactive risk management [15]. Preparation should be a direct antecedent of adaptability: high-quality briefings and rehearsals align mental models, reduce uncertainty through explicit contingencies, and prime crews to detect and resolve anomalies, thereby enabling quicker, safer adaptations in flight and on the line. Thus:

- H3. Pre-mission preparation is positively associated with adaptive performance.

Leadership may also exert direct effects on adaptive performance. Empowering leadership develops self-efficacy and autonomous motivation, both linked to flexible, creative responding under constraint [5, 7]. A mission command climate could similarly cue disciplined initiative and prudent risk-taking beyond formal routines [1, 2]. Nevertheless, much of leadership's influence is theorised to operate through routine quality, with preparation as the immediate execution-proximal pathway. Therefore:

- H4a. Empowering leadership has a positive direct association with adaptive performance (over and above preparation).
- H4b. Mission command climate has a positive direct association with adaptive performance (over and above preparation).

Integrating doctrine with CRM/SOP evidence yields a mediation logic: leadership climates and behaviours enable better preparation; better preparation enables adaptability at the point of execution. Rehearsal and debrief meta-analyses, together with SOP/monitoring guidance, support this sequencing by showing that teams that plan, rehearse, and reflect perform better when conditions change [8, 9, 12]. Consequently:

- H5a. Pre-mission preparation mediates the relationship between empowering leadership and adaptive performance.
- H5b. Pre-mission preparation mediates the relationship between mission command climate and adaptive performance.

This framework advances the literature in three ways. First, it disentangles governance climate from enacted leadership style within a single model, permitting an assessment of their distinct and joint contributions. Secondly, it elevates pre-mission preparation—an operational, practice-proximal routine—into the theorised mechanism bridging leadership and adaptability, integrating doctrinal claims with empirical CRM/SOP guidance. Thirdly, it extends evidence to a Southeast Asian air-operations context where climatic volatility and maritime interfaces heighten the premium on adaptive, sustainable practices, thereby informing leadership development and SOP reinforcement as complementary governance levers for resilient, resource-efficient operations.

3 Methodology

A cross-sectional survey design was used and the data were analysed with partial least squares structural equation modelling (PLS-SEM). The empirical context was Lanud Sultan Hasanuddin (Makassar), an operational base of the Royal Indonesian Air Force (TNI AU) that routinely operates under volatile, uncertain, complex, and ambiguous

(VUCA) conditions such as rapidly changing weather, NOTAM and airspace restrictions, dynamic ATC coordination, and cross-unit interoperability. These conditions render mission-command doctrine, emphasising clarity of commander's intent, devolved authority, disciplined initiative, prudent risk, and learning-oriented reviews— highly relevant to performance [1, 2, 4, 13].

The population comprised personnel engaged in the pre-mission cycle (planning, briefing, rehearsal, resource readiness, contingency planning) and sortie execution during the preceding six months. The sampling frame was compiled from unit rosters across operational clusters at the base (Skadron Udara 11, Skadron Udara 5, Skadron Udara 33, and supporting units). A clustered, stratified design was implemented: units served as clusters and role categories (Aircrew, Mission Support) served as strata. Within each stratum, census invitations were issued to all eligible personnel; participation was voluntary and anonymous. Inclusion required participation in at least three missions or large-scale exercises during the reference period; purely administrative roles without operational touchpoints were excluded. After eligibility screening and data-quality checks, 140 usable responses were retained. The respondents' characteristics are shown in Table 1.

Table 1. Sample characteristics

Characteristic	Category	n	%
Role	Aircrew	64	45,7
	Mission Support	76	54,3
Unit	Skadron Udara 11	30	21,4
	Skadron Udara 5	60	42,9
	Skadron Udara 33	30	21,4
	Skatek 044 / Wing Ops / Others	20	14,3
Rank	Perwira	41	29,3
	Bintara	63	45,0
	Tamtama	36	25,7
Tenure	< 2 years	37	26,4
	2–5 years	45	32,1
	6–10 years	33	23,6
	> 10 years	25	17,9
Flight hours (aircrew)	< 250	22	35,0
	250–999	22	35,0
	≥ 1,000	20	30,0
Education	Diploma or below	43	30,7
	Bachelor's	67	47,9
	Postgraduate	30	21,4

Note. Percentages are column percentages by characteristic. Flight hours percentages are based on Aircrew only (n = 64).
Source: Primary Data Process

All multi-item measures used a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Items were adapted to the TNI AU operational lexicon while preserving construct meaning and content validity. Empowering Leadership (EL) reflected discretion granting, participation, information sharing, coaching, recognition, and trust, adapted from established scales [5, 6, 7]. Mission Command climate (MC) captured clarity of commander's intent, devolved authority, disciplined initiative, prudent risk, back-briefs, after-action reviews, and unobstructed coordination [1, 2, 13, 3, 4]. Preparation (PREP) assessed briefing quality, rehearsal and checklist discipline, resource readiness, and contingency planning, drawing on aviation SOP/CRM sources and aeronautical information standards with evidence on rehearsal and debrief effectiveness [8, 9, 10, 11, 12, 16]. Adaptive Performance (AP) reflected adaptability under changing mission parameters, problem solving, rapid learning, coordination, re-prioritisation, risk spotting, and clear communication, adapted from validated scales [15, 14]. The instrument was prepared in English, translated into Bahasa Indonesia, and back-translated to verify semantic equivalence. A pilot study (~ 30–50 personnel) assessed clarity, completion time, and preliminary reliability, resulting in minor wording refinements.

Table 2. Construct-level descriptive statistics (N = 140; five-point Likert)

Construct	**Code (items)**	**Mean**	**SD**	**Min**	**Max**	**Skewness**	**Kurtosis**	**Cronbach's α**
Empowering Leadership	EL (8)	3.72	0.58	2.00	5.00	−0.35	−0.21	0.91
Mission Command climate	MC (7)	3.79	0.54	2.00	5.00	−0.40	0.10	0.90
Preparation	PREP (8)	3.86	0.52	2.00	5.00	−0.48	0.15	0.92
Adaptive Performance	AP (8)	3.81	0.55	2.00	5.00	−0.43	−0.05	0.89

Notes. Construct scores are the arithmetic mean of retained items. Skewness and kurtosis are reported as excess values. Internal consistency is reported as Cronbach's alpha.

Source: Primary Data Process

Table 2 shows the descriptive statistics of each variable with the construct of items. Scale purification followed a theory-driven, evidence-guided protocol consistent with best practice in PLS-SEM [17]. Reverse-worded statements were excluded a priori to minimise method artefacts and misresponse [18, 19]. To protect discriminant validity between conceptually adjacent constructs, the EL item emphasising explanation of commander's intent was removed due to overlap with MC intent clarity. For PREP, items were trimmed to preserve reflective unidimensionality while retaining coverage of briefing quality, rehearsal/checklist discipline, resource readiness, and contingency planning; AP was kept compact and homogeneous. Descriptive statistics indicated moderate to moderately high agreement across constructs with adequate dispersion and no ceiling effects: EL (M = 3.72, SD = 0.58), MC (M = 3.79, SD = 0.54), PREP (M = 3.86, SD = 0.52), and AP (M = 3.81, SD = 0.55). Skewness (−0.48 to −0.35) and kurtosis (−0.21 to 0.15) were near zero, consistent with approximately symmetric distributions; PLS-SEM does not require multivariate normality. Internal consistency was high (Cronbach's α = .89–.92). Convergent validity was supported, with the square roots of AVE on the diagonal of the correlation matrix equal to 0.79 (EL), 0.81 (MC), 0.82 (PREP), and 0.79 (AP), implying AVE ≈ .62–.67 (≥ .50). Fornell–Larcker discriminant validity held, as each diagonal entry exceeded its corresponding inter-construct correlations; the largest bivariate correlation was PREP–AP (r = .66). Given inter-predictor correlations below .65, structural collinearity was expected to be modest (indicative VIFs < 2), well below conservative thresholds [20, 21].

Data were collected via a secure online questionnaire accessed through QR codes/links distributed during routine briefings, with two reminders at approximately one-week intervals. Procedural remedies to reduce common-method bias included anonymity and confidentiality assurances, psychological separation of construct blocks, neutral wording, and randomised item order [18]. Post-hoc diagnostics comprised Harman's single-factor test (< 50% variance explained) and full-collinearity VIF checks with a conservative 3.3 threshold; no diagnostic suggested substantive bias. Cases were screened for eligibility, straight-lining, excessive missingness, and unrealistically short completion times; attention-check items were included. Missing data were minimal and handled via mean substitution at the indicator level where appropriate for reflective items.

Table 3. Inter-construct correlations and square roots of AVE

	EL	**MC**	**PREP**	**AP**
EL	**0.79**			
MC	0.56***	**0.81**		
PREP	0.62***	0.58***	**0.82**	
AP	0.53***	0.51***	0.66***	**0.79**

Notes. Pearson correlations are shown below the diagonal. Values on the diagonal are the square roots of the average variance extracted for each construct. Fornell–Larcker discriminant validity holds where each diagonal entry exceeds the off-diagonal correlations in its row and column. *** p < .001.

Source: Primary Data Process

PLS-SEM analyses were conducted in SmartPLS with all constructs specified as reflective, consistent with the expectation that latent traits drive the observed indicators. Measurement quality was evaluated through indicator reliability (target loadings ≥

.708), internal consistency (Cronbach's α; composite reliability .70–.95), convergent validity (AVE ≥ .50), and discriminant validity via HTMT (≤ .85 for conceptually close constructs) alongside inspection of cross-loadings (see Table 3) [20, 21, 17]. Structural paths were estimated using bootstrapping with 5,000–10,000 resamples (two-tailed, α = .05). Reported statistics include path coefficients, confidence intervals, R^2 for endogenous constructs, f^2 effect sizes, and Q^2 from blindfolding to assess predictive relevance; PLSpredict provided an optional out-of-sample assessment. Indirect effects of EL and MC on AP through PREP were examined to establish mediation. Role, rank, tenure/flight hours, unit, and mission type were entered as single-indicator exogenous controls. Robustness checks trimmed marginal indicators and re-estimated the model to verify the stability of substantive conclusions; multi-group analysis by role (Aircrew vs. Mission Support) was planned subject to measurement-invariance assessment for composite models [17].

4 Results

Measurement quality was satisfactory. Standardised indicator loadings (see Table 4) ranged from .76 to .84 and were all statistically significant ($t > 15$; $p < .001$), evidencing strong indicator reliability and no need for further item pruning on statistical grounds. Internal consistency and convergent validity were also adequate (see Table 5): Cronbach's alpha values fell between .89 and .92, composite reliability between .91 and .94, and AVE between .62 and .67, confirming that each construct explained more than half of the variance in its indicators.

Table 4. Measurement model: standardised item loadings

Construct	Item	Loading	t-value	p-value
Empowering Leadership (EL)	EL2	0.79	18.6	<.001
	EL3	0.82	22.1	<.001
	EL4	0.78	17.9	<.001
	EL5	0.81	20.7	<.001
	EL6	0.77	16.5	<.001
	EL7	0.84	24.3	<.001
	EL8	0.76	15.8	<.001
	EL9	0.80	19.6	<.001
Mission Command climate (MC)	MC1	0.83	23.1	<.001
	MC2	0.79	18.2	<.001
	MC3	0.82	21.6	<.001
	MC4	0.76	15.7	<.001
	MC5	0.78	17.1	<.001
	MC6	0.81	20.2	<.001
	MC7	0.80	19.2	<.001
Preparation (PREP)	PREP4	0.83	23.4	<.001
	PREP5	0.80	19.9	<.001
	PREP6	0.78	17.5	<.001
	PREP7	0.84	24.7	<.001
	PREP8	0.81	20.9	<.001
	PREP10	0.79	18.6	<.001
	PREP13	0.83	23.0	<.001
	PREP14	0.80	19.7	<.001
Adaptive Performance (AP)	AP1	0.82	21.2	<.001
	AP2	0.79	18.4	<.001
	AP3	0.77	16.3	<.001
	AP4	0.80	19.6	<.001
	AP5	0.81	20.5	<.001
	AP6	0.76	15.9	<.001
	AP7	0.78	17.0	<.001
	AP8	0.82	21.4	<.001

Note. All loadings ≥ .76; two-tailed tests.

Source: Primary Data Process

Table 5. Reliability and convergent validity

Construct	Cronbach's α (CA)	Composite reliability (CR)	AVE
Empowering Leadership (EL)	0.91	0.93	0.62
Mission Command climate (MC)	0.90	0.92	0.66
Preparation (PREP)	0.92	0.94	0.67
Adaptive Performance (AP)	0.89	0.91	0.62

Source: Primary Data Process

Construct distinctiveness was supported by the HTMT ratios in Table 6, which lay between .58 and .73, comfortably below the conservative .85 criterion. This pattern aligns with the Fornell–Larcker evidence already reported (see Table 3), where the square roots of AVE (0.79–0.82) exceeded the corresponding inter-construct correlations, indicating that the latent variables are empirically separable.

Table 6. Discriminant validity: HTMT matrix

	EL	MC	PREP	AP
EL	0.79	**0.62**	**0.66**	**0.58**
MC	0.56***	0.81	**0.64**	**0.57**
PREP	0.62***	0.58***	0.82	**0.73**
AP	0.53***	0.51***	0.66***	0.79

Note. All HTMT < .85, consistent with Table 3 (Fornell–Larcker).

Source: Primary Data Process

Multicollinearity did not threaten the structural estimates. As shown in Table 7, VIFs for predictors of Preparation were 1.46 (Empowering Leadership) and 1.46 (Mission Command climate), while predictors of Adaptive Performance showed VIFs of 1.78 (Preparation), 1.52 (Empowering Leadership), and 1.49 (Mission Command climate). All values were well below typical cut-offs (e.g., 3.0), indicating stable estimation.

Table 7. Collinearity diagnostics (VIF) for structural equations

Endogenous	Predictor	VIF
PREP	EL	1.46
	MC	1.46
AP	PREP	1.78
	EL	1.52
	MC	1.49

Note. All VIFs < 3.0.

Source: Primary Data Process

Structural paths (see Table 8) were directionally consistent with the theorised mechanism in which leadership climates enhance Preparation, which in turn improves Adaptive Performance. Both leadership constructs were positively associated with Preparation: Empowering Leadership → Preparation ($\beta = .41$, 95% CI [.30, .51], $t = 7.95$, $p < .001$; $f^2 = .24$, small–medium) and Mission Command climate → Preparation ($\beta = .36$, 95% CI [.25, .47], $t = 6.54$, $p < .001$; $f^2 = .18$, small–medium). Preparation showed a strong positive association with Adaptive Performance ($\beta = .55$, 95% CI [.47, .63], $t = 12.11$, $p < .001$; $f^2 = .49$, large). Direct effects from leadership to Adaptive Performance were comparatively small: Empowering Leadership → Adaptive Performance ($\beta = .12$, 95% CI [0.00, .23], $p = .049$; $f^2 = .02$, small) and Mission Command climate → Adaptive Performance ($\beta = .10$, 95% CI [−.02, .22], $p = .101$; $f^2 = .01$, negligible).

Table 8. Structural model: direct effects

Path	β	t	p	95% CI (BCa)	f^2
EL → PREP	0.41	7.95	<.001	[0.30, 0.51]	0.24
MC → PREP	0.36	6.54	<.001	[0.25, 0.47]	0.18
PREP → AP	0.55	12.11	<.001	[0.47, 0.63]	0.49
EL → AP	0.12	1.97	.049	[0.00, 0.23]	0.02
MC → AP	0.10	1.64	.101	[−0.02, 0.22]	0.01

Source: Primary Data Process

Model performance statistics (see Table 9) indicated substantial explanatory power with $R^2 = .52$ for Preparation and $R^2 = .57$ for Adaptive Performance. Predictive relevance was evidenced by positive Q^2 values (.31 and .33, respectively), and approximate fit was acceptable (SRMR = .06).

Table 9. Model explanatory and predictive power

Endogenous	R^2	Adjusted R^2	Q^2	SRMR
PREP	0.52	0.52	0.31	
AP	0.57	0.56	0.33	0.06

Note. $Q^2 > 0$ indicates predictive relevance; SRMR for the full model.
Source: Primary Data Process

Mediation tests (see Table 10) identified Preparation as the principal conduit linking leadership climates to adaptive outcomes. The indirect effect of Empowering Leadership on Adaptive Performance via Preparation was $\beta = .23$ (95% CI [.15, .31], $p < .001$), coexisting with a small residual direct effect ($\beta = .12$, $p = .049$), consistent with partial mediation. For Mission Command climate, the indirect effect was $\beta = .20$ (95% CI [.13, .27], $p < .001$) while the direct path was not significant ($\beta = .10$, $p = .101$), indicating full mediation. The total effects on Adaptive Performance were $\beta = .35$ (Empowering Leadership) and $\beta = .30$ (Mission Command climate), underscoring that improvements in pre-mission preparation constitute the dominant pathway through which leadership climates enhance adaptability in this operational context.

Table 10. Mediation analysis

Effect	Indirect β (X→M→Y)	95% CI (BCa)	p	Direct β (X→Y)	95% CI	p	Total β	Mediation
EL → PREP → AP	0.23	[0.15, 0.31]	<.001	0.12	[0.00, 0.23]	.049	0.35	Partial
MC → PREP → AP	0.20	[0.13, 0.27]	<.001	0.10	[−0.02, 0.22]	.101	0.30	Full

Source: Primary Data Process

5 Discussion

The hypothesis tests indicate that leadership logics associated with mission command enhance adaptive performance chiefly by elevating the calibre of pre-mission preparation. Empowering leadership and a mission-command climate were each positively and significantly related to preparation (empowering leadership → preparation β = .41, 95% CI [.30, .51], p < .001; mission-command climate → preparation β = .36, 95% CI [.25, .47], p < .001), consistent with theory that discretion granting, timely information sharing, participative problem-solving, coaching, explicit articulation of intent, and disciplined initiative translate into more rigorous briefings, rehearsal and checklist discipline, resource verification, and contingency planning [5, 6, 2, 1, 13, 7]. Preparation, in turn, exhibited a strong positive association with adaptive performance (β = .55, 95% CI [.47, .63], p < .001), aligning with aviation human-factors and crew resource management guidance that positions briefing quality, rehearsal, checklist discipline, and contingency design as proximal drivers of safe, effective execution [8, 9, 10, 12].

The direct pathways from leadership to adaptive performance were comparatively weaker, clarifying which hypotheses were supported and where the operative mechanism resides. Empowering leadership retained a small but statistically significant direct effect on adaptive performance (β = .12, 95% CI [0.00, .23], p = .049), offering weak support for the corresponding hypothesis and suggesting a residual route—plausibly via heightened self-efficacy and initiative—beyond improved routines [5, 7]. By contrast, the direct path from mission-command climate to adaptive performance was not significant (β = .10, 95% CI [−.02, .22], p = .101), such that the hypothesis positing a direct association was not supported. This pattern coheres with the conception of mission command as a climate that sets expectations and incentives but must be operationalised through concrete preparation practices in order to affect behaviour at the point of execution [2, 1, 13, 3, 4].

Mediation tests refine these conclusions. For empowering leadership, the indirect effect via preparation was significant (β = .23, 95% CI [.15, .31], p < .001) while a small direct effect remained, indicating partial mediation and thereby supporting the mediation hypothesis. For mission-command climate, the indirect effect via preparation was significant ($\beta = .20$, 95% CI [.13, .27], $p < .001$) whereas the direct effect was not, indicating full mediation and supporting the corresponding mediation hypothesis. Together with substantial explanatory and predictive power (R^2 for preparation = .52; R^2 for adaptive performance = .57; $Q^2 > 0$), the results reinforce a governance-to-routinesto-outcomes architecture for high-reliability operations [20, 21, 17].

These findings carry clear implications. First, the strongest lever is the reliability and completeness of preparation routines. Units seeking to lift adaptability should standardise intent-anchored briefing templates that integrate current NOTAMs, weather and airspace constraints; institutionalise structured back-briefs; run short, scenario-based rehearsals of time-critical procedures; enforce checklist discipline with peer verification; and codify contingency branches and communication fallbacks, followed by learning-oriented after-action reviews [8, 9, 10, 12]. Secondly, leader development should emphasise empowering micro-behaviours—early dissemination of mission-critical information, targeted pre-sortie coaching, and genuine participation when plans require adjustment—because these behaviours reliably raise preparation quality and provide a modest direct boost to adaptability [5, 6, 7]. Thirdly, commanders should treat mission command as a climate to be made tangible: articulating intent consistently, delegating authority to the point of action, and recognising disciplined initiative will only improve outcomes when mirrored in preparation metrics (briefing completeness, rehearsal rates, checklist adherence, contingency coverage), which are the mechanisms through which climate affects performance.

Finally, the pathway has sustainability salience. By reducing retasking, diversions and aborts through better preparation, units limit unnecessary fuel burn and airframe wear, improve punctual coordination with partners, and lower the environmental footprint of operations—outcomes consonant with blue–green priorities and resilient governance [10, 8]. While measurement quality and collinearity diagnostics met conservative benchmarks for variance-based SEM [20, 21, 17], the cross-sectional, single-base design and reliance on self-reports suggest that future research should incorporate objective performance indicators (e.g., diversion rates, deviations from fuel plans, timeto-replan) and consider longitudinal or quasi-experimental designs to strengthen causal inference and external validity [22, 23, 18, 19].

6 Conclusion

This study examined how leadership associated with mission command relates to adaptive performance in a VUCA air-operations setting, with pre-mission preparation specified as the proximal mechanism. The evidence shows that empowering leadership and a mission-command climate are each positively associated with preparation, and that preparation is strongly associated with adaptive performance during execution. Direct effects from leadership to adaptive performance are comparatively small or non-significant, and mediation tests indicate partial mediation for empowering leadership and full mediation for mission-command climate. Overall explanatory power is substantial, indicating that the model captures practically meaningful drivers of adaptability in operational units.

Theoretical contributions are threefold. First, the findings disentangle a governance climate (mission command) from enacted leadership behaviour (empowering leadership), demonstrating that the two are empirically distinct and operate through different channels. Secondly, pre-mission preparation is elevated from assumed good practice to a tested mechanism linking leadership logics to adaptive outcomes, clarifying why climate effects are fully mediated whilst empowering behaviour retains a modest direct link. Thirdly, the study extends external validity by providing contextually grounded evidence from an Indonesian air base, a setting underrepresented in the literature on high-reliability, joint air operations.

Managerially, the dominant lever is the reliability and completeness of preparation routines. Units seeking to raise adaptability should standardise intent-anchored briefing templates, institutionalise structured back-briefs, run short scenario-based rehearsals of time-critical procedures, enforce checklist discipline with peer verification, and codify contingency branches and communication fallbacks, followed by learning-oriented after-action reviews. Leadership development should emphasise empowering micro-behaviours—timely information sharing, targeted pre-sortie coaching, and genuine participation when plans require adjustment—because these behaviours reliably lift preparation quality and provide a small direct boost to adaptability. At the command level, mission-command principles should be made tangible and measurable through preparation metrics (briefing completeness, rehearsal rates, checklist adherence, and contingency coverage), as these are the levers through which climate affects outcomes.

The pathway identified here also has sustainability salience. By reducing retasking, diversions, and aborts through better preparation, units can limit unnecessary fuel burn and airframe wear, improve punctual coordination with partners, and thereby lower the environmental footprint of operations, outcomes aligned with resilient, blue–green governance.

Limitations include the cross-sectional, single-site design and reliance on self-reported measures. Future work should incorporate objective indicators of operational performance (e.g., diversion rates, deviations from fuel plans, and time-to-replan), adopt longitudinal or quasi-experimental designs to strengthen causal inference, and use multilevel models to examine how unit climate, crew familiarity, and mission complexity moderate the leadership → preparation → adaptability pathway. Comparative studies across bases and services would test the generalisability of the observed mediation pattern and refine guidance on where leadership development and preparation standardisation yield the greatest returns.

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