MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1, 2026, Pages: 3875-3882

Beyond Engagement: Causal Links Between Digital Transformational Leadership and DevOps Productivity in Hybrid Fintech Teams Using Trace Data

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Abstract

The post-pandemic normalization of hybrid work has increased the importance of leadership quality, coordination architecture, and tool-enabled management in software-intensive firms, especially in fintech organizations where software delivery speed and reliability are tightly linked to customer trust, compliance, and competitiveness. However, much of the existing leadership literature still relies on perceptual or self-reported outcomes rather than objective engineering outputs. This paper addresses that gap by proposing a quasi-experimental, multi-method framework to examine whether digital transformational leadership causally affects DevOps productivity in hybrid fintech teams using trace data.

The model links digital transformational leadership to objective software delivery outcomes through two mediating mechanisms, namely psychological safety and coordination quality, while testing whether hybrid intensity and AI tool maturity moderate these relationships. The proposed research design integrates organizational trace data from version control systems, pull-request workflows, CI/CD pipelines, incident logs, and on-call systems with validated survey instruments, including the Multifactor Leadership Questionnaire and Utrecht Work Engagement Scale. The empirical approach combines difference-in-differences estimation around leadership transitions and hybrid policy changes with multilevel regression, mediation analysis, event-study testing, reliability testing, and qualitative triangulation.

Illustrative results suggest that stronger digital transformational leadership is associated with higher deployment frequency, shorter pull-request cycle times, lower change failure rates, and faster mean time to recovery. These effects appear strongest in teams characterized by high psychological safety and mature AI-assisted development practices. The study extends earlier COVID-era work on leadership, employee motivation, and work quality in Indian organizations into a post-COVID hybrid fintech context grounded in objective productivity indicators. It contributes theoretically by connecting transformational leadership research with software engineering performance literature and contributes practically by proposing a governance-aware, privacy-sensitive measurement framework aligned with the Digital Personal Data Protection Act, 2023 and responsible AI principles. The paper offers a feasible pathway for management and software engineering scholars seeking causal evidence on how leadership shapes socio-technical productivity in high-velocity hybrid environments.

Keywords: digital transformational leadership; DevOps productivity; hybrid work; fintech; psychological safety; coordination quality; trace data; DORA metrics; AI-assisted software development

1. Introduction

Fintech firms operate in environments where software delivery is directly tied to strategic and operational outcomes. Product releases affect customer trust, fraud exposure, compliance obligations, service continuity, and revenue realization. In such settings, DevOps performance is not merely a technical concern but a managerial and organizational one. Contemporary software delivery research increasingly evaluates performance using objective indicators such as deployment frequency, lead time for changes, change failure rate, and mean time to recovery, which are widely recognized within the DORA research tradition (Forsgren, Humble and Kim, 2018; DORA, 2024).

At the same time, hybrid work has significantly altered the context within which leadership is exercised. Evidence suggests that hybrid work does not necessarily reduce performance, but it can weaken coordination, relational visibility, and innovation if team processes are poorly designed (Bloom et al., 2024; Gibbs et al., 2024). In software-intensive environments, this means leadership quality may exert influence not only through motivation or engagement, but also through coordination discipline, communication clarity, psychological safety, and the quality of socio-technical routines.Transformational leadership has long been associated with employee motivation, engagement, creativity, and performance (Purvanova and Bono, 2009; Bartsch et al., 2024). Earlier COVID-era studies in Indian organizations and MSMEs also found that transformational leadership positively affected employee motivation, productivity, and quality of work life during conditions of disruption (Sharma and Jain, 2023a; Sharma and Jain, 2023b; Sharma and Jain, 2023c; Sharma, 2023). Those studies established the salience of leadership under crisis conditions, but they were largely based on survey or perceptual outcomes rather than trace-based operational evidence.

The present study extends that line of inquiry into post-COVID hybrid fintech contexts. It asks whether digital transformational leadership can be linked causally to objective DevOps productivity outcomes, and through which mechanisms such influence operates. This shift is important for three reasons. First, leadership effects in digital firms should be visible in delivery systems and not only in attitudinal responses. Second, AI-assisted software development is increasingly changing the structure of development workflows, making leadership's role in orchestration and governance more important (DORA, 2025; Lee, Park and Jeong, 2024). Third, a trace-data design creates a stronger bridge between management research, information systems, and software engineering.

Accordingly, the central research question is:

How and to what extent does digital transformational leadership causally influence DevOps productivity in hybrid fintech teams, and through which socio-technical mechanisms do these effects occur?

This paper makes four contributions. First, it links transformational leadership theory with DevOps performance research. Second, it proposes a causal identification strategy using leadership transitions and hybrid policy shifts. Third, it integrates key mediators and moderators relevant to hybrid software work. Fourth, it embeds productivity analytics within privacy and responsible AI governance concerns relevant to regulated digital sectors.

2. Literature Review

2.1 Digital transformational leadership in hybrid organizations: Digital transformational leadership extends the core logic of transformational leadership into digitally mediated organizational settings. It combines vision, inspiration, intellectual stimulation, and individualized consideration with digital fluency, data-driven sensemaking, and the capacity to orchestrate work through digital systems (Orkamo et al., 2025; Tønnessen, Dhir and Flåten, 2024). In organizations undergoing digital transformation, leaders are increasingly expected not only to motivate teams but also to interpret data, structure workflows, and align human and technological capabilities (Dennehy and Sammon, 2024; Vial, 2024). In hybrid environments, leadership is filtered through asynchronous communication, distributed visibility, and reduced informal interaction. As a result, trust, clarity, and coordination become more leadership-dependent than in fully collocated settings (Klotz et al., 2023; Parker, Knight and Keller, 2023). Studies on hybrid teams suggest that leadership quality affects task performance and relational dynamics more strongly when interaction is digitally mediated (Nurhidayah and Muliansyah, 2024; Hanzis et al., 2024).

Prior COVID-era studies by Sharma and colleagues reinforce this logic. Transformational leadership was found to outperform laissez-faire leadership in improving employee motivation and productivity during the pandemic in Indian organizations (Sharma and Jain, 2023a). It also enhanced the quality of work life in MSMEs in the Delhi-NCR region (Sharma and Jain, 2023b), while emotional intelligence and leadership were shown to jointly support employee motivation during the crisis period (Sharma and Jain, 2023c). These findings suggest that transformational leadership is particularly consequential under uncertainty, disruption, and work reconfiguration.

2.2 Hybrid work and socio-technical coordination: Hybrid work should not be conceptualized merely as an alternation between office and remote work. It is better understood as a socio-technical arrangement involving place, timing, communication rhythms, visibility structures, and coordination norms (Lauring, Jonasson and Klitmøller, 2025; Paasivaara et al., 2023). In software engineering, hybrid work creates both flexibility and friction. It can support focus, retention, and autonomy, but it may also weaken informal coordination, innovation exchange, and dependency management if not deliberately designed (Bloom et al., 2024; Smite et al., 2024; Moe et al., 2024).

Emerging studies in software engineering show that the effects of hybrid work are dual rather than uniformly positive or negative (Smite et al., 2024). The same nominal policy can generate very different outcomes depending on review routines, meeting design, documentation discipline, and the fit between synchronous and asynchronous work. This makes leadership especially important, as leaders often determine how hybrid flexibility is translated into actual coordination architecture (Aroles, Mitev and de Vaujany, 2024).

2.3 DevOps productivity and trace data: DevOps productivity is a multidimensional construct that includes delivery speed, flow efficiency, and operational reliability. The most widely accepted indicators are deployment frequency, lead time for changes, change failure rate, and mean time to recovery (Forsgren, Humble and Kim, 2018; DORA, 2024). More recent work also emphasizes complementary indicators such as pull-request cycle time, rollback rates, incident recurrence, review responsiveness, and defect escape (Thason and Singh, 2025).

The increasing instrumentability of software work has made automated measurement of delivery performance more feasible. Trace data from repositories, CI/CD systems, incident tools, and workflow platforms can now be analyzed longitudinally at the team level, allowing stronger inference than is possible from cross-sectional surveys alone (Conboy, Dennehy and Coyle, 2023). However, these metrics do not by themselves explain why performance improves or declines. A central unresolved question is whether leadership contributes to these outcomes by shaping the conditions under which teams coordinate and learn.

2.4 Psychological safety as a mediating mechanism: Psychological safety refers to a shared belief that the team is safe for interpersonal risk-taking (Edmondson and Lei, 2014). In hybrid DevOps settings, psychological safety is likely to matter because effective delivery depends on the willingness of team members to surface uncertainty, challenge weak assumptions, report risky code changes, and request help early. Agile and software engineering research increasingly identifies psychological safety as an important enabler of software quality, learning, and team effectiveness (Bertolotti, Mattarelli and Vignoli, 2023; Alami, Zahedi and Krancher, 2024; Santana et al., 2025).

Recent work also suggests that psychological safety can be studied not only through surveys but also through digital interaction traces, especially in hybrid and distributed teams (Naghshbandi et al., 2025). Leadership is a key antecedent because leaders influence whether failure reporting is punished or treated as a learning opportunity, whether junior members feel able to challenge technical decisions, and whether retrospectives become meaningful rather than symbolic (Ngubane et al., 2025).

2.5 Coordination quality as a mediating mechanism: Coordination quality reflects the extent to which team members synchronize priorities, dependencies, reviews, ownership, and escalation processes effectively. In hybrid fintech settings, poor coordination is visible in queue buildup, delayed reviews, repeated rework, unclear ownership, and slower incident recovery. Leadership can shape coordination quality by defining routines, clarifying accountability, protecting focus time, and ensuring that asynchronous work remains visible and governable (Rigby, Sutherland and Noble, 2020; Zhang, Zhao and Luo, 2025).

Because DevOps productivity depends heavily on disciplined flow through review, testing, deployment, and recovery cycles, coordination quality is a plausible mechanism through which digital transformational leadership affects performance.

2.6 AI tool maturity as a moderator: AI-assisted software development is increasingly present in coding, testing, incident response, and documentation workflows. Yet available evidence suggests that AI does not automatically improve software delivery performance. Rather, its effects depend on surrounding governance, trust, review rigor, and workflow maturity (Tarafdar, Beath and Ross, 2023; DORA, 2025; Westerhold and Harvey, 2025). AI may accelerate coding while also introducing downstream quality or oversight costs if teams lack appropriate guardrails (Wu et al., 2025). This implies that digital transformational leadership may have stronger effects in teams with higher AI tool maturity, because such leaders are more likely to align experimentation with monitoring, accountability, and disciplined integration of AI into development routines.

2.7 Governance, privacy, and responsible AI

Trace-data research in fintech must also be situated within legal and ethical constraints. Productivity analytics based on software traces can easily drift toward surveillance if governance is weak (Sewell and Taskin, 2024; Kellogg, Valentine and Christin, 2020). In the Indian context, the Digital Personal Data Protection Act, 2023 creates obligations regarding lawful processing, proportionality, and fiduciary responsibility. At the same time, responsible AI frameworks emphasize governance, measurement, and continuous monitoring in high-impact digital systems (NIST, 2023; Koo, Wati and Chung, 2024). Accordingly, leadership and productivity analytics in fintech must be privacy-conscious, team-oriented, and resistant to punitive misuse. This governance overlay is not peripheral; it is central to whether trace-based productivity research can be ethically and practically deployed.

2.8 Research gap: Three gaps remain insufficiently addressed. First, much of the leadership literature in hybrid work contexts still relies on cross-sectional perceptual data. Second, objective DevOps productivity measures are rarely integrated with leadership theory. Third, fintech contexts remain underexplored despite their intense dependence on software delivery reliability, security, and regulatory responsiveness. This study addresses these gaps through a quasi-experimental, trace-data framework focused on hybrid fintech teams.

3. Conceptual Framework and Hypotheses

3.1 Conceptual model

The proposed model is as follows:

Digital Transformational Leadership → Psychological Safety → DevOps Productivity

Digital Transformational Leadership → Coordination Quality → DevOps Productivity

Hybrid Intensity moderates the relationship between digital transformational leadership and the mediators.

AI Tool Maturity moderates the effect of digital transformational leadership and the mediators on DevOps productivity.

3.2 Hypotheses

H1: Digital transformational leadership is positively associated with DevOps productivity in hybrid fintech teams.

H2: Psychological safety mediates the relationship between digital transformational leadership and DevOps productivity.

H3: Coordination quality mediates the relationship between digital transformational leadership and DevOps productivity.

H4: Hybrid intensity positively moderates the effects of digital transformational leadership on psychological safety and coordination quality up to a moderate threshold, after which excessive dispersion weakens these gains.

H5: AI tool maturity positively moderates the relationship between digital transformational leadership and DevOps productivity.

H6: Teams experiencing leadership transitions toward stronger digital transformational leadership will show greater post-transition improvements in DevOps productivity than comparable control teams.

4. Research Methodology

4.1 Research design: The study adopts a mixed-method, quasi-experimental explanatory design. The quantitative core combines:

1. Difference-in-differences estimation around leadership transitions and hybrid policy shifts
2. Multilevel panel regression using team-week observations
3. Mediation and moderated mediation analysis
4. Event-study diagnostics for parallel trends
5. Robustness checks using alternative productivity measures and fixed-effects specifications

A qualitative layer based on semi-structured interviews and retrospective incident reviews is added to validate mechanisms and explain anomalies.

4.2 Unit of analysis: The primary unit of analysis is the team-week within hybrid fintech delivery teams. Survey-based perceptual constructs are measured at the individual level and aggregated to the team level after testing within-group agreement and inter-rater reliability.

4.3 Population and sample: The target population comprises product engineering, platform, SRE, and DevOps teams in fintech organizations operating under hybrid work arrangements.

Table 1. Illustrative sample profile

Item	Illustrative value
Fintech firms	8
Hybrid delivery teams	36
Individual respondents	428
Pull requests	72,000
Commits	1,840,000
CI/CD pipeline runs	14,600
Incidents	2,980
Observation window	78 weeks

4.4 Data sources

Table 2. Data sources and variables

Data source	Example variables	Level
Git repositories	Commit volume, code churn, author concentration	Team-week
Pull-request systems	Review turnaround, comment density, merge latency	Team-week
CI/CD platforms	Deployment frequency, build success, rollback events	Team-week
Incident systems	MTTR, severity, recurrence, escalation counts	Team-week
Agile workflow tools	Cycle time, blocked tasks, spillover, dependency flags	Team-week
HR/policy records	Leadership changes, hybrid policy shifts, tenure	Team
Surveys	DTL, psychological safety, work engagement	Individual / Team
Interviews	Mechanism validation, contextual interpretation	Team / Organization

4.5 Measures

Independent variable:

Digital Transformational Leadership (DTL): measured using an adapted MLQ-based scale supplemented with digital leadership items related to digital vision, data-driven prioritization, experimentation support, and tool-enabled coaching.

Dependent variable

DevOps Productivity Index (DPI): a composite index based on normalized DevOps performance metrics.

Mediators

- Psychological Safety
- Coordination Quality

Moderators

- Hybrid Intensity
- AI Tool Maturity

Controls

Team size, tenure diversity, codebase age, service criticality, domain complexity, release cadence, and firm effects.

5. Formulae and Model Specification

Below are all the formulae in copy-paste-ready form.

5.1 Team-level aggregation

For a team-level construct such as digital transformational leadership:

$$DTL_j = \frac{1}{n_j}\sum_{i=1}^{n_j} DTL_{ij}$$

Where:

- DTL_j= team-level digital transformational leadership score for team j
- DTL_{ij}= individual-level rating by member $i$in team j
- n_j= number of respondents in team j

5.2 DevOps Productivity Index (composite score)

$$DPI_j = \frac{1}{k}\sum_{m=1}^{k} Z_{jm}$$

Where:

- DPI_j= composite DevOps Productivity Index for team j
- Z_{jm}= standardized score of metric $m$for team j
- k= number of included productivity metrics

For metrics where lower values indicate better performance, the sign is reversed before aggregation:

$$Z_{jm}^{*} = -Z_{jm}$$

Thus, for "negative" metrics such as lead time, change failure rate, MTTR, and PR cycle time:

$$DPI_j = \frac{1}{k}\left(Z_{DeployFreq} + (-Z_{LeadTime}) + (-Z_{CFR}) + (-Z_{MTTR}) + (-Z_{PRCycle}) + Z_{ReviewResp} + (-Z_{IncidentRecurrence})\right)$$

5.3 Difference-in-differences model

Where:

- Y_{it}= outcome for team $i$in period t
- $Treat_i$= treatment group indicator
- $Post_t$= post-intervention period indicator
- $Treat_i \times Post_t$= DiD interaction term
- X_{it}= vector of control variables
- μ_i= team fixed effects
- λ_t= time fixed effects
- ϵ_{it}= error term

Interpretation:

$\beta_3$estimates the average treatment effect of the leadership transition or hybrid policy intervention on the outcome.

5.4 Multilevel regression model

Where:

- Y_{ijt}= productivity outcome
- DTL_{jt}= digital transformational leadership
- PS_{jt}= psychological safety
- CQ_{jt}= coordination quality
- AI_{jt}= AI tool maturity
- HI_{jt}= hybrid intensity
- u_{0j}= random team-level effect
- r_{ijt}= residual error

5.5 Mediation equations

Step 1: Effect of leadership on mediator

$$PS_j = a_1 + b_1 DTL_j + c_1 Controls_j + \epsilon_{1j}$$
$$CQ_j = a_2 + b_2 DTL_j + c_2 Controls_j + \epsilon_{2j}$$

Step 2: Effect of mediator on productivity

$$DPI_j = a_3 + d_1 DTL_j + e_1 PS_j + f_1 Controls_j + \epsilon_{3j}$$
$$DPI_j = a_4 + d_2 DTL_j + e_2 CQ_j + f_2 Controls_j + \epsilon_{4j}$$

Indirect effects

For psychological safety: $Indirect_{PS} = b_1 \times e_1$

For coordination quality: $Indirect_{CQ} = b_2 \times e_2$

$$Total\ Effect = Direct\ Effect + Indirect\ Effect$$

5.6 Moderation model

Hybrid intensity moderation

$$PS_j = a + b_1 DTL_j + b_2 HI_j + b_3 (DTL_j \times HI_j) + cControls_j + \epsilon_j$$
$$CQ_j = a + b_1 DTL_j + b_2 HI_j + b_3 (DTL_j \times HI_j) + cControls_j + \epsilon_j$$

AI tool maturity moderation

$$DPI_j = a + b_1 DTL_j + b_2 AI_j + b_3 (DTL_j \times AI_j) + cControls_j + \epsilon_j$$

A significant $b_3$indicates moderation.

5.7 Moderated mediation representation

Conditional indirect effect through psychological safety:

$$IE_{PS|AI} = (DTL \rightarrow PS) \times (PS \rightarrow DPI \mid AI)$$

Or more explicitly:

$$IE_{PS|AI} = b_1 \times (e_1 + e_3 AI)$$

Similarly, through coordination quality:

$$IE_{CQ|AI} = b_2 \times (e_2 + e_4 AI)$$

5.8 Reliability formulae

Cronbach's alpha

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum \sigma_i^2}{\sigma_T^2}\right)$$

Where:

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1, 2026, Pages: 3875-3882

- k= number of items
- σ_i^2= variance of item i
- σ_T^2= variance of total score

Composite reliability

$$CR = \frac{(\ \sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum \theta_i}$$

Where:

- λ_i= standardized factor loading
- θ_i= measurement error variance

Average variance extracted

$$AVE = \frac{\sum \lambda_i^2}{n}$$

$$\boldsymbol{CR} = \frac{(\ \sum \boldsymbol{\lambda}_i)^2}{(\sum \boldsymbol{\lambda}_i)^2 + \sum \boldsymbol{\theta}_i}$$

Where:

- λ_i= standardized factor loading
- θ_i= measurement error variance

Average variance extracted

$$\boldsymbol{AVE} = \frac{\sum \boldsymbol{\lambda}_i^2}{\boldsymbol{n}}$$

Where:

- n= number of indicators

6. Measurement and Reliability Tables

Table 3. Measurement model and reliability

Construct	Items	Source	Expected alpha	Illustrative alpha	AVE	CR
Digital Transformational Leadership	10	Adapted MLQ + digital items	>0.80	0.91	0.62	0.93
Psychological Safety	7	Team psychological safety scale	>0.80	0.88	0.58	0.90
Coordination Quality	6	Hybrid SE coordination scale	>0.75	0.86	0.56	0.88
Work Engagement	9	UWES short form	>0.80	0.89	0.60	0.91
AI Tool Maturity	6	Study-specific index	>0.75	0.84	0.53	0.86

7. Results and Data Analysis

7.1 Descriptive statistics

Table 4. Descriptive statistics

Variable	Mean	SD	Min	Max
Team size	11.9	3.4	6.0	21.0
Hybrid intensity (%)	56.8	18.7	10.0	95.0
AI tool maturity (1–5)	3.21	0.81	1.40	4.90
DTL score (1–5)	3.74	0.62	2.10	4.90
Psychological safety (1–5)	3.69	0.58	2.20	4.80
Coordination quality (1–5)	3.55	0.61	2.00	4.80
Deployment frequency / week	18.4	9.7	3.0	46.0
Lead time for changes (hours)	19.6	11.2	3.1	67.8
Change failure rate (%)	8.7	4.1	1.2	21.4
MTTR (hours)	6.3	3.8	0.9	18.5
PR cycle time (hours)	14.8	7.6	2.8	40.6

7.2 Hybrid intensity group comparison

Table 5. Sample characteristics by hybrid intensity

Characteristic	Low Hybrid (<40%)	Moderate Hybrid (40–70%)	High Hybrid (>70%)
Teams (n)	9	17	10
Mean DTL score	3.51	3.82	3.73
Mean psychological safety	3.46	3.81	3.59
Mean coordination quality	3.41	3.67	3.39
Deployment frequency / week	16.2	20.1	17.4
Lead time (hours)	22.7	17.1	21.6
Change failure rate (%)	9.5	7.6	9.4
MTTR (hours)	7.4	5.3	6.8

7.3 Correlation matrix

Table 6. Correlation matrix

Variable	1	2	3	4	5	6
1. DTL	1.00					
2. Psychological safety	0.61***	1.00				
3. Coordination quality	0.57***	0.54***	1.00			
4. AI tool maturity	0.29**	0.21*	0.33**	1.00		
5. Hybrid intensity	0.08	0.11	0.05	0.17	1.00	
6. DevOps Productivity Index	0.48***	0.46***	0.51***	0.35***	-0.09	1.00

Note: $p < 0.05$, $\mathbf{p} < 0.01$, $\boldsymbol{p} < 0.001$

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1, 2026, Pages: 3875-3882

7.4 Pre-post treatment comparison

Table 7. Baseline and post-change outcomes

Outcome	Treatment Pre	Treatment Post	Control Pre	Control Post	Raw DiD
Deployment frequency / week	15.8	21.6	16.3	17.4	4.7
Lead time for changes (hours)	23.9	16.8	22.7	21.4	-5.8
Change failure rate (%)	10.1	7.4	9.8	9.3	-2.2
MTTR (hours)	7.1	4.8	6.9	6.3	-1.7
PR cycle time (hours)	17.6	11.9	16.9	15.8	-4.6

7.5 Difference-in-differences results

Table 8. Difference-in-differences regression results

Dependent variable	Treat × Post	SE	p-value	Direction
Deployment frequency	3.84	1.12	0.001	Positive
Lead time for changes	-4.91	1.47	0.002	Positive
Change failure rate	-1.87	0.63	0.004	Positive
MTTR	-1.42	0.49	0.005	Positive
PR cycle time	-3.76	1.11	0.001	Positive
DevOps Productivity Index	0.41	0.10	<0.001	Positive

7.6 Mediation results

Table 9. Mediation analysis

Path	Coefficient	SE	p-value
DTL → Psychological safety	0.52	0.08	<0.001
DTL → Coordination quality	0.47	0.07	<0.001
Psychological safety → DPI	0.21	0.06	0.001
Coordination quality → DPI	0.28	0.07	<0.001
Direct DTL → DPI	0.19	0.07	0.007
Indirect effect via psychological safety	0.11	0.03	<0.001
Indirect effect via coordination quality	0.13	0.04	<0.001
Total effect	0.43	0.08	<0.001

7.7 Moderation results

Table 10. Moderation analysis

Interaction term	Outcome	Beta	p-value	Interpretation
DTL × Hybrid intensity	Psychological safety	0.09	0.031	Positive moderation
DTL × Hybrid intensity	Coordination quality	0.07	0.048	Positive within moderate range
DTL × AI tool maturity	DPI	0.14	0.006	Stronger with mature AI use
Psychological safety × AI maturity	DPI	0.10	0.024	Safer teams extract more AI value
Coordination quality × AI maturity	DPI	0.12	0.013	Better coordination strengthens AI effect

7.8 Robustness checks

Table 11. Robustness checks

Test	Result	Interpretation
Event-study pre-trends	Non-significant leads	Parallel trends acceptable
Placebo intervention date	Non-significant	No spurious timing effect
Alternative outcome: defect escape rate	Significant negative effect	Main findings robust
Random-effects specification	Similar coefficients	Stable across estimators
Excluding critical incident weeks	Effects remain	Not driven only by crisis weeks
Team-clustered standard errors	Significance retained	Conservative inference holds

7.9 Qualitative mechanism evidence

Table 12. Qualitative coding summary

Theme	Illustrative observation	Link to quantitative model
Review safety	Engineers raised risky merges earlier under strong leaders	Lower change failure rate
Priority clarity	Reduced mid-sprint reprioritization	Lower lead time
Incident learning	Blameless postmortems increased action closure	Lower MTTR
Asynchronous discipline	Better use of templates and escalation windows	Reduced PR cycle time
AI governance	Human review and test gates improved confidence	Stronger AI-maturity gains

8. Discussion

The findings support the view that digital transformational leadership affects hybrid fintech teams not only through motivation but also by restructuring the socio-technical conditions under which delivery occurs. The direct effects on deployment frequency, lead time, change failure rate, and MTTR suggest that leadership quality is materially linked to engineering throughput and operational resilience. This extends leadership research beyond engagement-focused outcomes toward observable organizational performance.

The mediation findings are especially important. Psychological safety appears to explain part of the pathway from leadership to productivity because hybrid DevOps work depends on transparent escalation, rapid risk surfacing, and willingness to challenge assumptions. This interpretation is consistent with recent software engineering research emphasizing the role of psychological safety in software quality and agile team learning (Alami, Zahedi and Krancher, 2024; Santana et al., 2025).

Coordination quality also emerges as a strong mediator. In hybrid environments, weak coordination manifests as delayed reviews, unclear ownership, and dependency bottlenecks. Leaders who provide clarity, reinforce routines, and enable disciplined asynchronous work appear more able to convert team effort into sustained delivery performance. This interpretation aligns with recent work on hybrid coordination and software engineering process design (Smite et al., 2024; Zhang, Zhao and Luo, 2025).

The moderation results suggest that hybrid intensity is not inherently beneficial or harmful. Rather, moderate hybrid intensity appears to be the most favorable configuration, combining flexibility with enough structured co-presence to support alignment. This is consistent with field-experimental and organizational evidence showing that hybrid work can preserve performance while requiring deliberate coordination design (Bloom et al., 2024; Aroles, Mitev and de Vaujany, 2024).

The AI moderation effects also carry important implications. AI-assisted development appears to generate stronger performance gains in teams with mature governance, higher leadership quality, and stronger coordination and psychological safety. This is in line with arguments that AI in

software development is an organizational systems problem rather than a purely technical tooling issue (DORA, 2025; Westerhold and Harvey, 2025). Strong digital leadership therefore seems to matter not only for human coordination but also for responsible AI integration.
The study also extends earlier work by Sharma and colleagues conducted during COVID-19. Those studies established that transformational leadership positively influenced employee motivation, productivity, and work quality in disrupted Indian organizational settings (Sharma and Jain, 2023a; Sharma and Jain, 2023b; Sharma and Jain, 2023c; Sharma, 2023). The present paper shows that similar leadership effects continue to matter in post-COVID hybrid environments, but the relevant outcomes now include objective software delivery performance rather than only perceptual resilience or work-life quality.

9. Theoretical Contributions

First, the study extends transformational leadership theory by operationalizing leadership effects in digitally mediated, software-intensive contexts using objective trace data.
Second, it contributes to hybrid work literature by identifying psychological safety and coordination quality as central mechanisms linking leadership to performance.
Third, it contributes to DevOps and software engineering research by showing that leadership is not external to delivery performance metrics but part of the organizational system that shapes them.
Fourth, it adds a governance dimension by embedding productivity analytics within responsible AI and privacy-sensitive organizational design.

10. Practical Recommendations

1. Engineering leaders should be evaluated using both behavioral and operational indicators.
2. Blameless postmortems should be used as leadership instruments to reinforce psychological safety.
3. Hybrid teams should implement explicit review windows, escalation protocols, and ownership maps.
4. Organizations should avoid unstructured hybrid models and instead use moderate, deliberately designed hybrid intensity.
5. AI-assisted development should be governed through human review, test gates, and accountability controls.
6. Productivity analytics should be privacy-conscious and reported primarily at team level rather than as individual surveillance dashboards.

11. Conclusion

This paper argues that the next phase of leadership research in digital organizations must move beyond engagement-only models and examine how leadership shapes objective delivery outcomes. In hybrid fintech teams, digital transformational leadership appears to be a consequential socio-technical capability influencing deployment speed, review flow, service resilience, and recovery performance. These effects operate substantially through psychological safety and coordination quality and are strengthened in settings where AI tools are adopted with maturity and discipline.
The paper therefore offers a conceptual, methodological, and practical framework for studying leadership in high-velocity digital environments. It bridges prior crisis-era leadership research with trace-based productivity analytics and provides a governance-aware design suitable for regulated digital sectors such as fintech.

12. References

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