

The Mediating Role of Work Engagement in the Relationship between Flexible Work Arrangements, Work-life Balance, and Organizational Commitment

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ABSTRACT

Purpose – This study tests work engagement as the mechanism linking flexible work arrangements (FWA) to work-life balance (WLB) and organizational commitment (OC) among employees of pharmaceutical companies in Batam, Indonesia, motivated by two prior studies reporting non-significant results along this pathway.

Design/methodology/approach – A quantitative, cross-sectional survey of 300 employees across production, quality control/quality assurance, regulatory affairs, and administrative roles was analyzed using partial least squares structural equation modeling (PLS-SEM) with Confirmatory Tetrad Analysis (CTA-PLS), the Cross-Validated Predictive Ability Test (CVPAT), and Importance-Performance Map Analysis (IPMA) as supplementary techniques.

Finding/Results – Flexible work arrangements significantly predicted work engagement, and work engagement significantly predicted both work-life balance and organizational commitment. Flexible work arrangements had no significant direct effect on organizational commitment, which was instead fully mediated by work engagement. Flexible work arrangements had a significant direct effect on work-life balance, but in the opposite direction to that hypothesized, producing a competitive mediation pattern with the positive indirect effect through work engagement.

Originality/Value – The study refines the application of the Job Demands-Resources model in a flexible work context by showing that work engagement mediates the flexibility-to-outcome pathway differently depending on the outcome, offering a more nuanced account than a uniform mediation story in an under-studied manufacturing/pharmaceutical setting.

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1. Introduction

Organizations increasingly treat flexible work arrangements as a deliberate lever for shaping employee engagement rather than a peripheral perk, redesigning schedules and work locations to sustain motivation and long-term attachment (Gašić & Berber, 2023). This shift places work engagement at the center of contemporary human resource strategy, because engaged employees are expected to translate organizational investment into measurable outcomes such as work-life balance and organizational commitment (Anderson & Kelliher, 2009). The stakes are considerable: when flexible arrangements fail to translate into genuine engagement, the anticipated gains in employee well-being and organizational loyalty do not materialize, leaving managers uncertain about which levers actually work (Rameshkumar, 2020).

The dominant theoretical account of this process rests on the Job Demands-Resources model, which frames flexible scheduling and autonomy as job resources that trigger a motivational process culminating in higher work engagement (Bakker & Demerouti, 2007). Building on this logic, prior empirical work has generally reported that flexible work arrangements strengthen employee engagement, which in turn predicts favorable organizational outcomes, including engagement's link to organizational commitment (Gašić & Berber, 2023; Anderson & Kelliher, 2009). Work engagement is therefore positioned as the mechanism that channels the benefits of flexibility toward both individual well-being and organizational attachment.

Yet this mediating mechanism is not consistently supported across contexts. Afdillah and Rachmawati (2021) surveyed 271 employees across state-owned companies in Indonesia and found that the implementation of teleworking, a core form of flexible work, did not have a significant effect on work engagement, with job resources instead carrying the motivational process on their own. A parallel inconsistency appears further downstream in the model: Rameshkumar (2020), studying Indian seafaring officers, reported that employee engagement was not significantly associated with the continuance dimension of organizational commitment, even though it was significantly related to the affective and normative dimensions of commitment among the same respondents. Taken together, these two findings indicate that the pathway from flexibility to engagement, and from engagement to commitment, cannot be assumed to hold uniformly across samples, occupational contexts, or commitment dimensions, leaving the mediating role of work engagement empirically unsettled.

This inconsistency motivates the present study, which tests work engagement as the mechanism linking flexible work arrangements to work-life balance and organizational commitment among employees of pharmaceutical companies in Batam, Indonesia, a manufacturing-intensive setting where flexible arrangements are typically confined to non-production, administrative, and quality-documentation roles while production-floor staff remain bound to fixed shift schedules under Good Manufacturing Practice requirements, making the strength of the engagement-mediated pathway an open empirical question. Using partial least squares structural equation modeling, the study estimates the direct paths from flexible work arrangements to both outcomes alongside the indirect paths through work engagement, allowing a direct test of whether engagement meaningfully explains variance that direct effects alone cannot capture in this specific context.

By examining whether work engagement functions as a dependable mediator or a context-bound one, this study contributes theoretically by refining the application of the Job Demands-Resources model to the flexible work literature in this sample, rather than establishing a

general boundary condition of the theory, and practically by indicating whether organizations should treat engagement-building programs as a prerequisite for flexible work policies to pay off in well-being and commitment outcomes.

2. Literature Review and Hypothesis Development

This study is grounded in the Job Demands-Resources (JD-R) model, which posits that job resources such as autonomy and scheduling control initiate a motivational process leading to work engagement, while engagement itself functions as a resource that shapes subsequent employee attitudes and behaviors (Bakker & Demerouti, 2007). The conceptual model in Figure 1 positions flexible work arrangements as the antecedent job resource, work engagement as the motivational mechanism, and work-life balance and organizational commitment as its behavioral and attitudinal consequences.

2.1 Flexible Work Arrangements and Work Engagement

Flexible work arrangements represent a job resource, and the Job Demands-Resources model holds that job resources initiate a motivational process that raises work engagement by satisfying employees' needs for autonomy and competence (Bakker & Demerouti, 2007). Consistent with this logic, Gašić and Berber (2023) surveyed 514 highly educated employees in Serbia and found that flexible work arrangements were significantly and positively related to employee engagement, which subsequently reduced turnover intentions. Similarly, Anderson and Kelliher (2009) reported across seven case organizations that flexible working strengthened engagement primarily when employees experienced genuine choice over when, where, and how they worked, linking that engagement to stronger organizational commitment and job satisfaction. However, as noted in the Introduction, this relationship is not unconditional: the non-significant effect reported by Afdillah and Rachmawati (2021) indicates that the strength of this path depends on whether employees perceive genuine autonomy rather than a merely nominal policy, rather than on the presence of a flexible arrangement per se. Taken together, these findings support a positive average effect while leaving room for boundary conditions, which the present study's use of a specific occupational context (Section 3) is designed to probe. This reasoning yields the following hypothesis.

H1: Flexible work arrangements have a significant positive effect on work engagement.

2.2 Flexible Work Arrangements and Work-life Balance

Flexible work arrangements grant employees control over the timing and location of their work, which directly expands their capacity to meet both professional and personal demands. A comprehensive meta-analysis of 113 studies and 88,618 participants by Harrop, Jiang, and Overall (2025) confirmed that flexible work arrangements were significantly and positively related to work-life balance, with the effect strengthened when employees had access to both flextime and flexplace rather than either alone. Consistent with this pattern, the same review reported that flexible arrangements consistently improved employees' work-family interface across the studies examined. Field-level evidence supports the same direction: flexible work arrangements have been shown to significantly and positively affect work-life balance among public university employees, with schedule flexibility carrying the strongest relationship among the flexibility dimensions tested. These converging findings indicate that flexible arrangements function as a boundary-management resource, allowing employees to shift work activities around personal obligations rather than sacrificing one domain for the other. This evidence base supports the following hypothesis.

H2: Flexible work arrangements have a significant positive effect on work-life balance.

2.3 Flexible Work Arrangements and Organizational Commitment

Beyond its effect on daily scheduling, flexible work arrangements also carry a relational signal: when an organization grants employees discretion over their work, employees tend to reciprocate with stronger attachment to that organization. The meta-analysis by Harrop, Jiang, and Overall (2025) found flexible work arrangements were significantly associated with higher organizational commitment across the pooled studies, alongside gains in job satisfaction and job autonomy. Consistent with this, a mini-review of flexible work arrangements and employee performance concluded that flexible arrangements are associated with increased organizational commitment alongside attendance and productivity gains, framing commitment as one of the more consistently reported outcomes of workplace flexibility (Çivilidağ & Durmaz, 2024). Anderson and Kelliher (2009) likewise linked flexible working to organizational commitment through employees' positive interpretation of the flexibility offered to them, rather than through the schedule change itself. Collectively, these studies support a direct path from flexible work arrangements to organizational commitment that operates independently of, and in parallel with, any engagement-mediated pathway. Accordingly, the following hypothesis is put forward.

H3: Flexible work arrangements have a significant positive effect on organizational commitment.

2.4 Work Engagement and Work-life Balance

Work engagement reflects a state of vigor, dedication, and absorption in one's work, and engaged employees are theorized to approach their tasks with the energy and focus needed to complete them efficiently, freeing time and psychological resources for life outside work (Bakker & Demerouti, 2007). Testing this pathway directly, Alnagbi, Aldabbas, Gernal, Elamin, and Ahmed (2025) surveyed 98 employees across government, private, and non-profit organizations in the United Arab Emirates and found that work engagement was significantly and positively related to work-life balance, which in turn improved individual work performance. The authors specifically modeled the path from engagement toward work-life balance, arguing that engaged employees gain a clearer sense of control over their schedules that they can then extend to personal commitments. This evidence positions work-life balance as a downstream benefit of engagement rather than only its antecedent, reversing the direction commonly assumed in job-resources research. On this basis, the following hypothesis is advanced.

This directional choice is not the only theoretically defensible one. A substantial body of work-family literature instead conceptualizes reduced work-family conflict or work-life balance as a resource that replenishes the psychological capacity employees invest in their work, implying the reverse order, work-life balance predicting engagement. With single-wave, cross-sectional data, the estimated model is consistent with the hypothesized ordering but cannot rule out this reverse specification, nor can it establish temporal precedence; the reported paths should be read as covariance patterns consistent with the proposed model rather than as evidence that engagement causes work-life balance. A supplementary exploratory check of the reverse ordering is reported in Section 4.10.1.

H4: Work engagement has a significant positive effect on work-life balance.

2.5 Work Engagement and Organizational Commitment

Engaged employees are theorized to develop a reciprocal sense of obligation toward the organization that affords them a fulfilling work experience, a mechanism formalized in Saks's (2006) foundational study, which found that job and organization engagement significantly

mediated the relationship between antecedent job resources and organizational commitment among 102 employees across varied organizations. As introduced above, Rameshkumar's (2020) study of Indian seafaring officers refines rather than contradicts this mechanism: engagement was significantly related to the affective and normative dimensions of commitment, consistent with engaged employees identifying more strongly with organizational goals, but not to the continuance dimension, which rests on calculative switching costs rather than emotional or moral attachment. This dimension-specific pattern indicates that the engagement-commitment link is directionally robust but may vary in strength depending on which commitment dimension is examined, a distinction the present study examines through a supplementary composite-level analysis reported in Section 4.5.1, alongside the primary aggregate-construct test of Hypothesis 5.

H5: Work engagement has a significant positive effect on organizational commitment.

2.6 Conceptual Framework

Figure 1 integrates hypotheses H1 through H5 into a single mediation model. Flexible work arrangements are positioned as the exogenous job resource, work engagement as the mediating motivational mechanism, and work-life balance and organizational commitment as the two parallel outcome variables. H1 captures the resource-to-engagement path; H2 and H3 capture the direct paths from flexible work arrangements to each outcome; and H4 and H5 capture the second leg of the two mediated pathways, through which work engagement is hypothesized to carry part of flexible work arrangements' influence on each outcome.

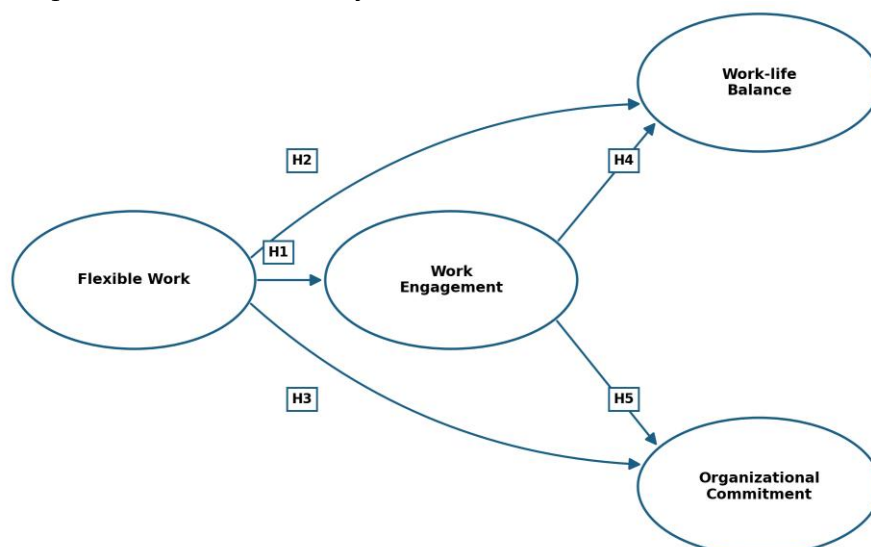
Because H1 through H5 jointly imply an indirect pathway rather than stating one directly, the two mediation hypotheses that follow from this structure are stated explicitly below, consistent with the recommendation that mediating relationships be specified as formal hypotheses rather than inferred after estimation.

H6: Work engagement significantly mediates the relationship between flexible work arrangements and work-life balance.

H7: Work engagement significantly mediates the relationship between flexible work arrangements and organizational commitment.

H6 and H7 are tested in Section 4.5 using the specific indirect effects (FWA → WE → WLB and FWA → WE → OC) already reported in Table 5, together with the classification of each mediation pattern following Zhao, Lynch, and Chen's (2010) typology.

Figure 1. Conceptual model of the study



3. Methodology

3.1 Population, Sample, and Sampling Technique

This study adopts a positivist paradigm and a quantitative, cross-sectional survey design, consistent with prior studies testing the same class of relationships through covariance- or variance-based structural equation modeling (Gašić & Berber, 2023; Alnagbi, Aldabbas, Gernal, Elamin, & Ahmed, 2025). The population comprises employees of pharmaceutical companies operating in Batam, Indonesia, spanning production and manufacturing, quality control/quality assurance, regulatory affairs and research and development, and administrative, management, or sales roles, restricted to respondents whose current role includes access to at least one form of flexible work arrangement. Given the absence of a complete sampling frame across Batam's pharmaceutical companies, a purposive and snowball sampling technique was used, consistent with the sampling approach used across this research program.

The maximum number of structural arrows pointing at a single endogenous construct in this model is two, as work-life balance and organizational commitment each receive a direct path from flexible work arrangements and an indirect path from work engagement; applying Cohen's (1992) minimum sample size table at this arrow count, a significance level of 1%, and a conservative minimum R-squared of 0.10 yields a floor of 158 valid responses. The study targeted 300 valid responses, a deliberate buffer well above this floor intended to allow for anticipated data loss during screening and to preserve adequate power for subgroup comparisons between production and non-production respondents; 300 valid responses were in fact obtained (Section 4.2).

Cohen's (1992) arrow-counting heuristic is a widely used but dated shortcut, so it is supplemented here with a formal a priori power calculation for multiple regression (the approximation on which the heuristic itself rests), evaluated at the two-predictor endogenous constructs (work-life balance and organizational commitment), $\alpha = .05$, and power = .80. A sample of 300 provides approximately 80% power to detect an effect as small as $f\text{-squared} = .033$, which by Cohen's (1992) conventions falls between the small (.02) and medium (.15) benchmarks; at the actually small benchmark of $f\text{-squared} = .02$, achieved power at $N = 300$ is approximately 58%, meaning the study is adequately powered to detect small-to-moderate effects but may be underpowered for very small effects, a consideration relevant to interpreting the non-significant paths (H3, and the null total effect on work-life balance) as absence of evidence rather than evidence of absence. This power profile also informed the retrospective judgment that the subgroup and multigroup comparisons requested elsewhere in this review (Section 6) would require a larger sample than was collected here to be adequately powered, reinforcing the case for treating them as a priority for future data collection rather than attempting them on the present, undersized subsamples.

The choice of variance-based PLS-SEM (Hair, Hult, Ringle, & Sarstedt, 2022) over covariance-based SEM (CB-SEM) also warrants explicit justification rather than reliance on sample size alone, particularly because the structural model itself is not complex (four constructs, five direct paths). Three considerations favor PLS-SEM here. First, this study's design deliberately incorporates prediction-oriented diagnostics, specifically CVPAT and IPMA, alongside theory testing; PLS-SEM natively supports both objectives within a single estimation framework, whereas CB-SEM is oriented toward covariance-structure fit and would require a separate analytical framework to obtain comparable out-of-sample predictive metrics. Framed this

way, the study pursues a dual explanatory-predictive objective, with CVPAT treated as a central rather than supplementary diagnostic, consistent with the recommendation that this rationale be made explicit rather than implied. Second, the Likert-scale indicator data exhibited non-trivial departures from multivariate normality typical of organizational survey data, which favors PLS-SEM's distribution-free estimation over CB-SEM's reliance on maximum-likelihood estimation under normality assumptions. Third, several constructs (work-life balance, organizational commitment) are treated provisionally as reflective composites of related but conceptually distinct sub-facets rather than as unidimensional reflective factors in the strict CB-SEM sense (see Section 4.3 and Section 4.5.1); PLS-SEM's composite-based estimation is more tolerant of this measurement ambiguity than CB-SEM's stricter factor-analytic requirements, though this tolerance is a pragmatic accommodation rather than a substitute for resolving the underlying measurement-architecture questions raised throughout this review.

Before full-scale distribution, the questionnaire was pilot tested on 50 respondents drawn from the same population but excluded from the main data collection, exceeding the common rule-of-thumb minimum of approximately 30 for PLS-SEM pilot studies. Sampling adequacy and internal consistency were assessed statistically rather than only through qualitative debriefing; the corresponding results are reported in Section 4.1.

3.2 Measures

Each construct was measured using items adapted from established, validated scales rather than newly written items, operationalized as summarized in Table 1. A seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree), was used for all substantive items, for consistency with the response format used across this research program.

Table 1. Operationalization of Research Variables

Variable	Definition	Dimensions / Example Indicators	Items	Key Source
Flexible Work Arrangements (FWA)	Employees' perceived control over the timing and location of their work.	Control over start/end times; choice of work location; supervisor support for flexible arrangements.	5	Hill et al. (2001); Rau & Hyland (2002)
Work Engagement (WE)	A positive, fulfilling, work-related state of mind characterized by vigor, dedication, and absorption.	Vigor; Dedication; Absorption.	9	Bakker & Demerouti (2007)
Work-life Balance (WLB)	The degree to which an individual is able to meet both work and personal-life demands without one domain undermining the other.	Work interference with personal life; personal life interference with work; overall work-life satisfaction.	5	Hayman (2005)
Organizational Commitment (OC)	The psychological bond tying an employee to the organization, reducing the likelihood of turnover.	Affective; Continuance; Normative.	9	Meyer & Allen (1997)

Notes: All items use a seven-point Likert scale. Organizational commitment is measured with nine reflective items spanning three theoretical dimensions (affective, continuance, normative), which are combined into a single reflective construct for the primary structural model (H1-H5). A supplementary composite-level dimension-specific analysis is reported separately in Section 4.5.1.

3.3 Data Analysis Technique

Data were analyzed using partial least squares structural equation modeling in SmartPLS 4, following a two-stage assessment of the measurement model (loadings, AVE, composite reliability, HTMT) and the structural model (path coefficients, t/p-values, R-squared, f-squared, Q-squared predict). Given the self-reported, single-source nature of the data, common method bias was addressed procedurally through respondent anonymity and item counterbalancing at the design stage; the corresponding collinearity-based statistical diagnostic (inner VIF) is reported alongside the measurement model results in Section 4.2.

Two supplementary techniques strengthen the rigor of the PLS-SEM analysis beyond the core measurement and structural results. First, before the measurement model was interpreted, whether each construct behaves reflectively or formatively was confirmed empirically rather than assumed from theory alone, using Confirmatory Tetrad Analysis for PLS (CTA-PLS) (Gudergan, Ringle, Wende, & Will, 2008); this bootstrapped, Bonferroni-adjusted test of each construct's non-redundant tetrads was run first, because a tetrad confidence interval that includes zero supports the reflective specification, whereas an interval excluding zero would require respecifying the construct as formative, and the outcome of this test determines which downstream validity criteria apply to each construct (results in Section 4.3). Second, the structural model's out-of-sample predictive power was formally tested against benchmark models using the Cross-Validated Predictive Ability Test (CVPAT) (Liengaard et al., 2021), which performs a k-fold, holdout-sample comparison of the theoretical model's average prediction loss against an indicator-average (naive) model and a linear regression model and returns a formal significance test rather than the purely descriptive comparison that PLSpredict alone provides (results in Section 4.7).

A third technique extends the interpretation of the structural model beyond statistical significance alone. Importance-Performance Map Analysis (IPMA) contrasts an antecedent's unstandardized total effect on a target construct (importance) with that antecedent's average rescaled performance score (performance) (Ringle & Sarstedt, 2016), identifying antecedents that carry a strong effect on the target construct yet currently show comparatively low performance, and therefore represent priority areas for managerial intervention. IPMA was run with work engagement as the target construct, the only construct for which flexible work arrangements is a direct predecessor in this model; results are reported in Section 4.8. Results from all three techniques are reported in dedicated tables rather than merged together: a CTA-PLS tetrad table, a CVPAT loss-comparison table alongside the Q-squared predict values from PLSpredict, and an importance-performance map for the target construct examined.

4. Result and Discussion

4.1 Pilot Test

Prior to full-scale distribution, the questionnaire was pilot tested on 50 respondents drawn from the target population. Sampling adequacy was confirmed by a Kaiser-Meyer-Olkin (KMO) measure of 0.720, exceeding the conventional 0.60 threshold, and Bartlett's test of sphericity was significant (chi-square = 925.75, df = 378, $p < .001$), indicating the item

correlation matrix was suitable for factor analysis. Overall internal consistency across all 28 substantive items was excellent (Cronbach's alpha = 0.910). At the item level, all corrected item-total correlations exceeded 0.20, with the majority above the stricter 0.30 threshold; four items (FWA1, FWA5, WLB2, WLB3) fell marginally below 0.30 in the pilot sample. Because none produced a material drop in scale-level alpha when removed and all four subsequently exhibited standardized loadings above 0.60 in the full-sample measurement model (Section 4.2), they were retained for the main survey rather than dropped on pilot evidence alone.

4.2 Measurement Model Assessment

The main survey yielded 300 valid responses, matching the target sample size established in Section 3. All standardized outer loadings ranged from 0.682 to 0.832, exceeding the 0.60 minimum retention threshold (Table 2); most exceeded the stricter 0.708 benchmark, with only WE2, WE4, WE6, and WE8 falling marginally below it while still contributing acceptably to their construct's average variance extracted. Convergent validity was established for all four constructs, with average variance extracted (AVE) ranging from 0.541 to 0.645, above the 0.50 minimum, and composite reliability (rho_c) ranging from 0.897 to 0.942, above the 0.70 minimum. Cronbach's alpha ranged from 0.856 to 0.931, confirming internal consistency reliability.

Table 2. Measurement Model Assessment

Construct	Items	Loading range	Cronbach's alpha	rho_c (CR)	AVE
Flexible Work Arrangements	5	0.767-0.832	0.859	0.898	0.638
Work Engagement	9	0.682-0.782	0.894	0.914	0.541
Work-life Balance	5	0.776-0.812	0.856	0.897	0.635
Organizational Commitment	9	0.779-0.824	0.931	0.942	0.645

Discriminant validity was assessed using the heterotrait-monotrait ratio (HTMT) and the Fornell-Larcker criterion. All HTMT values remained below the conservative 0.85 threshold, with the highest observed between Work Engagement and Organizational Commitment (HTMT = 0.572), and the Fornell-Larcker criterion was satisfied for every construct, as the square root of each construct's AVE exceeded its correlations with all other constructs. Outer VIF values ranged from 1.53 to 2.55 and inner model VIF values for the hypothesized structural paths did not exceed 1.118, both well below the conservative threshold of 3.3. These structural-model VIFs, however, only capture collinearity among the predictors of each hypothesized path and are not equivalent to a full-collinearity test. Following the full-collinearity procedure recommended for common method bias assessment (Kock, 2015), each construct's latent variable score was regressed on all three remaining constructs; the resulting VIFs (FWA = 1.16, OC = 1.40, WE = 1.64, WLB = 1.19) remained well below the conservative 3.3 threshold, providing stronger evidence that common method variance is unlikely to materially distort the structural estimates. This diagnostic is nonetheless a statistical safeguard rather than definitive proof that method variance is absent: all constructs were self-reported by the same respondent at a single point in time, and no marker variable or measured latent method factor was included in the design to rule out common method bias directly. Procedural remedies applied at the design stage included respondent anonymity, physical separation of the construct blocks in the questionnaire, and neutral, non-evaluative item wording intended to reduce evaluation apprehension and social desirability bias; these procedural and statistical

safeguards are reported as partial mitigations, and the absence of a marker-variable test is acknowledged explicitly as a design limitation in Section 5.

4.3 Confirmatory Tetrad Analysis (CTA-PLS)

Following the procedure outlined in Section 3.3, non-redundant tetrads were bootstrapped (10,000 subsamples) for each construct with a Bonferroni-adjusted significance level. For all four constructs, every tetrad's bias-corrected confidence interval included zero at the adjusted alpha level, meaning no tetrad differed significantly from zero. The reflective specification is therefore not contradicted by the tetrad test for Flexible Work Arrangements, Work Engagement, Work-life Balance, and Organizational Commitment, and the reflective validity criteria reported in Section 4.2 accordingly apply. This statistical result should not be read as settling the measurement-mode question on its own: whether a construct is reflective or formative is fundamentally a theoretical decision about the causal direction between indicators and construct, and a non-significant tetrad test is a necessary rather than sufficient condition for reflective specification. This qualification is especially relevant for Work-life Balance and Organizational Commitment, whose indicators span conceptually distinct sub-facets (see Section 4.5 and Section 5 for further discussion of the dimensional structure of these constructs)

Table 3. Confirmatory Tetrad Analysis (CTA-PLS) Summary

Construct	Tetrads tested	Adj. alpha	Sig. tetrads	Smallest p	Decision
Flexible Work Arrangements	5	.0200	0	.212	Reflective confirmed
Work Engagement	27	.0037	0	.216	Reflective confirmed
Work-life Balance	5	.0200	0	.155	Reflective confirmed
Organizational Commitment	27	.0037	0	.00669	Reflective confirmed

Note: A construct's reflective specification is retained when none of its non-redundant tetrads differ significantly from zero at the Bonferroni-adjusted alpha level (Gudergan et al., 2008). Organizational Commitment's smallest observed p-value (.00669) remained above its adjusted alpha (.0037) and is therefore not significant.

4.4 Structural Model and Hypothesis Testing

The structural model was estimated via bootstrapping with 5,000 subsamples. The model explained 27.9% of the variance in Organizational Commitment, 10.5% in Work Engagement, and 15.5% in Work-life Balance (all R-squared values statistically significant, $p < .001$), indicating weak-to-moderate explanatory power typical of individual-level attitudinal outcomes. Table 4 reports the path coefficients, bootstrapped t-statistics, p-values, and effect sizes (f-squared) for each hypothesized path.

Table 4. Structural Model Results (Direct Effects)

H	Path	Beta	t	p	f2	Decision
H1	FWA -> WE	0.324	7.095	< .001	0.118	Supported
H2	FWA -> WLB	-0.187	3.064	.002	0.037	Not supported (sig., opposite sign)
H3	FWA -> OC	0.039	0.761	.446	0.002	Not supported
H4	WE -> WLB	0.413	9.003	< .001	0.180	Supported
H5	WE -> OC	0.514	10.878	< .001	0.328	Supported

Note: Two-tailed test, 5,000 bootstrap subsamples.

H1, H4, and H5 were supported in the hypothesized positive direction. H3 was not supported: the direct path from flexible work arrangements to organizational commitment was small and statistically indistinguishable from zero. H2 requires a more careful reading: the direct path

from flexible work arrangements to work-life balance was statistically significant, but negative, the opposite of the hypothesized direction, so H2 is not supported as stated even though the effect is not merely a null result.

4.5 Mediation Analysis

Table 5 reports the indirect and total effects underlying H1 through H5, and provides the direct test of mediation hypotheses H6 and H7. Both specific indirect effects through work engagement were statistically significant, but the two outcomes display different mediation patterns once the direct and total effects are considered jointly.

Table 5. Indirect and Total Effects

Path	Indirect (t, p)	Direct (t, p)	Total (t, p)	Mediation pattern
FWA -> WE -> OC	0.167 (5.84, <.001)	0.039 (0.76, .446) ns	0.205 (3.96, <.001)	Indirect-only (full)
FWA -> WE -> WLB	0.134 (5.09, <.001)	-0.187 (3.06, .002) sig.	-0.053 (0.86, .390) ns	Competitive (inconsistent)

For the path to organizational commitment, work engagement fully mediates the relationship: flexible work arrangements have no significant direct effect on organizational commitment once work engagement is accounted for, but their total effect through work engagement is significant and positive, consistent with an indirect-only (full) mediation pattern in the Zhao, Lynch, and Chen (2010) typology. For the path to work-life balance, the pattern is markedly different: the significant positive indirect effect through work engagement is offset by a significant negative direct effect, producing a total effect that is statistically indistinguishable from zero. This is a competitive (inconsistent) mediation pattern, in which work engagement and the direct pathway pull in opposite directions, and it explains why a simple total-effect test would have missed a relationship that the mediation analysis reveals on both of its component paths.

4.5.1 Post Hoc Dimension-Specific Analysis of Organizational Commitment

The structural model above aggregates the nine organizational commitment items into a single reflective construct. Because the introduction to this study (Section 1) and Rameshkumar (2020) both raise the possibility that engagement relates unevenly to the affective, continuance, and normative dimensions of commitment, a post hoc composite-score analysis was conducted to test this directly. Affective (OC1-OC3), continuance (OC4-OC6), and normative (OC7-OC9) composites were formed following Meyer and Allen's (1997) three-component structure, and each showed acceptable internal consistency (Cronbach's alpha = .809 to .814). Work Engagement was significantly and positively related to all three dimensions at comparable magnitudes: affective ($b = .638$, $t = 10.03$, $p < .001$), continuance ($b = .632$, $t = 9.73$, $p < .001$), and normative ($b = .616$, $t = 9.59$, $p < .001$) commitment. Flexible Work Arrangements showed no significant direct effect on any of the three dimensions once Work Engagement was controlled (affective: $b = .023$, $p = .697$; continuance: $b = .056$, $p = .351$; normative: $b = .036$, $p = .541$), mirroring the null direct effect on the aggregate construct reported in Table 4. In this sample, therefore, the aggregated organizational commitment construct does not appear to be masking an opposing or null relationship for any single dimension: engagement relates to all three components in a directionally and statistically consistent manner. This diverges from Rameshkumar's (2020) finding that engagement was unrelated to continuance commitment among Indian seafaring officers, and is discussed as a boundary-condition contrast in Section 5. Two caveats qualify this analysis. First, it relies on summed composite scores rather than a full re-estimation of the structural model with three separate latent endogenous constructs, so

bootstrapped standard errors, measurement-model fit, and indirect effects through Work Engagement were not re-estimated for each dimension; a full multi-outcome PLS-SEM re-specification is recommended for future work seeking to confirm this pattern with construct-level rather than composite-level estimates. Second, the three dimension composites were highly correlated with one another ($r = .82$ to $.85$), which, while consistent with the dimensions belonging to a broader higher-order commitment construct, also means the present data cannot rule out that respondents in this sample did not clearly distinguish among the three theoretical facets when responding, a possibility noted as a measurement limitation in Section 5.

4.6 Model Fit

The estimated model showed an acceptable fit to the data: the standardized root mean square residual (SRMR) was 0.0495, below the conventional 0.08 threshold, and the normed fit index (NFI) was 0.904.

4.7 Cross-Validated Predictive Ability Test (CVPAT)

Following the procedure outlined in Section 3.3, the theoretical model's average prediction loss was compared against an indicator-average (IA) benchmark and a linear model (LM) benchmark using 10-fold cross-validation. Overall, the PLS-SEM model produced significantly lower prediction loss than both benchmarks (vs. IA: average loss difference = -0.038 , $t = 2.576$, $p = .010$; vs. LM: average loss difference = -0.024 , $t = 2.582$, $p = .010$), providing formal statistical support for the theoretical structure over naive alternatives. At the construct level, however, this advantage was not uniform (Table 6).

Table 6. CVPAT Results by Target Construct (PLS-SEM vs. Indicator Average)

Construct	PLS loss	IA loss	Loss diff.	t	p	Q2predict
Work Engagement	1.223	1.289	-0.066	2.859	.005	0.096
Organizational Commitment	1.529	1.563	-0.034	1.529	.127	0.034
Work-life Balance	1.357	1.352	+0.004	0.817	.415	-0.005

Only Work Engagement showed a significant predictive advantage over the naive benchmark and a positive Q-squared predict value, indicating genuine out-of-sample predictive relevance. Organizational Commitment showed a positive but non-significant advantage. Work-life Balance showed no predictive advantage at all: its Q-squared predict value was slightly negative and its CVPAT loss difference was not significant, meaning the model's prediction of work-life balance for new cases was statistically indistinguishable from, and numerically slightly worse than, simply predicting the sample mean. This predictive weakness for work-life balance is plausibly related to the competitive mediation pattern identified in Section 4.5, in which the opposing direct and indirect effects leave limited net explanatory signal for out-of-sample prediction, though this connection is an inference rather than a directly tested mechanism.

A second CVPAT comparison against a linear regression benchmark qualifies this picture. Work Engagement retained a significant predictive advantage over the linear model (average loss difference = -0.022 , $t = 2.225$, $p = .027$), and, notably, Work-life Balance also showed a significant advantage over the linear model (average loss difference = -0.025 , $t = 2.092$, $p = .037$) despite showing none over the indicator-average benchmark. Organizational Commitment showed no significant advantage over either benchmark. This divergence indicates that the PLS-SEM model captures some non-linear or interactive structure in the data relevant to work-life balance that a linear model cannot reproduce, even though the model's absolute predictive accuracy for work-life balance remains no better than simply predicting the sample mean;

predictive relevance and predictive accuracy are therefore distinct properties that should not be conflated. Given this uneven pattern across constructs and benchmarks, the model should not be characterized as broadly or uniformly predictive on the strength of the significant overall loss comparison alone; predictive relevance in the CVPAT sense is well supported only for Work Engagement, partially supported for Work-life Balance relative to a linear alternative, and not supported for Organizational Commitment.

4.8 Importance-Performance Map Analysis (IPMA)

IPMA was run with work engagement as the target construct, the only construct for which flexible work arrangements is a direct predecessor in this model. Table 7 reports the construct-level results, and Table 8 decomposes flexible work arrangements' importance and performance down to its five individual indicators.

This analysis carries an inherent scope limitation: because Work Engagement has only one antecedent in the estimated model, the construct-level importance-performance map cannot be used to prioritize among competing strategic drivers, and the indicator-level ranking depends entirely on the validity of the Flexible Work Arrangements measurement block. A more informative priority map for managerial decision-making would target Work-life Balance or Organizational Commitment, each of which has two antecedents (Flexible Work Arrangements and Work Engagement) that could be compared directly; this analysis was outside the scope of the present study and is noted as a direction for future research in Section 5. Consistent with this limitation, the IPMA results below should be read as descriptive information about the relative importance and performance of Flexible Work Arrangements' indicators for Work Engagement specifically, not as a validated tool for organization-wide resource allocation across all outcomes in the model.

Table 7. IPMA Construct-Level Results (Target: Work Engagement)

Predecessor construct	Importance (total effect)	Performance (0-100)
Flexible Work Arrangements	0.324	56.1

Table 8. IPMA Indicator-Level Results for Flexible Work Arrangements

Indicator	Importance (total effect)	Performance (0-100)
FWA1 - Control over start/end times	0.064	55.8
FWA2 - Choice of work location	0.074	56.9
FWA3 - Working-hour options suited to needs	0.099	55.7
FWA4 - Schedule adjustment without complex approval	0.089	56.9
FWA5 - Supervisor support for flexible arrangements	0.079	55.3

Flexible work arrangements combines a moderate importance for work engagement with a performance score just above the scale midpoint, suggesting room for improvement in how flexible work arrangements are implemented before their engagement benefits are fully realized. At the indicator level, the combination of relatively high importance and relatively low performance for FWA3 (working-hour options suited to individual needs) suggests that, if practical prioritization within flexible work arrangements is needed, tailoring working-hour options to individual employee needs may offer more leverage for strengthening engagement than the other four indicators, though this reading should be treated as indicative rather than confirmatory given that only one construct-level target was analyzed.

4.9 Flexible Work Arrangements, Work Engagement, and the Application of the JD-R Model in This Context

The finding that flexible work arrangements predict work engagement is consistent with the Job Demands-Resources logic set out in Section 2, in which scheduling and location autonomy

function as a job resource that fuels a motivational process (Bakker & Demerouti, 2007). This result also aligns with the broader empirical pattern reported by Gašić and Berber (2023) and Anderson and Kelliher (2009), both of whom found flexible arrangements associated with stronger engagement, particularly when employees experienced the arrangement as genuine discretion rather than a nominal policy. At the same time, the Introduction highlighted that this relationship is not universal: Afdillah and Rachmawati (2021) found no significant effect of teleworking on engagement among Indonesian state-owned company employees. The present study's positive result, obtained in a pharmaceutical manufacturing context where flexibility is unevenly distributed across production and non-production roles, suggests that the JD-R resource logic held in this setting despite that structural unevenness, though it does not by itself explain why the Indonesian teleworking-specific study found otherwise. A plausible reading, consistent with Afdillah and Rachmawati's own interpretation, is that the form and perceived authenticity of flexibility, not merely its formal availability, is what determines whether it functions as a genuine job resource.

4.10 Divergent Pathways to Work-life Balance and Organizational Commitment

The clearest theoretical contribution of this study lies not in the paths that behaved as expected, but in the two that did not. For organizational commitment, flexible work arrangements showed no meaningful direct relationship once work engagement was taken into account, with the entire relationship channeled through engagement. This is consistent with Anderson and Kelliher's (2009) argument that flexible working shapes commitment through employees' psychological interpretation of the arrangement rather than through the schedule change itself, and it extends Rameshkumar's (2020) finding that engagement relates unevenly to different components of commitment by showing that, in this sample, engagement was necessary for flexibility to matter for commitment at all rather than merely strengthening an existing direct relationship.

The path to work-life balance told a different and more cautionary story. Flexible work arrangements related positively to work-life balance indirectly, through work engagement, but related negatively to work-life balance directly. Read together, these two paths describe employees for whom flexibility that successfully engages them also, through some other channel, encroaches on personal time net of that engagement benefit. This pattern is not addressed directly by the literature reviewed in Section 2, which generally treats flexible work arrangements as beneficial for work-life balance (Harrop et al., 2025; Hill, Hawkins, Ferris, & Weitzman, 2001), but it is not inconsistent with the boundary-management reasoning underlying that literature: the same autonomy that lets an engaged employee absorb more work into personal time can blur the boundary between the two domains, particularly in a manufacturing organization where flexibility is concentrated in non-production roles that may carry after-hours administrative or coordination demands not captured by the flexibility measure itself. This interpretation is offered cautiously; the cross-sectional, self-report design of this study cannot establish that flexibility causes reduced boundary control, only that the two are associated once engagement is held constant, and alternative explanations, including reverse causality or an unmeasured third variable such as workload, cannot be ruled out. This has a direct bearing on the research gap identified in the Introduction: where Afdillah and Rachmawati (2021) and Rameshkumar (2020) each reported a single non-significant path, the present findings suggest that at least one apparent null or weak total-effect relationship in this literature may conceal offsetting direct and indirect pathways rather than reflecting a genuinely absent relationship.

The boundary-blurring account offered above should be read as one plausible interpretation rather than a demonstrated mechanism, since no measure of workload, after-hours connectivity, work-family conflict, availability expectations, or schedule unpredictability was included in the model to test it directly. Three supplementary checks were run to interrogate the negative direct path rather than simply asserting a mechanism. First, the zero-order correlation between Flexible Work Arrangements and Work-life Balance was small and statistically non-significant ($r = -.053$, $p = .390$), matching the non-significant total effect already reported in Table 5; the negative, significant direct path therefore only emerges once Work Engagement is held constant, a pattern consistent with statistical suppression rather than an association that was already present before Work Engagement entered the model. Second, a quadratic term for Flexible Work Arrangements was added to the Work-life Balance equation to test whether the relationship is curvilinear rather than linear; the quadratic term was non-significant ($b = -.001$, $t = .017$, $p = .987$) while the linear direct effect remained essentially unchanged, providing no evidence that moderate versus extensive flexibility produces opposing effects on work-life balance in this sample. Third, flextime and remote or hybrid arrangements were not modeled separately, so the possibility that different forms of flexibility carry different consequences for work-life balance could not be tested with the present measurement approach. Taken together, these checks rule out a simple curvilinear explanation and show that the negative path is not attributable to a pre-existing negative zero-order association, but they cannot adjudicate between suppression, an omitted boundary-management mechanism, reverse causality, or unmeasured workload differences across roles. Consistent with this uncertainty, the competitive mediation pattern is better characterized as an unexplained inconsistent mediation pattern that motivates future research incorporating boundary-management and workload measures, rather than as confirmed evidence that flexibility erodes personal time through boundary erosion.

4.10.1 Supplementary Checks: Reverse Direction and Work-life Balance Item Structure

Two supplementary checks address concerns raised about directionality and measurement that a single cross-sectional structural model cannot resolve on its own. First, because work-life balance is plausibly an antecedent rather than a consequence of engagement, an exploratory reverse-direction regression was estimated using the latent variable scores from the primary model: flexible work arrangements and work-life balance were entered as joint predictors of work engagement. Work-life balance predicted work engagement strongly ($b = .370$, $t = 7.32$, $p < .001$), and this reverse specification explained more variance in work engagement ($R\text{-squared} = .242$) than flexible work arrangements alone explains in work-life balance in the hypothesized model ($R\text{-squared} = .155$) or than flexible work arrangements alone explains in work engagement in the hypothesized model ($R\text{-squared} = .105$). This is an approximate, composite-score check rather than a fully re-estimated competing PLS-SEM model with its own measurement model and bootstrapped standard errors, but it shows the reverse ordering is at least as empirically consistent with the data as the hypothesized ordering, and in this sample work-life balance is a numerically stronger correlate of engagement than flexible work arrangements is. This finding reinforces rather than resolves the direction concern raised above: it should be read as evidence that reverse or reciprocal causality is a live alternative that the present cross-sectional design cannot rule out, not as evidence that the hypothesized direction is wrong. A longitudinal or experimental design remains necessary to adjudicate between these competing orderings, and this is elevated as a priority for future research in Section 6.

Second, to rule out measurement architecture as the source of the negative direct path, all five work-life balance items are reported verbatim with their descriptive statistics: WLB1, "I am able to balance my time between work and my personal life" ($M = 4.37$, $SD = 1.17$); WLB2, "My job rarely interferes with my time with family or loved ones" ($M = 4.37$, $SD = 1.18$); WLB3, "I have enough time and energy for personal activities outside of work" ($M = 4.28$, $SD = 1.18$); WLB4, "My personal matters rarely interfere with my concentration at work" ($M = 4.35$, $SD = 1.13$); and WLB5, "Overall, I am satisfied with the balance between my work and personal life" ($M = 4.37$, $SD = 1.15$). All five items were worded so that stronger agreement indicates better work-life balance; none required reverse-scoring, and no coding errors were identified. WLB2 corresponds to the Work-Interference-with-Personal-Life dimension and WLB4 to the Personal-Life-Interference-with-Work dimension in Hayman's (2005) framework, while WLB1, WLB3, and WLB5 reflect overall balance and satisfaction. Inter-item correlations ranged narrowly from .51 to .58 with no outliers, and WLB2 and WLB4 correlated with the mean of the remaining three items at .67 and .64 respectively, indicating all five items point in a consistent conceptual direction and none behaves as a discordant sub-facet. This does not fully resolve the concern that work-life balance combines conceptually distinct components, which remains noted in Section 6, but it does rule out reverse-coding or scoring artifacts as the source of the unexpected negative direct path.

4.11 Theoretical and Practical Implications

These findings refine rather than overturn the Job Demands-Resources account motivating this study. Work engagement functioned as the mechanism the JD-R model predicts for the path to organizational commitment, consistent with full mediation, but it did not fully account for the path to work-life balance, where a countervailing direct effect remained, suggesting that treating work engagement as a uniform, all-purpose conduit from job resources to well-being outcomes may understate the complexity of resource allocation once autonomy-based resources are involved. For pharmaceutical companies in Batam and similar manufacturing settings, these findings imply that expanding flexible work arrangements is likely to strengthen organizational commitment primarily to the extent that it genuinely engages employees, not as a direct or automatic effect of the policy itself. For work-life balance, the findings counsel caution: managers should not assume that granting flexibility protects personal time by default, and may need to pair flexible arrangements with explicit boundary-setting norms to prevent the same autonomy that engages employees from eroding the personal time that flexibility was intended to protect.

5. Conclusion and Suggestion

This study tested work engagement as the mechanism linking flexible work arrangements to work-life balance and organizational commitment among pharmaceutical company employees in Batam, Indonesia. Three of the five hypothesized paths were supported in their hypothesized direction: flexible work arrangements predicted work engagement, and work engagement predicted both work-life balance and organizational commitment. The remaining two paths revealed more nuanced patterns rather than simple support or rejection. Flexible work arrangements had no meaningful direct effect on organizational commitment, which instead was fully mediated by work engagement, indicating that flexibility builds commitment only through successfully engaging employees. Flexible work arrangements had a significant direct effect on work-life balance, but in the opposite direction to that hypothesized, producing a competitive mediation pattern in which the positive effect

channeled through work engagement was offset by a negative direct effect, such that the two effects combined left no significant net relationship. The two mediation hypotheses were both supported in the sense that the specific indirect effect of work engagement was statistically significant in each case (H6, H7), but the two paths differ in mediation type: indirect-only (full) mediation for organizational commitment, and competitive (inconsistent) mediation for work-life balance, a distinction that matters for how each finding should be interpreted and acted upon.

These findings suggest that work engagement is a dependable mediator for the path to organizational commitment but only a partial and, on the work-life balance path, a countervailing one, refining the assumption that work engagement functions as a uniform conduit from flexible work arrangements to employee well-being outcomes. For organizations, particularly in manufacturing settings where flexibility is unevenly distributed across roles, the pattern observed here suggests, as a plausible rather than established implication, that flexible work policies may benefit from being designed and communicated in ways that actively build engagement, potentially paired with boundary-management guidance intended to limit the autonomy that drives engagement from simultaneously eroding employees' personal time. This study did not test any intervention and therefore cannot establish that boundary-setting policies would in fact eliminate or reduce the negative direct path to work-life balance; that claim would require an intervention or longitudinal study designed to test it directly, and is offered here as a direction for future research rather than a validated recommendation. Future researchers extending this line of work are encouraged to adopt a longitudinal design and to incorporate a direct measure of work-family boundary management or conflict, as detailed in Section 6.

6. Limitations and Future Research

This study's cross-sectional design permits association but not causal inference, a limitation that bears most heavily on the competitive mediation pattern discussed in Section 4.10, since a longitudinal or experimental design would be needed to establish whether flexibility precedes, follows, or interacts dynamically with the boundary strain it appears to be associated with. All constructs were measured through self-report from a single source, at a single point in time, using the same seven-point response format; this is treated here as a major internal-validity limitation rather than a routine methodological note, because the positive FWA-WE, WE-WLB, and WE-OC paths in particular all involve employee perceptions collected simultaneously, and a generalized positive response tendency could inflate these specific associations. Although procedural remedies were applied at the design stage (Section 4.2) and the full-collinearity diagnostic (Section 4.2) is well below conventional thresholds, this diagnostic is a statistical safeguard rather than a definitive test, and common method variance cannot be fully excluded as a contributor to the observed relationships without a marker variable, which the survey instrument did not include (see also the fifth point below). The sample was drawn from a single sector and city, which limits generalizability to other industries, regions, or regulatory environments where the composition and perceived authenticity of flexible work arrangements may differ. Finally, the importance-performance map analysis in this study was limited to work engagement as the target construct because flexible work arrangements is its only direct predecessor in the model; a fuller priority-map picture for work-life balance and organizational commitment, which each have two antecedents, would require importance-performance map analysis runs targeting those

constructs directly. Future research should pursue a longitudinal or multi-wave design to clarify the direction of the competitive mediation pattern identified here, incorporate a boundary-management or work-life conflict measure to test directly whether it accounts for the negative direct path to work-life balance, and extend the importance-performance analysis to organizational commitment and work-life balance as target constructs.

Several additional limitations, raised during peer review, are acknowledged here rather than resolved, because the data available for this study cannot address them without new data collection. First, the sample was restricted by design to employees whose current role provides access to at least one form of flexible work arrangement; employees without any access to flexibility were not sampled for comparison. This restriction of range means the reported relationships describe associations among employees already exposed to some degree of flexibility, not the effect of introducing flexibility relative to having none, and the negative direct path to work-life balance in particular should be interpreted within this restricted population rather than generalized to a full population contrast. Second, although the sample spans production, quality control/quality assurance, regulatory affairs, and administrative roles, and the Introduction notes that flexibility is typically concentrated in non-production roles in this industry, the demographic and role-distribution data linked to individual responses were not retained in a form that permitted a production-versus-non-production multigroup comparison in this study; such a comparison, along with tests of measurement invariance across roles, tenure, and shift status, is an important next step given the occupational heterogeneity of the pharmaceutical manufacturing setting. Third, respondents are nested within pharmaceutical companies in Batam, and the number of companies represented, the distribution of respondents across them, and the resulting intra-class dependence were not recorded or modeled; company-level policies could induce correlated responses that single-level PLS-SEM does not account for, and cluster-robust inference or a multilevel approach should be considered in future replications. Fourth, the Work-life Balance construct combines items reflecting work-interference-with-personal-life, personal-life-interference-with-work, and overall balance satisfaction; while the post hoc analysis in Section 4.5.1 shows a parallel concern for organizational commitment did not materially affect the pattern of results, an equivalent item-level and dimension-specific analysis was not conducted for work-life balance in this study, and the possibility that its five items combine conceptually distinct sub-facets in ways that affect the interpretation of the negative direct path cannot be ruled out. Fifth, no marker variable or measured latent method factor was included in the survey design, so the common-method-bias diagnostics reported in Section 4.2 remain statistical safeguards rather than a definitive test that method variance has been excluded. Researchers extending this line of work are encouraged to collect and retain respondent-level role, tenure, shift, and company-affiliation data, include a theoretically unrelated marker construct, and consider a stratified sampling design that includes employees without flexible-work access as a comparison group.

Declaration of AI and AI-assisted technologies in the writing process

During the preparation of this work, the author(s) used Claude (Anthropic) to assist with drafting and structuring the literature review, hypothesis development, methodology, results reporting from SmartPLS and SPSS output files, discussion, and template formatting, and to cross-check the reference list against in-text citations for completeness and consistent formatting. After using this tool, the author(s) reviewed and edited the content as needed and

take full responsibility for the content of the publication, including independently verifying all references, particularly 2024-2025 sources, against publisher records prior to submission.

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