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Physical work environment, job design, and job satisfaction: Transformational leadership as a boundary condition

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ABSTRACT

Architecture and engineering consultancies depend on specialized expertise and durable client relationships. When dissatisfied professionals leave, firms risk losing tacit design knowledge and client-specific insights that are difficult to replace. In project-based professional service work, these retention risks make job satisfaction a strategically important outcome. The present study investigates the relationships among the physical work environment, job design, transformational leadership, and job satisfaction. It tests whether transformational leadership amplifies the satisfaction-relevant effects of both work conditions and task design features. Data were collected from 174 matched professionals using a two-wave time-lagged census survey with a four-week interval. Hypothesis testing employed variance-based structural equation modeling in SmartPLS, with statistical inference based on 5.000 bootstrap iterations. The results show that physical work environment, job design, and transformational leadership were positively associated with job satisfaction, with job design showing the strongest direct effect. Transformational leadership also strengthened the positive effects of physical work environment and job design on job satisfaction, although these interaction effects were modest in magnitude. The full model accounted for 55.7 percent of the variance in the outcome construct, indicating substantial explanatory coverage. These findings indicate that job satisfaction in project-based consultancy work depends not only on work conditions and task design but also on leadership quality, suggesting that retention can be supported through coordinated improvements in job design, physical work conditions, and leadership capability.

1. Introduction

Architecture and engineering consultancies are knowledge-intensive professional service firms that rely on specialized expertise and durable client relationships to deliver high-value, client-specific solutions in project-based settings (von Nordenflycht, 2010; Goetz & Wald, 2022). Their project-based mode of delivery requires rapid problem solving, tight

deadlines, and intensive cross-disciplinary coordination, conditions that have been linked to strain and turnover intention in construction and engineering workforces (Dodanwala & Santoso, 2022; Abdolmaleki et al., 2024). When experienced architects and engineers leave, firms risk losing tacit design knowledge and client-specific insights that are difficult to codify and replace, weakening learning across projects and reducing delivery quality over time (Galan, 2023; Marzo et al., 2025). In such settings, job satisfaction is strategically important because it relates not only to employee well-being, but also to workforce continuity in work systems that depend heavily on professional capability, coordination, and sustained project execution (Samimi & Sydow, 2021; Goetz & Wald, 2022).

This issue is particularly important in Indonesian architecture and engineering consultancies, where project-based work combines temporary organizing, client-specific demands, and strong dependence on specialized professionals, making both work-system design and employee retention especially consequential for organizational continuity (Samimi & Sydow, 2021; Goetz & Wald, 2022). This context is especially salient because job satisfaction and turnover-related attitudes have been widely examined in broader construction and organizational settings. However, evidence from architecture and engineering consultancy firms in Indonesia remains limited despite the analytical relevance of these firms as knowledge-intensive professional service settings characterized by coordination pressure, deadline intensity, and strong reliance on professional expertise (Dodanwala & Santoso, 2022; Abdolmaleki et al., 2024). Post-pandemic changes in workplace expectations have further increased managerial attention to job satisfaction as a retention lever, including through work redesign, flexibility, and supportive supervisory practices (Bloom et al., 2024). Recent evidence also indicates that younger employees increasingly value inclusive and supportive workplace climates, making leadership and work-system design especially salient for retention-oriented management in contemporary organizations (Katsaros, 2025). In sum, these conditions make Indonesian architecture and engineering consultancies a theoretically and practically relevant setting for examining how physical work environment, job design, and transformational leadership jointly shape job satisfaction.

The present study examines these issues in BITA Group, an Indonesian multidisciplinary architecture and engineering consultancy operating across commercial, industrial, and infrastructure projects. Based on internal human resource archival records, the firm experienced substantial employee movement from 2019 to 2025, with annual turnover peaking at 14.8 percent in 2021 and remaining at 10.7 percent in 2025. This pattern is consistent with broader evidence that construction and engineering workforces face persistent turnover-related risks driven by project intensity and technical specialization, and that the departure of experienced professionals can disrupt project continuity and weaken the retention of firm-specific knowledge over time (Dodanwala & Santoso, 2022; Galan, 2023; Abdolmaleki et al., 2024; Marzo et al., 2025). Prior research on project-based professional service work further suggests that retention risk in such settings is closely tied to whether employees experience their daily work conditions as sustainable and their jobs as worthwhile across repeated project cycles (Samimi & Sydow, 2021; Goetz & Wald, 2022).

However, the specific work conditions and supervisory practices that shape such evaluations in architecture and engineering consultancy settings have received limited integrated empirical attention, and three antecedents emerge from the broader literature as theoretically warranted candidates for investigation in this context. First, evidence from knowledge-intensive office environments shows that physical conditions, including ergonomics, thermal comfort, workspace quality, and fit-for-purpose equipment, shape whether professionals can sustain the concentration and coordination intensity that technical project work demands, which makes physical work environment substantively relevant in this setting (Felgueiras et al., 2024; Markkanen & Herneoja, 2024; Felgueiras et al., 2025). Second,

research on project-based organizing indicates that fragmented task structures, shifting client demands, and temporary team configurations can narrow employee discretion, weaken task identity, and reduce the developmental feedback available from the work itself, making job design a critical variable for understanding how professionals evaluate their work under such conditions (Hackman & Oldham, 1976; Samimi & Sydow, 2021). Third, evidence from work design and leadership research indicates that supervisory leadership shapes how employees interpret and respond to the task structures and work conditions they encounter, such that identical job features can generate different attitudinal outcomes depending on whether leaders help employees recognize those features as purposeful and worth investing in (Piccolo & Colquitt, 2006; Tummers & Bakker, 2021; Teetzen et al., 2022). This positions transformational leadership not only as a direct predictor of job satisfaction but also as a variable that conditions the extent to which the physical work environment and job design translate into favorable job evaluations in this setting. Together, these three streams of prior research justify examining physical work environment, job design, and transformational leadership as theoretically grounded predictors of job satisfaction in this setting. Importantly, while prior work has examined each of these predictors independently, far less is known about whether leadership simultaneously moderates the satisfaction-relevant effects of both work conditions and task design within a single integrated model, and whether this pattern holds in an Indonesian architecture and engineering consultancy context where such evidence remains scarce (Dodanwala & Santoso, 2022; Abdolmaleki et al., 2024).

Two foundational perspectives explain why structural work features should matter for job satisfaction. Herzberg's two-factor theory distinguishes hygiene factors, such as working conditions, from motivators embedded in the work itself, implying that improvements in baseline physical conditions primarily reduce dissatisfaction rather than create strong positive satisfaction (Herzberg et al., 1959). The job characteristics model explains how task features such as autonomy, task significance, skill variety, task identity, and feedback foster critical psychological states that support internal motivation and job satisfaction (Hackman & Oldham, 1976). Contemporary work design scholarship continues to reaffirm the centrality of these task characteristics while also encouraging clearer higher-order distinctions between contextual and motivational features of work (Carter et al., 2024; Parker & Knight, 2024). In line with these perspectives, the present study treats the physical work environment as a hygiene-related contextual condition and job design as motivational task content. Transformational leadership is introduced as a relational and interpretive leadership process that can shape employees' experiences of both domains in demanding project settings.

Prior research has more often estimated average direct effects or examined either contextual conditions or task characteristics in isolation, whereas less is known about whether leadership simultaneously strengthens the job satisfaction returns of both domains within a single model. This gap matters theoretically because project-based consultancy work combines uneven feedback cycles, coordination pressure, and shifting client demands, conditions under which the value of both supportive work conditions and enriched tasks may become more contingent on managerial interpretation and support (Samimi & Sydow, 2021; Goetz & Wald, 2022). It also matters empirically because much of the available evidence still comes from broad organizational samples or broader construction workforces rather than from architecture and engineering consultancies, which are project-based and knowledge-intensive firms (Dodanwala & Santoso, 2022; Abdolmaleki et al., 2024). Many studies also remain cross-sectional and single-source, which can weaken confidence in temporal ordering when procedural separation is limited (Bozionelos & Simmering, 2022; Podsakoff et al., 2024).

Transformational leadership is theoretically central to this inquiry because leaders shape how employees interpret work conditions and task characteristics in complex, interdependent settings (Bass & Riggio, 2005; Piccolo & Colquitt, 2006). Recent evidence

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suggests that leadership can influence how employees experience job demands and resources, how they derive motivational value from structural job conditions, and how work-related resources translate into attitudinal outcomes (Tummers & Bakker, 2021; Chen et al., 2022; Fareed et al., 2022; Pan et al., 2024). In project-based consultancy work, this implies that the same physical work conditions or task design may not generate the same level of job satisfaction across units, because leadership can shape whether employees experience these work features as supportive, meaningful, and developmentally useful. Leaders who articulate a compelling vision, provide individualized support, and encourage intellectual engagement can reasonably be expected to increase the perceived value of both adequate physical conditions and enriched task design, while also potentially contributing directly to job satisfaction through relational and trust-based processes (Bass & Riggio, 2005; Tummers & Bakker, 2021; Chen et al., 2022). For this reason, transformational leadership is examined not only as a direct antecedent of job satisfaction, but also as a boundary condition that may strengthen the effects of physical work environment and job design.

Accordingly, this study examines the direct and moderating roles of physical work environment, job design, and transformational leadership in shaping job satisfaction in an Indonesian architecture and engineering consultancy. The study contributes in three ways. First, it extends work design research by showing that transformational leadership can function as a cross-domain boundary condition that amplifies the attitudinal returns of both hygiene-related physical work conditions and motivational task characteristics within a single model. Second, it supports the continued relevance of Herzberg's two-factor theory and the job characteristics model in project-based professional service settings characterized by temporality, coordination intensity, and client-specific demands. Third, by modeling transformational leadership as both a direct predictor and a moderator, it offers a more complete account of how leadership shapes job satisfaction than models that include only one pathway. This logic is tested using a two-wave time-lagged design that strengthens temporal separation between predictors and outcomes relative to single-wave survey designs (Bozionelos & Simmering, 2022; Podsakoff et al., 2024).

2. Literature Review and Hypothesis Development

2.1. Theoretical Foundations and Construct Framing

2.1.1. Job Satisfaction in Project-Based Professional Service Work

Job satisfaction refers to an individual's overall evaluative judgment and affective experience regarding the job and work role (Locke, 1976; Weiss, 2002). In knowledge-intensive professional service firms, job satisfaction is strategically relevant because organizational value creation depends heavily on specialized expertise, reputation, and continuity in client-specific knowledge (von Nordenflycht, 2010). In project-based consultancy work, where employees regularly face shifting demands, temporary organizing, and high interdependence, job satisfaction also reflects whether professionals view their work arrangements as sustainable and worthwhile across projects (Samimi & Sydow, 2021; Goetz & Wald, 2022). In this setting, job satisfaction is not merely an individual attitude but also an organisationally consequential condition, as dissatisfaction may increase the risk of turnover, disrupt project continuity, and weaken retention of firm-specific professional knowledge across assignments.

2.1.2. Physical Work Environment and Job Design Through Herzberg's and Job Characteristics Model Lenses

Herzberg et al. (1959) conceptualized work-related attitudes through a two-category structure: contextual conditions that primarily prevent negative evaluations, and intrinsic task elements that generate active satisfaction. Within this framework,

suboptimal physical surroundings tend to lead to dissatisfaction, whereas substantively enriched work content drives positive job appraisal. The job characteristics model complements this logic by explaining how autonomy, skill variety, task identity, task significance, and feedback foster experienced meaningfulness, responsibility, and knowledge of results, which support internal motivation and job satisfaction (Hackman & Oldham, 1976). Contemporary work design scholarship continues to reaffirm the salience of these characteristics while also offering clearer higher-order structuring of work design domains and their attitudinal consequences (Carter et al., 2024; Parker & Knight, 2024). Consistent with this distinction, the present study conceptualizes the physical work environment as work design questionnaire work context characteristics, and job design as work design questionnaire task characteristics (Morgeson & Humphrey, 2006; Humphrey et al., 2007). This specification clarifies the construct by distinguishing physical work conditions as a hygiene-related baseline from task design features as motivational job content. Together, these two perspectives provide a coherent theoretical basis for distinguishing why physical work environment and job design should both matter for job satisfaction, but through partly different explanatory routes: physical conditions as a hygiene-related resource that prevents dissatisfaction and stabilizes job evaluations, and task features as motivational content that generates active positive satisfaction through experienced meaningfulness and responsibility.

2.1.3. Transformational Leadership as A Boundary Condition in Temporary Project Settings

Transformational leadership refers to leadership behaviors that articulate a compelling vision, provide individualized consideration, stimulate followers' intellectual development, and model valued standards and commitment (Bass & Riggio, 2005). Beyond direct effects, transformational leadership can serve as a boundary condition by shaping employees' interpretations of job demands, resources, and structural features of work in complex, interdependent settings (Piccolo & Colquitt, 2006; Tummers & Bakker, 2021). In temporary, project-based organizing, leadership may be especially important for aligning expertise, maintaining collaboration under time pressure, and helping professionals sustain a sense of purpose across shifting project demands (Samimi & Sydow, 2021; Goetz & Wald, 2022). Recent project-based evidence also shows that transformational leadership relates to job satisfaction through trust-based processes. In contrast, newer work-design evidence indicates that transformational leadership may shape employee well-being, in part, by influencing how work characteristics are experienced and enacted (Fareed et al., 2022; Teetzen et al., 2022; Pan et al., 2024). This logic motivates testing transformational leadership as an amplifier of the satisfaction returns from both physical work conditions and enriched job design.

2.2. Hypotheses Development

2.2.1. Physical Work Environment and Job Satisfaction

Herzberg's two-factor theory classifies physical working conditions as hygiene factors whose primary function is to prevent dissatisfaction by removing environmental barriers that interfere with effective professional work (Herzberg et al., 1959). When these conditions are inadequate, employees experience active dissatisfaction because environmental obstacles increase the physical and cognitive cost of task execution; when they are adequate, those obstacles are removed, and employees form more favorable evaluations of their job as a workable and sustainable professional role (Herzberg et al., 1959). In architecture and engineering consultancy

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work, this mechanism carries particular weight because prolonged screen-based design effort, technical coordination, and software-intensive project execution require sustained attention and reliable tools, making ergonomics, work conditions, and fit-for-purpose equipment substantively consequential rather than peripheral (Goetz & Wald, 2022; Abdolmaleki et al., 2024). Built-environment research in comparable knowledge-intensive professional settings supports this reasoning, showing that ergonomic adequacy, thermal comfort, and workspace usability are positively associated with job satisfaction among technically demanding workers (Felgueiras et al., 2024; Markkanen & Herneoja, 2024; Felgueiras et al., 2025; Indergård & Hansen, 2025). **H_1: The Physical Work Environment is Positively Associated with Job Satisfaction**.

2.2.2. Job Design and Job Satisfaction

The job characteristics model proposes that task characteristics generate job satisfaction through a motivational pathway that is qualitatively distinct from the hygiene-prevention mechanism governing physical conditions (Herzberg et al., 1959; Hackman & Oldham, 1976). Autonomy produces experienced responsibility; task identity and task significance produce experienced meaningfulness; and feedback provides knowledge of results. Together, these psychological states constitute active intrinsic engagement with the work itself, which drives positive job evaluation more directly than the removal of environmental obstacles (Hackman & Oldham, 1976). In project-based consultancy work, client revisions, shifting priorities, and interdependent coordination can progressively erode task ownership, narrow discretion, and interrupt feedback cycles, making enriched job design especially valuable because it counteracts this fragmentation (Samimi & Sydow, 2021; Goetz & Wald, 2022). Meta-analytic evidence confirms that autonomy, task significance, task identity, and feedback are among the most robust predictors of job satisfaction across organizational contexts (Humphrey et al., 2007; Carter et al., 2024; Parker & Knight, 2024). **H_2: Job Design is Positively Associated with Job Satisfaction.**

2.2.3. Transformational Leadership and Job Satisfaction

Transformational leadership should be positively associated with job satisfaction because leaders who articulate a compelling vision, provide individualized consideration, model valued standards, and encourage intellectual engagement elevate followers' perceived sense of purpose, confidence, and contribution significance (Bass & Riggio, 2005). Job satisfaction reflects an overall evaluative judgment about whether one's work role is meaningful and rewarding (Locke, 1976; Weiss, 2002), and transformational leadership strengthens the perceived purpose and relational support that employees incorporate into such judgments, so higher quality leadership should produce more favorable job evaluations (Bass & Riggio, 2005; Chen et al., 2022). In architecture and engineering consultancy settings, this direct pathway is especially relevant because of deadline pressure, temporary coordination, and client-specific demands, which can weaken employees' sense that their work is coherently directed and professionally valued across project cycles (Fareed et al., 2022; Goetz & Wald, 2022). Empirical studies support this reasoning, showing that transformational leadership predicts job satisfaction through trust, team cohesion, and supportive leader-follower exchange in project-based and professionally specialized contexts (Tummers & Bakker, 2021; Chen et al., 2022; Fareed et al., 2022; Siswanto & Yuliana, 2022). **H_3: Transformational Leadership is Positively Associated with Job Satisfaction.**

2.2.4. Transformational Leadership as A Boundary Condition for Physical Work Environment

Herzberg's two-factor theory treats physical conditions as hygiene factors whose evaluative contribution is realized only when employees perceive those conditions as adequate for performing their work (Herzberg et al., 1959). In project-based consultancy settings, this perceptual activation is not automatic because coordination pressure, deadline intensity, and shifting client demands can divert attention from the daily work environment and reduce the evaluative weight attached to contextual conditions (Samimi & Sydow, 2021; Goetz & Wald, 2022). Transformational leadership can counter this attentional fragmentation through core behaviors such as inspirational motivation, idealized influence, individualized consideration, and intellectual stimulation: these behaviors connect day-to-day physical conditions to collective purpose, signal that employees' working conditions matter organizationally, and encourage reflection on how the physical environment supports effective professional performance (Bass & Riggio, 2005; Piccolo & Colquitt, 2006). Through this evaluative framing, transformational leadership should strengthen the extent to which employees derive satisfaction from adequate physical conditions, a pattern consistent with evidence that leadership shapes the attitudinal value employees derive from the job resources available to them (Tummers & Bakker, 2021; Nielsen et al., 2023). **H_4: Transformational Leadership Strengthens the Positive Relationship Between Physical Work Environment and Job Satisfaction, Such That the Relationship is Stronger at Higher Levels of Transformational Leadership.**

2.2.5. Transformational Leadership as A Boundary Condition for Job Design

The job characteristics model acknowledges that the motivating potential of enriched task characteristics depends in part on enabling conditions that enable employees to engage with those features purposefully (Hackman & Oldham, 1976). Transformational leadership supplies those enabling conditions by reinforcing purpose, building confidence, and directing developmental attention toward the discretion and feedback already embedded in the work (Bass & Riggio, 2005; Piccolo & Colquitt, 2006). In project-based architecture and engineering consultancies, client revisions, tight deadlines, and coordination demands can reduce the practical value of discretion and fragment the meaning of task roles, making leadership support especially consequential for sustaining the motivational activation of job design features (Samimi & Sydow, 2021; Goetz & Wald, 2022). Transformational leaders help employees engage more fully with enriched tasks by reinforcing the significance of their contributions, encouraging reflective problem-solving under shifting demands, and framing autonomy as a professional growth opportunity rather than a source of uncertainty (Piccolo & Colquitt, 2006; Wojtczuk-Turek, 2022; Pan et al., 2024). Existing studies confirm that transformational leadership strengthens employees' purposeful engagement with job resources and supports more active use of autonomy and feedback under changing work conditions (Tummers & Bakker, 2021; Teetzen et al., 2022). **H_5: Transformational Leadership Strengthens the Positive Relationship Between Job Design and Job Satisfaction, Such That the Relationship is Stronger at Higher Levels of Transformational Leadership.**

Drawing on Herzberg's two-factor theory and the job characteristics model, this study proposes that job satisfaction reflects both hygiene-related working conditions in the physical work environment and motivational features embedded in job design

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(Herzberg et al., 1959; Hackman & Oldham, 1976). Building on recent work-design and leadership scholarship, the model further proposes that transformational leadership is directly associated with job satisfaction and also acts as a boundary condition that strengthens the relationships of physical work environment and job design with job satisfaction (Bass & Riggio, 2005; Piccolo & Colquitt, 2006; Tummers & Bakker, 2021). Figure 1 presents the conceptual framework and the five hypothesized paths.

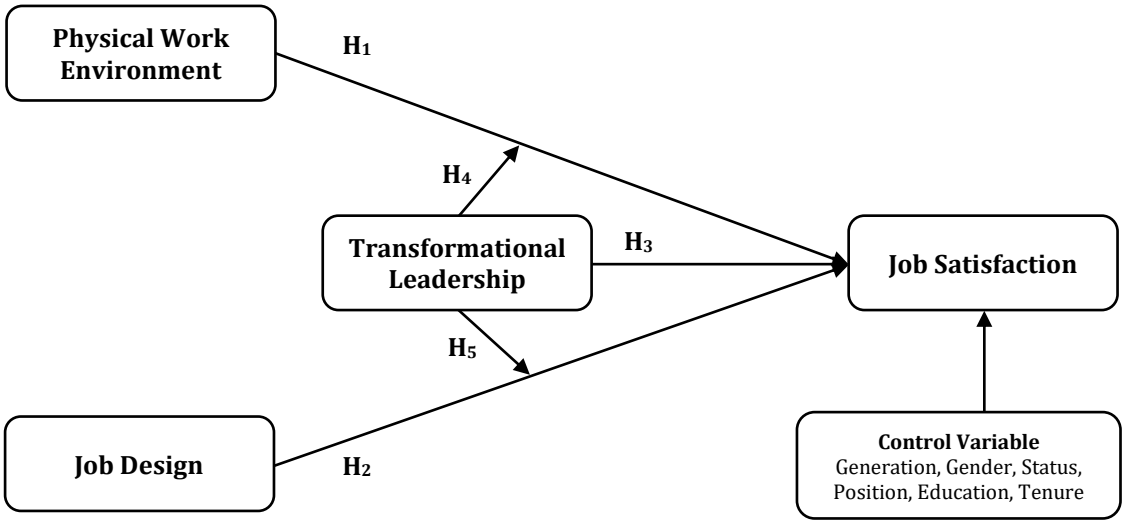

Figure 1. Research Framework

3. Research Methods

3.1. Population and Sampling Method

This study was conducted at BITA Group, an Indonesian architecture and engineering consultancy, using a quantitative two-wave time-lagged census survey design. The eligible population comprised 193 architecture and engineering professionals, and 181 responded to the first-wave survey. A total of 174 respondents completed both waves and were successfully matched through unique codes, yielding a final matched response rate of 90.2 percent of the eligible population. The first wave measured physical work environment and job design, whereas the second wave, administered four weeks later, measured transformational leadership and job satisfaction. This temporal separation was used to reduce same-wave common method concerns and to strengthen temporal ordering relative to single-wave survey designs (Bozionelos & Simmering, 2022; Podsakoff et al., 2024). The final sample size also exceeded contemporary expectations for a variance-based structural equation model with multiple direct and interaction paths (Becker et al., 2023; Guenther et al., 2023).

3.2. Measures

All focal constructs were measured with established scales. Table 1 summarises the parcel structure, the number of source items, and a representative paraphrased translated item stem for each parcel. Unless otherwise noted, responses were recorded on five-point Likert scales ranging from 1 = strongly disagree to 5 = strongly agree.

Table 1. Construct Operationalization and Paraphrased Survey Items by Parcel

Construct	Parcel Label and Code	Items	Illustrative Translated Item Stem
Physical Work Environment	Ergonomics (PWE1)	3	My chair and desk are comfortable and support my posture.

Construct	Parcel Label and Code	Items	Illustrative Translated Item Stem
	Physical Demands (PWE2)	3	My job does not require excessive physical effort.
	Work Conditions (PWE3)	5	The temperature and air quality in my workplace are generally comfortable.
	Equipment Use (PWE4)	3	This job uses specialized technology or equipment.
Job Design	Autonomy: Work Scheduling and Decision Making (JD1)	6	The job gives me discretion to arrange my work schedule.
	Autonomy: Work Methods (JD2)	3	The job gives me discretion to decide how to do my work.
	Skill Variety (JD3)	4	My job requires me to perform a variety of activities.
	Task Significance (JD4)	4	My work has an important impact on other people or project outcomes.
	Task Identity (JD5)	4	My job allows me to complete a whole and identifiable piece of work.
	Feedback From the Job (JD6)	3	The job itself provides clear information about how well I am performing.
Transformational Leadership	Intellectual Stimulation (TL_IS)	4	My leader encourages me to look at problems from different perspectives.
	Idealized Influence, Behavior (TL_IIB)	4	My leader emphasizes the importance of having a clear collective purpose.
	Inspirational Motivation (TL_IM)	4	My leader communicates an attractive vision of the future.
	Idealized Influence, Attributes (TL_IIA)	4	My leader makes me feel proud to work with them.
	Individualized Consideration (TL_IC)	4	My leader treats me as an individual and pays attention to my development.
Job Satisfaction	Intrinsic Satisfaction (JS_I)	12	My job allows me to use my abilities fully.
	Extrinsic Satisfaction (JS_E)	6	The rewards I receive are fair relative to my work responsibilities.
	General Satisfaction (JS_G)	2	Considering everything, I am satisfied with my job.

3.2.1. Physical Work Environment

Physical work environment (PWE) was operationalized using the work design questionnaire (WDQ) work context characteristics, which capture ergonomics, physical demands, work conditions, and equipment use (Morgeson & Humphrey, 2006). This operationalization was selected because the study conceptualizes the physical work environment as the material and contextual conditions in which professional work is performed, rather than as a broad, omnibus work-environment construct. Recent studies continue to use WDQ contextual characteristics to examine

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work-related well-being and job attitudes in professional and knowledge-intensive settings (Kwiotkowska & Gębczyńska, 2022; Montañez-Juan et al., 2023).

3.2.2. Job Design

Job design (JD) was measured using the WDQ task characteristics, covering autonomy, skill variety, task significance, task identity, and feedback from the job (Morgeson & Humphrey, 2006). This specification is consistent with the job characteristics model and with recent work design evidence showing that these task characteristics remain central predictors of employee attitudes and well-being (Carter et al., 2024; Parker & Knight, 2024). In project-based consultancy work, these characteristics are especially relevant because discretion, task meaning, and feedback can fluctuate across project phases and client constraints (Samimi & Sydow, 2021; Goetz & Wald, 2022). Humphrey et al. (2007) state meta-analysis further confirms that WDQ task characteristics are robustly associated with job satisfaction across organizational contexts, providing additional empirical support for using these task dimensions to examine job design effects in the present sample.

3.2.3. Transformational Leadership

Transformational leadership (TL) was measured using the multifactor leadership questionnaire (MLQ) 5X-short, covering intellectual stimulation, idealized influence, inspirational motivation, and individualized consideration (Bass & Avolio, 1995; Bass & Riggio, 2005). The MLQ remains one of the most widely used instruments in leadership research, and recent studies continue to support its use across national and organizational contexts while emphasizing the importance of reporting measurement quality in the study sample (Batista-Foguet et al., 2021; Bajcar & Babiak, 2022).

3.2.4. Job satisfaction

Job satisfaction (JS) was measured using the Minnesota Satisfaction Questionnaire (MSQ) short form, which captures intrinsic, extrinsic, and general satisfaction facets (Weiss et al., 1967). This instrument remains widely used in organizational research and has shown acceptable construct validity and reliability in translated and non-United States samples, making it suitable for the present context (Mardanov, 2021; Pana et al., 2025). Consistent with the parcel structure used in the study, job satisfaction was modeled using intrinsic, extrinsic, and general satisfaction parcels.

3.3. Parceling Procedure

To improve model parsimony while preserving content coverage, indicators were aggregated into theory-consistent parcels before a partial least squares-structured equation model (PLS-SEM). Parceling was applied only to reflective constructs with conceptually coherent item content and only after item-level screening supported internal consistency and factorability, consistent with current parceling guidance (Lee & Whittaker, 2021; Little et al., 2022). Screening was conducted in SPSS and included item-total correlations, corrected item-total correlations, Cronbach's alpha, Kaiser-Meyer-Olkin (KMO), Bartlett tests, and exploratory factor loadings. Parcels were then formed to represent the intended theoretical facets rather than to optimize model fit.

3.4. Control Variables

Following current guidance, control variables were included only when theoretically relevant and plausibly related to heterogeneity in job satisfaction (Li, 2021). The model controlled for gender, educational level, employment status, generational cohort, organizational tenure, and organizational position. These variables were retained for transparency and to reduce the risk that the focal relationships merely reflected demographic or organizational composition rather than substantive effects on work design and leadership. In the PLS-SEM, each control was represented as a single-indicator construct with the loading fixed at 1.00. Accordingly, bootstrap significance tests for their outer loadings are not substantively informative.

3.5. Analytical Approach and Decision Criteria

The hypotheses were tested using partial least squares structural equation modeling in SmartPLS with 5.000 bootstrap resamples. PLS-SEM was appropriate because the study emphasized explained variance and moderation testing in a parcel-based model with multiple direct and interaction paths (Becker et al., 2023; Guenther et al., 2023; Ringle et al., 2023). The measurement model was evaluated using outer loadings, Cronbach's alpha, composite reliability, average variance extracted, and heterotrait-monotrait (HTMT) ratios. Indicator reliability was considered adequate when reflective outer loadings reached or exceeded 0.7. Internal consistency was judged satisfactory when both Cronbach's alpha and composite reliability surpassed 0.70. Convergent validity was assessed using average variance extracted (AVE) values above 0.5 and discriminant validity was assessed using HTMT ratios against established conservative benchmarks (Guenther et al., 2023; Cheung et al., 2024). The structural model was assessed using path coefficients, t-statistics, p-values, bootstrap confidence intervals, f^2 effect sizes, R^2, and predictive performance via PLS predict and Q^2predict (Shmueli et al., 2019; Becker et al., 2023). Common method concerns were addressed procedurally through the two-wave design and diagnostically through collinearity checks, with such diagnostics treated as supplementary rather than definitive evidence against material common method bias (Kock et al., 2021; Bozionelos & Simmering, 2022; Podsakoff et al., 2024). Significant interaction terms were further interpreted using simple slopes at low, mean, and high levels of transformational leadership.

4. Results and Discussion

4.1. Respondent Profile and Preliminary Information

This section reports results for the matched two-wave sample of 174 respondents drawn from an Indonesian architecture and engineering consultancy. Table 2 presents the characteristics of respondents. The matched sample represents 90.2 percent of the eligible population (N = 193), which indicates strong organizational coverage for a census-based design. The sample was dominated by Generation Y (46.6 percent) and Generation Z (44.8 percent), with male respondents accounting for 78.2 percent. Most respondents held bachelor's degrees (72.4 percent), worked under contract status (64.9 percent), and occupied staff-level positions (76.5 percent). Organizational tenure was widely distributed, with 32.2 percent reporting more than 10 years of service and 28.7 percent reporting 6 to 10 years, indicating the presence of both early-career and experienced professionals in the sample.

No missing values remained in the matched dataset after data cleaning. As a supplementary diagnostic, full collinearity variance inflation factors were inspected to assess whether severe collinearity was likely to distort the structural estimates. The VIF values ranged from 1.02 to 1.77, indicating that multicollinearity was unlikely in the structural model. This check should be interpreted cautiously as an additional indication

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rather than a definitive test of common method bias, which was addressed primarily through the two-wave design and temporal separation between predictors and outcomes (Kock et al., 2021; Bozionelos & Simmering, 2022; Podsakoff et al., 2024).

Table 2. Sample Characteristics of Matched Two-Wave Survey Respondents

Characteristic	Category	Frequency	Percentage
Generational Cohort	Gen X	15	8.6
	Gen Y	81	46.6
	Gen Z	78	44.8
Gender	Male	136	78.2
	Female	38	21.8
Employment Status	Contract	113	64.9
	Permanent	61	35.1
Educational Level	Secondary	27	15.5
	Diploma	5	2.9
	Bachelor	126	72.4
	Master	16	9.2
Organizational Position	Staff	133	76.5
	Supervisor	30	17.2
	Manager	11	6.3
Organizational Tenure	Less than 1 year	11	6.3
	1–2 years	26	15
	3–5 years	31	17.8
	6–10 years	50	28.7
	More than 10 years	56	32.2

4.2. Descriptive Statistics, Measurement Model, and Discriminant Validity

4.2.1. Descriptive Statistics and Correlations

Table 3 presents the means, standard deviations, and bivariate correlations of the study constructs. Job satisfaction recorded the highest mean (3.07), followed by transformational leadership (2.99), job design (2.98), and physical work environment (2.97). The standard deviations ranged from 0.47 to 0.53, indicating moderate dispersion around the mean values. Job satisfaction was positively correlated with physical work environment (r = 0.34), job design (r = 0.53), and transformational leadership (r = 0.15), with the strongest bivariate association observed between job design and job satisfaction. These descriptive patterns are consistent with the subsequent structural results, although the structural model provides a more appropriate test because it estimates all direct, moderating, and control relationships simultaneously. The near-zero and slightly negative bivariate correlations among the three predictors (r = -0.10 for PWE-JD; r = -0.07 for PWE-TL; r = -0.02 for JD-TL) suggest that physical work environment, job design, and transformational leadership are empirically distinct in this sample, consistent with the discriminant validity evidence in Table 5. These low inter-predictor correlations also reduce concerns about multicollinearity in the structural model, as supported by the VIF diagnostics reported below.

Table 3. Descriptive statistics and correlations

Construct	Mean	SD	1	2	3	4
Physical Work Environment	2.97	0.53	1.00			
Job Design	2.98	0.51	-0.10	1.00		
Transformational Leadership	2.99	0.50	-0.07	-0.02	1.00	
Job Satisfaction	3.07	0.47	0.34	0.53	0.15	1.00

4.2.2. Measurement Model: Parcel-Level Outer Loadings, Reliability, and Convergent Validity

The indicators in the PLS-SEM model were parcels rather than individual survey items. Accordingly, the loadings reported in this section are parcel-level outer loadings rather than item-level validity coefficients. This distinction is important because the parcel structure reflects prior item-level screening and aggregation, whereas the PLS-SEM model itself uses facet-representative parcel indicators. As shown in Figure 2 and Table 4, all parcel loadings exceeded 0.80, which indicates satisfactory indicator reliability according to contemporary reporting guidance for variance-based PLS-SEM (Becker et al., 2023; Guenther et al., 2023; Cheung et al., 2024).

Internal consistency reliability was also supported. Cronbach's alpha ranged from 0.859 to 0.946, and composite reliability ranged from 0.914 to 0.957, both exceeding the conventional 0.70 threshold. Convergent validity was satisfactory, with average variance extracted values ranging from 0.744 to 0.787, indicating that each latent construct explained more than half of the variance in its parcel indicators. In sum, these results support the reliability and convergent validity of the four focal constructs in line with recent best-practice recommendations for structural equation modeling (Becker et al., 2023; Cheung et al., 2024).

Table 4. Parcel-Level Outer Loadings, Convergent Validity, and Reliability

Construct	Parcel Indicators Used In SEM	Outer Loading	Cronbach's Alpha	Composite Reliability	AVE
Physical Work Environment	PWE1	0.892	0.892	0.925	0.754
	PWE2	0.857			
	PWE3	0.872			
	PWE4	0.852			
Job Design	JD1	0.916	0.946	0.957	0.787
	JD2	0.874			
	JD3	0.894			
	JD4	0.877			
	JD5	0.906			
	JD6	0.853			
Transformational Leadership	TL_IS	0.851	0.916	0.936	0.744
	TL_IIB	0.903			
	TL_IM	0.836			
	TL_IIA	0.901			
	TL_IC	0.818			
Job Satisfaction	JS_I	0.925	0.859	0.914	0.780
	JS_E	0.916			
	JS_G	0.804			

Figure 2 presents the SmartPLS output for the full measurement and structural models. All parcel indicators loaded above the recommended threshold, with outer loadings ranging from 0.804 to 0.925. The figure also displays the estimated structural paths from physical work environment, job design, and transformational leadership to job satisfaction, together with the two interaction terms and the R^2 value of 0.557 for the endogenous construct. Seven single-indicator control variables are included with abbreviated labels: Gen (Gender), Gen_Y (Generation Y), Gen_Z (Generation Z), Ten (tenure), Pos (Position), ES (Employment Status), and Edu (Education Level), each represented by a single-indicator path fixed at 1.00.

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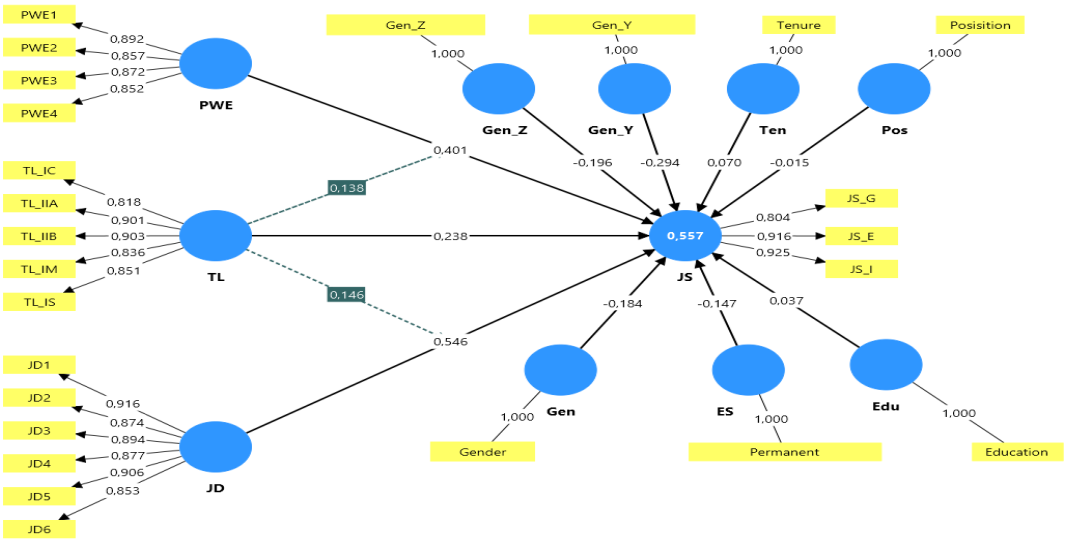

Figure 2. Measurement and Structural Model

4.2.3. Discriminant Validity

Discriminant validity was assessed using the HTMT ratio. Recent guidance for variance-based structural equation modeling recommends HTMT as a sensitive criterion for detecting discriminant validity problems. As shown in Table 5, all HTMT values were below the conservative threshold of 0.90, with the highest value observed for the relationship between job design and job satisfaction (0.593). These results indicate that the four constructs were empirically distinct from one another (Guenther et al., 2023; Cheung et al., 2024).

Table 5. HTMT Ratio Matrix

Construct	PWE	JD	TL	JS
Physical work environment (PWE)	-			
Job design (JD)	0.106	-		
Transformational leadership (TL)	0.103	0.077	-	
Job satisfaction (JS)	0.391	0.593	0.177	-

4.3. Structural Model and Hypothesis Testing

The structural model was estimated using 5.000 bootstrap resamples. Table 6 summarises the path coefficients, bootstrap confidence intervals, effect sizes, and decision outcomes for all five hypotheses. This estimation approach is consistent with recent guidance for moderation testing and significance assessment in variance-based SEM (Becker et al., 2023; Guenther et al., 2023).

Consistent with the first hypothesis, the physical work environment was positively associated with job satisfaction ($\beta = 0.401$, $t = 7.47$, $p < 0.001$, 95% CI [0.293, 0.505], $f^2 = 0.346$). This effect was statistically significant and substantively strong. Consistent with the second hypothesis, job design was positively associated with job satisfaction ($\beta = 0.546$, $t = 11.46$, $p < 0.001$, 95% CI [0.445, 0.632], $f^2 = 0.625$). This was the strongest direct effect in the model. Consistent with the third hypothesis, transformational leadership was directly and positively associated with job satisfaction ($\beta = 0.238$, $t = 3.96$, $p < 0.001$, 95% CI [0.092, 0.331], $f^2 = 0.121$), indicating that leadership contributed to job satisfaction above and beyond the two work-design predictors.

The moderation results also supported the proposed boundary-condition logic. Consistent with the fourth hypothesis, transformational leadership strengthened the

positive relationship between physical work environment and job satisfaction (β = 0.138, t = 2.18, p = 0.029, 95% CI [0.022, 0.268], f^2 = 0.036). Consistent with the fifth hypothesis, transformational leadership strengthened the positive relationship between job design and job satisfaction (β = 0.146, t = 2.68, p = 0.007, 95% CI [0.045, 0.255], f^2 = 0.045). Both interaction effects were statistically significant but small in magnitude, consistent with the expectation that moderation effects in organizational research are often incremental rather than large in absolute size (Finsaas & Goldstein, 2021; Becker et al., 2023). The model explained 55.7 percent of the variance in job satisfaction (R^2 = 0.557; adjusted R^2 = 0.524), indicating substantial explanatory power. Model fit indices were acceptable for PLS-SEM reporting, with SRMR = 0.049 and NFI = 0.858. None of the control variables reached conventional significance levels.

Table 6. Structural Model Results for Job Satisfaction

Path	β	t	p	95% CI	f^2	Decision
Main effects						
Physical Work Environment to Job Satisfaction	0.401	7.47	0.001	[0.293, 0.505]	0.346	Supported
Job Design to Job Satisfaction	0.546	11.46	0.001	[0.445, 0.632]	0.625	Supported
Transformational Leadership and Job Satisfaction	0.238	3.96	0.001	[0.092, 0.331]	0.121	Supported
Physical Work Environment × Transformational Leadership to Job Satisfaction	0.138	2.18	0.029	[0.022, 0.268]	0.036	Supported
Job Design × Transformational Leadership to Job Satisfaction	0.146	2.68	0.007	[0.045, 0.255]	0.045	Supported
Controls						
Education to Job Satisfaction	0.037	0.56	0.576	[−0.095, 0.162]	0.002	Not significant
Employment Status to Job Satisfaction	−0.147	0.91	0.363	[−0.451, 0.169]	0.006	Not significant
Gender to Job Satisfaction	−0.184	1.31	0.190	[−0.461, 0.089]	0.012	Not significant
Generation Y to Job Satisfaction	−0.294	1.80	0.071	[−0.598, 0.042]	0.012	Not significant
Generation Z to Job Satisfaction	−0.196	0.80	0.421	[−0.672, 0.286]	0.003	Not significant
Position to Job Satisfaction	−0.015	0.23	0.820	[−0.146, 0.107]	0.000	Not significant
Tenure to Job Satisfaction	0.070	0.75	0.455	[−0.119, 0.248]	0.004	Not significant

4.4. Discussion

All five focal hypotheses were supported, whereas none of the control variables reached conventional significance levels. Herzberg's two-factor theory, the job characteristics model, and transformational leadership theory provide the basis for interpreting why these positive direct and moderating relationships emerged, why job

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design showed the strongest direct effect, and why the two interaction effects, although statistically significant, were comparatively modest (Herzberg et al., 1959; Hackman & Oldham, 1976; Bass & Riggio, 2005).

4.4.1. Physical Work Environment and Job Satisfaction

Herzberg's two-factor theory predicts that adequate physical conditions stabilize job satisfaction by removing environmental barriers to effective professional work (Herzberg et al., 1959). Consistent with this prediction, the physical work environment showed a substantial positive effect on job satisfaction in the present model ($\beta = 0.401$; $f^2 = 0.346$). In architecture and engineering consultancy work, ergonomics, work conditions, and reliable equipment function as the material infrastructure through which design expertise is exercised under sustained concentration and deadline pressure. When these conditions are adequate, employees can perform their work with lower physical and cognitive strain and are more likely to evaluate their job as workable and sustainable (Herzberg et al., 1959; Abdolmaleki et al., 2024).

The strength of this effect is understandable in a technically demanding, project-based setting. Here, physical conditions do more than prevent dissatisfaction in an abstract sense; they preserve the everyday material conditions required for concentrated professional work across repeated project cycles (Herzberg et al., 1959; Goetz & Wald, 2022). This reading is consistent with built-environment research showing that ergonomic adequacy, thermal comfort, and workspace usability are positively associated with job satisfaction and professional well-being in comparable knowledge-intensive settings (Markkanen & Herneoja, 2024; Felgueiras et al., 2025; Indergård & Hansen, 2025).

The finding also supports the value of modeling the physical work environment through specific WDQ work-context facets rather than a single omnibus indicator. Ergonomics, physical demands, work conditions, and equipment use capture distinct material dimensions that professionals experience as consequential in different ways (Morgeson & Humphrey, 2006; Humphrey et al., 2007). In this setting, favorable physical conditions stabilize satisfaction by preserving the material conditions required for sustained knowledge work, rather than merely making the workplace more comfortable (Herzberg et al., 1959; Goetz & Wald, 2022). Contemporary work design scholarship reinforces this subdimension-level approach to contextual work features (Carter et al., 2024; Parker & Knight, 2024).

4.4.2. Job Design and Job Satisfaction

The job characteristics model predicts that task characteristics should be the primary direct driver of job satisfaction because they generate active intrinsic engagement rather than merely preventing dissatisfaction (Herzberg et al., 1959; Hackman & Oldham, 1976). Consistent with this theoretical ordering, job design produced the strongest direct effect in the model ($\beta = 0.546$; $f^2 = 0.625$). In project-based consultancy work, shifting client demands, tight deadlines, and interdependent coordination can erode task ownership, narrow discretion, and interrupt feedback cycles. Under such conditions, enriched job design becomes especially valuable because it restores the psychological conditions that enable employees to evaluate their work positively (Samimi & Sydow, 2021; Goetz & Wald, 2022).

This pattern follows directly from the model's motivational logic. Enriched job design restores professional control, reconnects effort to meaningful project outcomes, and maintains performance clarity when project complexity would otherwise obscure it (Hackman & Oldham, 1976; Humphrey et al., 2007). Meta-

analytic evidence supports this interpretation by showing that autonomy, task significance, and feedback remain among the most robust antecedents of job satisfaction across organizational settings (Humphrey et al., 2007; Carter et al., 2024; Parker & Knight, 2024).

The stronger effect of job design relative to physical work environment and transformational leadership indicates that the motivational core of the job remains central even in a setting characterized by temporality, coordination pressure, and client-specific demands (Hackman & Oldham, 1976; Parker & Knight, 2024). Project complexity does not reduce the relevance of core task characteristics; instead, it makes them more valuable, because well-designed jobs help employees maintain meaning, responsibility, and evaluative clarity under conditions that could otherwise narrow discretion and fragment work identity (Samimi & Sydow, 2021; Goetz & Wald, 2022).

4.4.3. Transformational Leadership and Job Satisfaction

Transformational leadership theory predicts a direct positive effect on job satisfaction because leader behaviors that articulate a compelling vision, provide individualized consideration, and encourage intellectual engagement strengthen followers' sense of purpose, confidence, and perceived contribution significance, which employees incorporate into their overall evaluation of the job (Locke, 1976; Bass & Riggio, 2005). Consistent with this expectation, transformational leadership showed a significant positive direct effect on job satisfaction ($\beta = 0.238$; $f^2 = 0.121$). In architecture and engineering consultancy settings, temporary coordination, deadline pressure, and shifting client requirements can weaken employees' sense that their work is coherently directed and professionally valued; leaders who provide direction and developmental attention can therefore restore that evaluative foundation directly and independently of structural work features (Bass & Riggio, 2005; Fareed et al., 2022; Goetz & Wald, 2022).

This interpretation is supported by recent evidence linking transformational leadership to job satisfaction through trust-based and relational mechanisms, including employee relations climate, team cohesion, and supportive leader-follower exchange (Tummers & Bakker, 2021; Chen et al., 2022; Fareed et al., 2022; Siswanto & Yuliana, 2022). In this context, leadership matters not only because it strengthens the value of structural work features, but also because it directly shapes how employees experience the social and developmental quality of their work environment (Bass & Riggio, 2005; Tummers & Bakker, 2021; Chen et al., 2022; Fareed et al., 2022).

The comparatively smaller direct coefficient of transformational leadership ($\beta = 0.238$) relative to physical work environment ($\beta = 0.401$) and job design ($\beta = 0.546$) is theoretically informative rather than incidental (Bass & Riggio, 2005). The leadership contributes both directly and by shaping employees' perceptions of work conditions and task characteristics, so the direct coefficient captures only one part of its overall influence on job satisfaction (Piccolo & Colquitt, 2006; Teetzen et al., 2022). The smaller coefficient should therefore not be interpreted as evidence that leadership is a weak antecedent, but rather as an indication that its influence operates through multiple interconnected routes in project-based professional service work (Tummers & Bakker, 2021; Teetzen et al., 2022).

4.4.4. Transformational Leadership as A Boundary Condition for Physical Work Environment

Herzberg's Two-Factor Theory posits that the satisfaction value of physical conditions depends on whether employees perceive them as adequate for effective

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professional work, and transformational leadership is relevant because it can shape that evaluation (Herzberg et al., 1959; Bass & Riggio, 2005). In the present study, the positive association between physical work environment and job satisfaction became stronger when transformational leadership was higher (β = 0.138; f^2 = 0.036). The conditional slope increased from 0.398 at low transformational leadership to 0.670 at high transformational leadership, indicating that employees derived more satisfaction from the same level of physical conditions when leadership quality was stronger. In project-based consultancy work, this pattern is plausible because leaders can connect day-to-day physical conditions to collective purpose, signal that those conditions matter organisationally, and encourage employees to reflect on how their environment supports effective professional work (Bass & Riggio, 2005; Piccolo & Colquitt, 2006).

Adjacent leadership research supports this interpretation. Transformational leadership has been shown to shape employees' attitudinal responses through trust, support, and positive evaluative climates, particularly in demanding and interdependent work settings (Tummers & Bakker, 2021; Chen et al., 2022). Related evidence also suggests that transformational leadership can strengthen favorable employee responses under pressure and during temporary organizing, consistent with the argument that leadership can amplify the evaluative benefits employees derive from supportive physical conditions in project-based consultancy work (Fareed et al., 2022; Nielsen et al., 2023).

The relatively small effect size is also theoretically understandable. Under Herzberg's hygiene logic, physical conditions primarily prevent dissatisfaction rather than generate strong positive satisfaction, which limits the extent to which leadership can amplify their evaluative effect (Herzberg et al., 1959). In addition, the physical work environment already exerted a substantial direct effect in this sample, so the remaining variation available for leadership to strengthen was necessarily narrower. This reading is consistent with organizational research showing that moderation effects are typically smaller than main effects because moderators strengthen existing relationships rather than replace them (Finsaas & Goldstein, 2021; Becker et al., 2023). The finding, therefore, suggests that physical conditions and transformational leadership are complementary influences on job satisfaction: leadership does not substitute for ergonomic support, work conditions, or fit-for-purpose equipment, but it increases the likelihood that employees will experience those conditions as supportive of effective professional work rather than as an unnoticed background feature of the workplace (Bass & Riggio, 2005; Tummers & Bakker, 2021).

4.4.5. Transformational Leadership as A Boundary Condition for Job Design

The job characteristics model posits that enriched task characteristics lead to greater job satisfaction when employees can engage with these features in a purposeful, developmentally meaningful way, and that transformational leadership can help create these conditions (Hackman & Oldham, 1976; Bass & Riggio, 2005). In the present study, the positive relationship between job design and job satisfaction became stronger as transformational leadership increased (β = 0.146; f^2 = 0.045). The conditional slope rose from 0.475 at low transformational leadership to 0.616 at high transformational leadership, indicating that enriched task characteristics led to greater satisfaction as leadership quality increased. This pattern is consistent with the view that leadership helps employees realize the motivational value already embedded in their work (Piccolo & Colquitt, 2006).

In project-based consultancy work, client revisions, coordination demands, and shifting priorities can weaken the motivational value of task characteristics by reducing practical discretion and interrupting feedback cycles (Samimi & Sydow, 2021; Goetz & Wald, 2022). Transformational leaders help employees engage more fully with enriched tasks by reinforcing task significance, encouraging reflective problem-solving, and framing discretion constructively, thereby supporting the psychological activation that project disruptions can erode (Piccolo & Colquitt, 2006; Pan et al., 2024). This interpretation is also consistent with evidence that transformational leadership strengthens employees' active engagement with job resources and supports more purposeful use of autonomy and feedback under changing work conditions (Tummers & Bakker, 2021; Wojtczuk-Turek, 2022).

The modest interaction remains theoretically informative. Good job design stayed the primary direct lever of job satisfaction, but its full attitudinal value was more consistently realized when leaders reinforced purpose and constructive engagement with professional discretion (Hackman & Oldham, 1976; Pan et al., 2024). The relatively small coefficient is therefore not disappointing; rather, it indicates that leadership functions as a facilitating condition rather than the primary engine of the job design to satisfaction relationship, which is also why interaction effects of this kind are typically smaller than strong main effects in field-based organizational research (Finsaas & Goldstein, 2021; Becker et al., 2023).

4.4.6. Integrated Interpretation and Contribution

Taken together, the results support an integrated explanation of job satisfaction in project-based consultancy work. Physical work environment contributed as a hygiene-related baseline, job design emerged as the strongest direct source of satisfaction, and transformational leadership mattered both directly and as a cross-domain amplifier. This pattern is consistent with Herzberg's distinction between contextual conditions and motivational job content, with the job characteristics model's emphasis on the psychological value of enriched task characteristics, and with transformational leadership theory's argument that leaders shape how followers interpret demanding work situations (Herzberg et al., 1959; Hackman & Oldham, 1976; Bass & Riggio, 2005).

The study therefore contributes in three linked ways. First, it shows that transformational leadership can function as a simultaneous boundary condition across both the physical work environment and job design within a single model, rather than being examined only in relation to one work-design domain. Second, it extends these arguments to an Indonesian architecture and engineering consultancy, a theoretically relevant setting because it combines knowledge intensity, temporary organizing, and strong coordination demands, yet remains underrepresented in the literature (Samimi & Sydow, 2021; Goetz & Wald, 2022; Abdolmaleki et al., 2024). Third, by modelling transformational leadership as both a direct predictor and a moderator within a single model, the study provides a more complete account of how leadership shapes job satisfaction in professional service settings, showing that leadership contributes both through its own relational and motivational properties and through the conditional value it adds to structural work features (Tummers & Bakker, 2021; Chen et al., 2022; Fareed et al., 2022).

Although none of the control variables reached conventional significance levels, this result does not weaken the focal findings. Recent methodological literature indicates that control variables should be theory-driven, causally justified, and reported transparently because inappropriate controls may introduce bias rather than

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reduce it (Li, 2021; Shiau et al., 2024; Mändli & Rönkkö, 2025; Hünermund et al., 2025; Hünermund & Louw, 2025). In this study, the controls were included as adjustment factors rather than as focal predictors. Their non-significance is therefore consistent with the interpretation that the observed effects of physical work environment, job design, and transformational leadership on job satisfaction were not simply attributable to demographic or organizational composition, while the coefficients of the controls themselves should not be overinterpreted as substantive findings (Li, 2021; Hünermund & Louw, 2025; Mändli & Rönkkö, 2025).

A practical implication of this overall pattern is that retention-oriented management in project-based professional service firms should not rely on a single intervention lever. Improvements in physical work conditions help stabilize baseline conditions for effective work; enriched job design provides the strongest direct route to higher job satisfaction; and transformational leadership increases the likelihood that employees will derive value from both domains simultaneously. In practice, this means that firms are more likely to sustain satisfaction when work design, physical conditions, and leadership development are treated as complementary managerial priorities rather than as separate agendas (Bass & Riggio, 2005; Carter et al., 2024; Parker & Knight, 2024).

5. Conclusion

This study examined whether physical work environment, job design, and transformational leadership were positively associated with job satisfaction, and whether transformational leadership strengthened the effects of physical work environment and job design on job satisfaction in an Indonesian architecture and engineering consultancy. Using a two-wave time-lagged design and PLS-SEM, all five hypotheses were supported. Consistent with Herzberg's two-factor theory and the job characteristics model, physical work environment and job design were positively associated with job satisfaction, with job design showing the stronger direct relationship (Herzberg et al., 1959; Hackman & Oldham, 1976). Consistent with transformational leadership theory, transformational leadership was also directly associated with job satisfaction and strengthened the positive relationships between the physical work environment and job design and job satisfaction (Bass & Riggio, 2005). Both interaction effects were statistically significant but modest in magnitude, indicating incremental rather than transformative amplification of the work-design effects in this setting. Taken together, these results suggest that, within this project-based Indonesian architecture and engineering consultancy, job satisfaction is shaped not only by structural work conditions and task design but also by the quality of leadership under which those work features are experienced, a pattern that future multi-site research should test for generalisability across other firms and national contexts.

The study contributes to the literature in three ways. First, this study provides initial single-site evidence that transformational leadership can operate simultaneously as a cross-domain boundary condition, amplifying the satisfaction returns of both hygiene-related physical work conditions and motivational task characteristics within a single model. This moves beyond designs that examine leadership moderation in only one work-design domain (Piccolo & Colquitt, 2006; Tummers & Bakker, 2021), whereas the single-firm design means that cross-domain generalisability has yet to be established through multi-site replication. Second, the findings are consistent with the applicability of Herzberg's two-factor theory and the job characteristics model in an Indonesian project-based architecture and engineering consultancy, indicating that these foundational frameworks retain explanatory value in knowledge-intensive, coordination-intensive settings characterized by temporality and client-specific demands (Herzberg et al., 1959; Hackman & Oldham, 1976; Carter et al., 2024; Parker

& Knight, 2024). Whether this applicability holds at comparable effect magnitudes across other national and organizational contexts remains an empirical question for future multi-firm research. Third, by modelling transformational leadership as both a direct predictor and a moderator, the study offers a more complete account of how leadership shapes job satisfaction than models that include only one of these pathways, which is consistent with recent calls to capture leadership influence through multiple relational and motivational routes (Bass & Riggio, 2005; Tummers & Bakker, 2021; Chen et al., 2022; Fareed et al., 2022).

The findings also offer practical implications for project-based architecture and engineering consultancies. The job design showed the strongest direct relationship with job satisfaction, managers should prioritize task-related interventions that preserve discretion in work methods, maintain skill variety, clarify task significance, and strengthen developmental feedback. These practices are consistent with recent evidence showing that enriched task characteristics remain central to employee well-being and positive work attitudes in professional and knowledge-intensive settings (Samimi & Sydow, 2021; Carter et al., 2024; Parker & Knight, 2024). At the same time, the significant role of physical work environment indicates that adequate ergonomics, comfortable work conditions, and fit-for-purpose equipment remain necessary baseline conditions for sustaining positive job evaluations, particularly in design-intensive and deadline-driven work (Markkanen & Herneoja, 2024; Felgueiras et al., 2025; Indergård & Hansen, 2025). Finally, the direct and moderating effects of transformational leadership suggest that leadership development should be treated as a complementary intervention rather than a separate initiative. Cultivating project leaders capable of articulating clear direction, attending to individual growth needs, and encouraging analytical engagement may therefore serve a dual retention function: elevating satisfaction independently while simultaneously magnifying the attitudinal returns of improved task structures and physical conditions (Bass & Riggio, 2005; Fareed et al., 2022; Siswanto & Yuliana, 2022).

This study has several limitations that bound the interpretation of the findings. First, the evidence was drawn from a single Indonesian architecture and engineering consultancy, which limits external validity and means the observed pattern should not be generalized to other industries, cultural settings, or organizational forms. Second, although the two-wave time-lagged design strengthened the temporal separation between predictors and outcomes, the study still relied on self-reported survey data and therefore could not eliminate all endogeneity or response-style concerns (Bozionelos & Simmering, 2022; Podsakoff et al., 2024). In addition, although attrition between waves was minimal, with 7 of 181 usable Wave 1 respondents (3.9 percent) not completing Wave 2, no formal non-response bias analysis was conducted, and selective dropout cannot be entirely ruled out. Third, the two moderation effects were statistically significant but small in magnitude. This indicates that transformational leadership provides incremental rather than transformative amplification of work-design effects in this sample, and that the direct effects of the physical work environment, especially job design, remain the primary explanatory levers. Accordingly, the moderation results should be interpreted as meaningful but modest.

Future research should replicate the model across multiple project-based firms and across different national and industrial settings to assess whether the same cross-domain boundary-condition pattern generalizes beyond the present case. Multi-source and multi-wave designs would also strengthen causal inference by more clearly separating leader-rated and follower-rated constructs (Bozionelos & Simmering, 2022; Podsakoff et al., 2024). In addition, future studies could examine process mechanisms that may explain why transformational leadership amplifies the effects of the physical work environment and job design, such as trust, meaning-making, goal clarity, or proactive problem-solving in project transitions (Tummers & Bakker, 2021; Fareed et al., 2022). Extending the outcome domain to

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include turnover intention, retention, and project performance would also help connect job satisfaction more directly to the organizational risks and benefits that motivate work design and leadership interventions in knowledge-intensive consultancy firms (Galan, 2023; Abdolmaleki et al., 2024).

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