Global Workplace Pressures in Engineering: A Cross-Sectional Survey of Role-Based Pressures, Peer Influence, and Psychological Outcomes

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Abstract

Engineering workplace pressure is widely acknowledged as a feature of professional practice, yet the scale, distribution, and consequences of that pressure across roles, sectors, countries, and demographic groups have not been systematically documented globally. This paper presents findings from a cross-sectional survey of engineering professionals (N = 335, 25 countries), which serves as the primary dataset for a companion series examining specific mechanisms, role groups, and outcomes in depth. Seven domains are examined: structural workplace pressures, psychological outcomes, organisational culture, peer influence on professional decisions, attribution of project failure, workforce retention, and variation by gender, sector, and employment type. Role expansion is the most prevalent pressure (66%), followed by hours beyond contracted time (63%) and unrealistic expectations (58%). Forty-six per cent report feeling overwhelmed, and 45% report workplace anxiety. Commissioning engineers report the highest hours pressure of any role (86%; r = .408 vs other roles). Organisational culture varies substantially by role ($H = 48.883$, $p < .001$), with commissioning ($M = 2.90$) and operations ($M = 2.84$) reporting the poorest culture. Gender differences in structural pressure and psychological outcomes are non-significant; women report marginally better organisational culture than men ($d = 0.26$, $p = .025$). Peer-pressure-driven professional compromise is widespread across the sample: 76%–82% of respondents report quality reductions, substandard acceptance, process skipping, or rework attributable to peer pressure. Leadership and management are most often blamed for project delays (47%), while documentation failure is the most cited systemic factor (51%). Eighty-three per cent report job satisfaction, yet

37% of satisfied respondents are considering leaving their organisation — a satisfied leaver paradox in which autonomy deficit and poor organisational culture are the only independent attrition predictors ($R^2 = .142$). Oil and gas reports the highest hours, pressure, and anxiety of any sector; consulting reports the best organisational culture. Contractors report higher hours pressure than employees (M = 4.11 vs 3.54). These findings establish the empirical baseline for a companion series of papers examining specific mechanisms, subgroups, and outcomes in depth.

Keywords: *workplace pressure; engineering; peer influence; psychological outcomes; job satisfaction; intention to leave; organisational culture; gender; sector; cross-sectional survey.*

1. Introduction

Engineering is a profession organised around risk management (Perrow, 2011; Rasmussen, 1997). Engineers design, build, verify, and operate systems whose failures can harm people, damage the environment, and impose substantial economic and social costs (Leveson, 2017). The professional and regulatory frameworks governing engineering practice reflect this: licensing requirements, ethics codes, and quality management standards all assume that engineers exercise independent technical judgement and maintain professional standards regardless of project or commercial pressures (Harris et al., 2005). Yet the conditions under which engineers actually work — the hours they work, the expectations placed on them, the peer dynamics of their teams, the psychological burden they carry, and the structural pressures that shape their decisions — remain poorly documented at a systematic, cross-role, international level (Trevelyan, 2014).

The absence of such data matters in several ways. It limits understanding of the upstream drivers of engineering quality failures, which are more often attributable to conditions of practice than to individual technical error (Dekker, 2011; Reason, 1990). It makes it difficult to design effective interventions: without knowing the distribution of pressure across roles and contexts, it is impossible to target improvements where they are most needed. It obscures workforce sustainability risks: if the engineering workforce is under sustained psychological pressure and considering departure at scale, the profession needs evidence to respond. And it prevents adequate examination of whether structural conditions — not individual deficits — explain patterns in who speaks up, who stays, and who is recognised in technical work (Faulkner, 2009; Hatmaker, 2013).

This paper addresses those gaps. It presents findings from a global cross-sectional survey of engineering professionals (N = 335, 25 countries) examining workplace pressure, psychological outcomes, peer influence, organisational culture, project failure attribution, and career outcomes across roles, sectors, countries, and demographic groups. This paper serves as the parent dataset

reference for a programme of research that examines in depth the mechanisms, subgroup patterns, and workforce consequences of engineering workplace pressure. The companion series addresses specific topics — including peer pressure and professional judgement, gatekeeper roles, documentation failure, attribution bias, psychological wellbeing, and workforce attrition — each drawing on the same dataset. This paper provides the full sample profile, cross-cutting descriptive findings, and the conceptual system within which those specific analyses are situated. Readers of any companion paper are directed here for the full sample characteristics and methodological context. The specific contributions of this paper are: (1) the first cross-role, cross-sector global empirical baseline for engineering workplace pressure conditions; (2) empirical grounding for the companion study series through a documented, publicly accessible dataset; and (3) evidence of a layered pressure architecture — structural, social, cultural, and psychological — that is measurably patterned by role and sector.

The constructs examined in this paper and the companion series are conceptually related but analytically distinct. Structural pressure refers to organisational demands and constraints imposed on individuals — excessive hours, role expansion, and unrealistic expectations that exceed the terms of employment. Peer and social pressure refers to the influence of colleagues and team norms on individual professional decisions, operating through conformity, the anticipated social cost of dissent, and groupthink dynamics. Organisational culture refers to the broader workplace climate — encompassing leadership support, communication quality, treatment of mistakes, and autonomy — that either buffers or amplifies the effects of structural and social pressure. Psychological outcomes refer to the individual-level responses to this pressure system: overwhelm, anxiety, and autonomy deficit. Workforce outcomes refer to the downstream consequences for retention, engagement, and professional behaviour. These constructs form a layered system: structural pressures create the conditions within which social pressures operate, organisational culture shapes both, and the combination produces psychological and workforce outcomes. This conceptual architecture is described in Section 2.5 and illustrated in Figure 1.

This article contributes a system-level model of engineering workplace pressure that integrates structural, social, cultural, and psychological mechanisms into a single empirical architecture.

This article serves as the parent paper in a broader programme of companion studies that draw on the same dataset. It provides the complete sample characteristics, methodological context, and cross-cutting descriptive findings that underpin the mechanism-specific analyses reported elsewhere. Each companion paper examines a distinct component of the workplace-pressure system—peer influence, commissioning conditions, documentation failure, attribution patterns, psychological well-being, or workforce attrition—within the conceptual architecture outlined here. Readers of any companion paper are directed to this article for the empirical baseline and methodological reference point.

2. Literature Review

2.1 Workplace Pressure in Engineering

Research on engineering workplace conditions has concentrated in three areas: work intensity and hours in project-based settings (Lingard et al., 2012), psychological health in specific sectors such as construction and oil and gas (Håvold, 2010) and professional identity under pressure (Trevelyan, 2014). These studies consistently document elevated hours, role boundary violations, and psychological strain. What is less well established is the comparative distribution of these pressures across engineering roles, the relationship between structural pressure and peer-driven professional compromise, and whether the conditions of practice vary meaningfully across sectors, employment types, and demographic groups at a global scale.

The job demands-resources (JD-R) model provides the primary theoretical framework for this study (Bakker and Demerouti, 2007; Karasek, 1979). The model predicts that high job demands deplete psychological resources and generate strain outcomes unless buffered by adequate job resources. Organisational culture — encompassing leadership support, communication quality, treatment of mistakes, and autonomy — functions as a primary resource in the JD-R framework. The moderation hypothesis, that resources buffer the demands–strain relationship, is tested directly in this paper.

2.2 Peer Pressure and Professional Judgement

The influence of peer and team dynamics on individual professional decisions has been documented in social psychology (Asch, 1951; Cialdini, 1993; Janis, 1972), but has rarely been empirically examined at scale in engineering practice. Normalisation of deviance — the incremental accommodation of departures from correct practice under social and schedule pressure — has been identified as a mechanism in major engineering incidents (Dekker, 2011; Vaughan, 2016) but remains underexamined as a routine feature of engineering work. The present study provides systematic prevalence data on peer-pressure-driven professional compromise across a multi-role, multi-country sample.

2.3 Gender, Recognition, and Professional Authority

Research on gender in engineering has documented persistent underrepresentation of women in technical roles (UNESCO, 2021), differential access to high-visibility technical work (Faulkner, 2009; Hatmaker, 2013), and the credibility challenges that women in engineering face in establishing professional authority (Beddoes, 2013; Powell et al., 2009). Less is known about whether these patterns are reflected in self-reported psychological outcomes and workplace pressure at scale, or whether gender differences in engineering practice conditions are statistically detectable in a global sample. This paper provides the demographic baseline for companion papers that examine these questions in depth.

2.4 Workforce Retention and the Satisfaction Paradox

Engineering workforce retention is identified as a critical global challenge (Engineers Australia, 2023; RAE, 2020). High job satisfaction coexisting with departure consideration — documented in professional occupations including medicine (Shanafelt et al., 2015) and law (Dinovitzer and Garth, 2007) — suggests that satisfaction scores may be unreliable predictors of retention in professional contexts. The present study tests this directly by combining satisfaction, dysfunction, and dual departure intention measures within a single sample, distinguishing between organisational and profession-level departure intentions.

2.5 A Conceptual System of Engineering Workplace Pressure

The constructs examined in this study do not operate in isolation. Prior research has examined structural demands, social influence, organisational culture, and psychological outcomes as separate phenomena; this paper treats them as components of an interconnected system. Drawing on the JD-R model, social influence theory, and professional judgement scholarship, the system is conceptualised as follows: structural pressures — excessive hours, role expansion, and unrealistic expectations — create the conditions within which social conformity dynamics operate. Peer and team pressure then translates structural overload into behavioural compromise: process steps are skipped, sub-standard outputs are accepted, and quality is traded for speed. Organisational culture moderates both pathways — a supportive culture reduces baseline pressure exposure and may reduce the social cost of dissent — but the present study tests whether culture is sufficient to interrupt these mechanisms or merely suppresses their baseline level. The downstream consequences of this system are psychological — overwhelm, anxiety, autonomy deficit — and workforce-level: dissatisfaction, departure intention, and disengagement. Figure 1 illustrates this conceptual architecture. Each layer of the system is examined descriptively in this paper; the mechanisms within each layer are examined in the companion series.

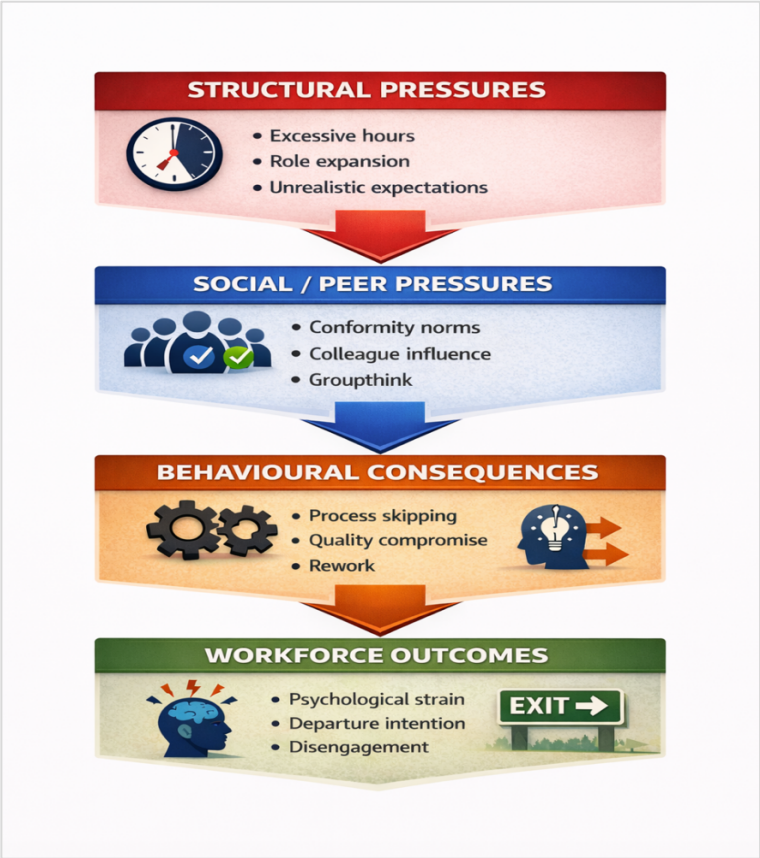

Figure 1 Conceptual System of Engineering Workplace Pressure

Note. Figure 1. Organisational culture moderates all pathways but does not interrupt the system. Each layer is examined descriptively in this paper; mechanisms are examined in the companion series.

3. Method

3.1 Study Design

Data were drawn from a global cross-sectional survey of engineering professionals conducted between January and February 2026 (N = 335) across 25 countries. One response was excluded for failing the eligibility criteria. Participants were recruited through LinkedIn, Facebook engineering groups, Reddit engineering communities, personal and professional networks, university alumni networks, and engineering association outreach. Recruitment through self-selecting online channels may over-represent professionals engaged with workplace conditions; prevalence estimates should be treated as indicative rather than representative. The study is perception-based and cross-sectional; the design identifies associations between constructs but cannot establish causal relationships, and causal language is not used in reporting findings. Ethical approval was obtained through the University of Malaysia, and all participants provided informed consent. Full methodology is documented in the companion preprint (Ayres et al., 2026).

3.2 Sample

Table 1 presents the full sample profile. Commissioning and start-up engineers constitute the largest role group (n = 81, 24%), followed by design engineers (n = 35, 10%), operations (n = 24, 7%), leadership and management (n = 22, 7%), and planning/scheduling (n = 22, 7%). The gender distribution is 68% male, 31% female. The sample spans six primary sectors: construction and infrastructure (17%), energy and utilities (16%), mining and resources (14%), oil and gas (14%), water (13%), and consulting (12%). Australia (17%), the United Kingdom (13%), Canada (10%), Indonesia (10%), and the United States (9%) are the largest national contributors across 25 countries. The sample is broadly mid-career (50% aged 25–44). Work setting is predominantly site-based (50%) or hybrid (22%). Employment type is predominantly full-time (67%), with 26% in contractor or consultant roles.

3.3 Measures

Four conceptually distinct constructs are measured, corresponding to the system layers described in Section 2.5. Structural pressure was assessed through five universal Likert items (1 = Strongly disagree to 5 = Strongly agree) covering hours beyond contracted time, unrealistic expectations, role expansion, harsh judgement, and fear of mistakes. Psychological outcomes were assessed through three items: overwhelm, workplace anxiety, and autonomy deficit. Organisational culture — the broader workplace climate distinct from acute pressure or peer dynamics — was assessed through four items covering leadership support, communication openness, treatment of mistakes, and encouragement of independence. Peer influence was assessed using items measuring the frequency with which peer pressure led to quality, substandard acceptance, process-skipping acceptance, and speed-over-quality decisions. Additional modules covered project failure attribution (multi-select blame and systemic factor items), career outcomes (job satisfaction, work–life balance, hours, and dual departure intention), and commissioning-specific items on documentation, safety, and recognition administered to the commissioning subsample (n = 81). Internal consistency for the three multi-item scales was acceptable to excellent: structural pressure (5 items, $\alpha = .78$), psychological outcomes (3 items, $\alpha = .81$), and organisational culture (4 items, $\alpha = .91$). All findings represent perceived experiences; responses reflect professional perception rather than objectively verified behaviour.

3.4 Analytical Approach

Descriptive statistics are reported for all items across the full sample and by subgroup. Cross-role, cross-sector, and cross-setting comparisons used the Mann-Whitney U test (rank-biserial r, Cohen's d as effect size measures) and the Kruskal-Wallis test. Spearman correlations examined associations between pressure and outcome items. Hierarchical OLS regression with mean-centred interaction terms examined organisational culture as a potential moderator of the pressure–psychological outcome relationship. A separate OLS regression identified independent correlates of departure intention. All tests were conducted at $\alpha = .05$. Effect sizes are reported throughout; confidence intervals are reported for regression coefficients. All statistical analyses were

conducted using JASP (Version 0.96.0; JASP Team, 2025). The cross-sectional design supports identification of associations only; no causal inferences are drawn.

4. Results

4.1 Sample Profile

Table 1. Full Sample Profile (N = 335)

Characteristic	n	%
PRIMARY ROLE		
Commissioning / Start-up	81	24%
Design Engineering	35	10%
Operations / Plant Operations	24	7%
Leadership / Management	22	7%
Planning / Scheduling / Project Controls	22	7%
Project Management	21	6%
QA/QC	20	6%
Construction / Site-based	19	6%
HSE	19	6%
Other roles (9 categories)	72	21%
SECTOR		
Construction / Infrastructure	56	17%
Energy / Utilities	53	16%
Mining / Resources	47	14%
Oil & Gas / Petrochemical	47	14%
Water	42	13%
Consulting / Professional services	40	12%
GENDER		
Man	229	68%
Woman	105	31%
Prefer not to say	1	<1%
AGE		
18–24	47	14%
25–34	83	25%
35–44	84	25%
45–54	63	19%
55–64	48	14%
65–74	10	3%

EMPLOYMENT TYPE		
Employed (full-time)	226	67%
Contractor / Consultant	88	26%
Other (part-time, self-employed, owner)	21	7%
WORK SETTING		
Mostly site-based	167	50%
Hybrid	74	22%
Mostly office-based	86	26%
HIGHEST QUALIFICATION		
Bachelor's degree	180	54%
Master's degree	58	17%
Diploma / Associate degree	55	16%
High school / secondary	27	8%
PhD / Doctorate	13	4%
TOP COUNTRIES		
Australia	56	17%
United Kingdom	44	13%
Canada	35	10%
Indonesia	34	10%
United States	31	9%
Malaysia	28	8%
India	29	9%
Nigeria	29	9%
Other (17 countries)	28	8%

Note. Percentages may not sum to 100% due to rounding. Country name variants consolidated for analysis. First career in engineering: 68% (n = 229); career changers: 29% (n = 98).

4.2 Structural Workplace Pressures

Table 2 presents the prevalence of structural workplace pressure and psychological outcome items across the full sample. These figures describe the first layer of the conceptual system outlined in Section 2.5: the structural demands that characterise engineering work before peer dynamics or organisational culture are taken into account.

Role expansion is the most prevalent pressure (66%), followed by hours beyond contracted time (63%) and unrealistic expectations (58%). These three items collectively describe a workforce in which the contracted terms of employment are routinely exceeded across two-thirds of respondents. 45% report feeling judged more harshly than peers, and 19% report fear of making mistakes—a lower figure that nonetheless indicates a non-trivial minority working under explicit performance threat.

Psychological outcomes are substantial. Forty-six per cent report feeling overwhelmed by their workload and 45% report workplace anxiety. All three structural pressure items are associated with both overwhelm and anxiety (Spearman ρ = .406–.495, all p < .001; Table 3), indicating that structural demands translate into psychological strain across all three pressure dimensions. Role expansion and unrealistic expectations show the strongest associations with psychological strain, suggesting that the boundary-violating, expectation-exceeding character of the workload is as psychologically costly as its volume alone.

Table 2. Prevalence of Workplace Pressure and Psychological Outcome Items (N = 335)

Item	M	SD	Agree+ %	Scale
STRUCTURAL PRESSURE				
Role expansion beyond original scope	3.67	1.11	66%	Likert 1–5
Pressure to work beyond contracted hours	3.67	1.09	63%	Likert 1–5
Unrealistic expectations from leadership/clients	3.42	0.89	58%	Likert 1–5
Feel judged more harshly than peers	3.21	1.01	45%	Likert 1–5
Fear of making mistakes penalised	2.63	0.99	19%	Likert 1–5
PSYCHOLOGICAL OUTCOMES				
Feeling overwhelmed by workload	3.29	0.87	46%	Likert 1–5
Workplace anxiety	3.22	0.94	45%	Likert 1–5
Lack of autonomy	3.07	1.10	37%	Likert 1–5

Note. Agree+ = proportion rating ≥ 4 (Agree or Strongly agree).

Table 3. Spearman Correlations: Structural Pressure Items and Psychological Outcomes (N = 330–335*)*

	Overwhelmed	Anxiety	Autonomy lack	Leave org
Unrealistic expectations	.495**	.444**	.392**	.247**
Hours pressure	.406**	.417**	.431**	.167**
Role expansion	.466**	.458**	.358**	.195**

Note. Spearman ρ. ** p < .01. All associations significant. Cross-sectional design; associations do not imply causal direction.

4.3 Cross-Role Pressure and Culture

The prevalence data described above indicate that structural pressure is widely reported across this sample as a feature of engineering work. The following cross-role analysis examines whether that pressure is distributed equally across the workforce or concentrated in particular roles, alongside corresponding differences in organisational culture.

Table 4 presents cross-role comparisons. Significant role differences are found for hours pressure ($H = 36.977$, $p < .001$) and role expansion ($H = 25.908$, $p < .001$). Commissioning engineers report the highest hours pressure of any role (86% agree/strongly agree; $M = 4.30$), with a medium-to-large effect relative to all other roles ($r = .408$, $p < .001$). HSE professionals report the highest rate of role expansion (89%). Design engineering reports the lowest hours pressure (51%) and role expansion (40%). Unrealistic expectations show no significant difference in role ($p = .054$), indicating that this pressure is broadly shared across roles.

Organisational culture varies substantially across roles ($H = 48.883$, $p < .001$). Commissioning ($M = 2.90$) and operations ($M = 2.84$) report the poorest culture of any role group — more than a full scale point below project management ($M = 3.96$) and design engineering ($M = 3.63$). This pattern is consistent with the hypothesis that physical delivery proximity is associated with both higher workload and lower organisational support, though the cross-sectional design does not permit causal attribution. Psychological outcome items (overwhelm, anxiety) show no significant role differences, suggesting that psychological strain is broadly distributed across the engineering workforce rather than concentrated in the highest-pressure roles.

Table 4. Cross-Role Comparison: Pressure, Culture, and Psychological Outcomes

Item	Cx	HSE	QA	Design	PM	Ops	KW p
Hours pressure %	86%	68%	40%	51%	57%	75%	< .001
Role expansion %	81%	89%	65%	40%	62%	83%	< .001
Unrealistic expectations %	72%	84%	45%	49%	62%	71%	.054
Overwhelmed %	47%	58%	30%	34%	38%	67%	.171
Anxiety %	46%	63%	50%	43%	29%	54%	.256
Org culture M	2.90	3.51	3.61	3.63	3.96	2.84	< .001

Note. Cx = Commissioning (n=81); HSE (n=19); QA/QC (n=20); Design (n=35); PM (n=21); Ops (n=24). % = agree or strongly agree. Org culture = mean composite (1–5). Kruskal-Wallis.

4.4 The Site–Office Divide

Site-based engineers ($n = 167$) report significantly higher hours pressure than office-based colleagues ($M = 4.02$ vs 3.38; $d = 0.62$, $r = .320$, $p < .001$) and substantially worse organisational culture ($M = 2.98$ vs 3.62; $d = 0.72$, $r = .417$, $p < .001$). Overwhelm and anxiety do not differ significantly between settings ($p > .13$). The combination of higher hours pressure and substantially worse culture in site-based settings — without a corresponding elevation in measured psychological outcomes — is consistent with normalisation of adverse conditions as an accepted feature of site work, though alternative explanations cannot be ruled out given the cross-sectional design (Dekker, 2011; Vaughan, 2016). This site–office culture gap ($d = 0.72$) is examined further in the companion paper series.

4.5 Organisational Culture: Suppressor but Not Moderator

Hierarchical regression examined the association between organisational culture and psychological outcomes, and whether culture moderated the pressure–outcome relationship. Better organisational culture is associated with lower overwhelm (B = −0.253, 95% CI [−0.358, −0.149], $p < .001$) and lower anxiety (B = −0.311, 95% CI [−0.424, −0.198], $p < .001$), with models explaining approximately 36% of variance in each outcome. The interaction terms are non-significant in both models (overwhelm p = .713; anxiety p = .694), indicating that organisational culture does not moderate the strength of the pressure–outcome relationship in this sample. Culture appears to be associated with the baseline level of psychological distress rather than with the rate at which pressure translates into strain. This distinction has practical implications: cultural improvement alone may be insufficient to protect workers from the psychological consequences of structural overload.

4.6 Sector and Employment Type Variation

The role-level differences described above indicate that the pressure system varies with proximity to project delivery. The following sector and employment type analysis examines whether the same pattern is present at the industry and contract levels.

Table 5 presents pressure and culture profiles by sector. The oil and gas sector reports the highest hours pressure (M = 4.11) and anxiety (M = 3.57) of any major sector, alongside the poorest organisational culture (M = 2.93). Consulting reports the best culture (M = 3.77) and lowest hours pressure (M = 3.32). Construction and infrastructure (M = 3.73 hours; M = 3.29 anxiety) and water (M = 3.76 hours) present elevated pressure profiles relative to the sample mean. Contractors and consultants report higher hours pressure than full-time employees (M = 4.11 vs 3.54), consistent with contract-based employment structures that may provide limited protection against scope expansion and schedule demands.

Table 5. Sector Profiles: Workplace Pressure and Organisational Culture

Sector	n	Hours M	Overwhelm M	Anxiety M	Culture M
Oil & Gas / Petrochemical	47	4.11	3.77	3.57	2.93
Construction / Infrastructure	56	3.73	3.25	3.29	3.29
Energy / Utilities	53	3.75	3.30	3.21	3.42
Water	42	3.76	3.29	3.14	3.10
Mining / Resources	47	3.60	3.13	3.02	3.36
Consulting / Professional services	40	3.32	2.88	2.92	3.77

Note. Sectors with n < 10 excluded. Culture M = four-item composite (1–5). Descriptive comparisons; significance testing not reported given unequal subgroup sizes.

4.7 Gender Differences in Pressure, Culture, and Outcomes

Gender differences in structural pressure and psychological outcomes are reported here as the demographic baseline for the companion paper series. The sample comprises 229 men (68%) and 105 women (31%). Across all structural pressure items and psychological outcome items, gender differences are non-significant (all $p > .34$; $d < 0.11$), indicating that the broad experience of workplace pressure — hours, role expansion, unrealistic expectations, overwhelm, and anxiety — is not significantly differentiated by gender at the sample level. These findings represent perceived experiences and should be interpreted with the limitations of self-report data in mind.

One significant gender difference is observed: women report marginally better organisational culture than men (W M = 3.48 vs M M = 3.24; $d = 0.26$, $p = .025$). This difference is small but replicates across all four culture items. Its interpretation warrants caution: women may genuinely experience better culture, may apply different reference standards, or may be concentrated in sectors or roles with better culture profiles. Departure intention does not differ by gender (leave organisation: $p = .794$; leave profession: $p = .538$), suggesting that attrition risk is not gender-differentiated in this sample.

These patterns reinforce the system-level nature of engineering workplace pressure: structural demands and psychological strain appear to operate across demographic lines, consistent with the layered model in Section 2.5.

4.8 Peer Influence on Professional Decisions

The structural and cultural landscape described in the preceding sections provides the organisational context within which peer influence and behavioural compromise occur. Table 6 presents the prevalence of peer-pressure-driven professional compromise across the full sample.

Peer-pressure-driven quality compromise is widely reported in this sample: 76% report quality reduction under peer influence, 77% have accepted sub-standard outputs, 67% have skipped process steps, and 79% have delivered quickly rather than correctly. Rework attributable to peer influence is reported by 82%, with 16% experiencing major rework impact. At the project delivery level, workarounds are the most prevalent consequence (73% sometimes or more often), followed by out-of-sequence work (71%), cost increases (74%), and shortened testing (62%). Safety-critical consequences — bypassed approvals (9% often/very often) and accepted safety risks (7%) — are less frequent but present at a non-trivial scale across a safety-critical professional sample. Cross-role comparisons indicate that commissioning engineers report significantly higher process skipping (M = 2.85 vs 1.98; $r = .498$, $p < .001$), workarounds ($r = .588$), and out-of-sequence work ($r = .612$) than other roles, despite equivalent exposure to conformity culture.

These findings illustrate the mechanism through which structural overload translates into behavioural compromise via social influence, aligning with the system architecture described earlier.

Table 6. Peer-Pressure-Driven Professional Compromise: Full Sample Prevalence (N = 286–335)

Outcome	n	Any occurrence	Often/frequently
QUALITY COMPROMISES			
Quality of work reduced	334	76%	8%
Accepted sub-standard outputs	332	77%	12%
Skipped process steps	332	67%	7%
Delivered quickly over correctly	331	79%	10%
Peer pressure led to rework	335	82%	16% major
DELIVERY CONSEQUENCES			
Workarounds	324	73%	37%
Out-of-sequence work	321	71%	32%
Cost increases	321	74%	27%
Shortened testing	251	62%	26%
Bypassed approvals	289	46%	9%
Safety risk accepted	286	41%	7%

Note. Any occurrence = proportion reporting at least sometimes. Often/frequently = often or very often for frequency items; yes-often for yes/frequency items; major impact for rework. Findings represent self-reported perceived behaviour.

4.9 Attribution of Project Failure

The peer influence findings above document the behavioural consequences of social pressure within teams. The attribution data below examine how responsibility for project-level failures is perceived and distributed across engineering roles.

Respondents identified the groups most responsible for project delays and cost overruns (multi-select). Leadership and management attracted the highest blame (47%), followed by design engineering (39%), construction and site contractors (34%), and asset owners and clients (32%). HSE professionals were blamed by 15% — the lowest rate of any gatekeeper role — while project controls were blamed by 13%. The most frequently cited structural and process-level factors were documentation not kept up to date (51%), poor communication between teams (48%), incomplete or inaccurate information (44%), and workforce shortages (40%). The gap between person-level blame (leadership, design, contractors) and structural factors (documentation, communication, information quality) indicates an attribution pattern in which individuals and groups are held responsible for failures whose structural origins are simultaneously identified by the same respondents.

The coexistence of structural explanations and person-level blame reflects a system in which responsibility is personalised despite recognition of systemic origins, a pattern consistent with organisational accident theory and the layered model.

4.10 Safety Risk and Commissioning Conditions

Within the commissioning subsample (n = 81), 12% report safety risk acceptance often or very often (M = 2.70), and 15% report permit bypass at the same frequency (M = 2.64). The majority of commissioning engineers (69%) report that safety sign-off moderately or fully reflected actual system safety, but 31% report it reflected safety only slightly or not at all. Across the full sample, 7% report peer-pressure-driven safety risk acceptance often or very often, and 9% report bypassing approvals at the same frequency. Among commissioning engineers, 43% report that their role contribution is rarely or never recognised by other teams (cx_recognition M = 2.64). Gender differences in the recognition item within commissioning are in the expected direction but do not reach significance at the available subsample size ($p = .344$).

These commissioning-specific patterns position commissioning as a structurally exposed phase where elevated pressure, reduced recognition, and compromised safety governance converge within the broader pressure system.

4.11 Job Satisfaction, the Satisfied Leaver, and Departure Intention

The pressure and culture findings above describe conditions that the JD-R model predicts would generate both psychological strain and departure risk. The following workforce outcome data examine whether those predictions are borne out in this sample, and in particular whether job satisfaction is a reliable indicator of workforce health under these conditions.

Eighty-three per cent of respondents report job satisfaction, and only 2% report dissatisfaction. This figure coexists with widespread dysfunction: 63% of satisfied respondents report hours pressure, 42% report feeling overwhelmed, and 40% report workplace anxiety. The satisfaction paradox is most starkly illustrated by the satisfied leaver finding: 37% of satisfied respondents are considering or actively planning to leave their current organisation. Satisfied leavers report significantly higher anxiety (M = 3.42 vs 2.95; $p < .001$, $r = .268$) and significantly worse culture (M = 3.17 vs 3.59; $p < .001$, $r = .262$) than satisfied stayers, indicating that anxiety and poor culture are associated with departure consideration even among those reporting satisfaction.

Table 7 presents the full breakdown of departure intentions. 45% of the full sample are considering or actively planning to leave their current organisation (12% actively). 24% are considering leaving the engineering profession, and 4% are actively planning to do so. The gap between organisational and professional departure intentions suggests that employer conditions, rather than professional disillusionment, are the primary driver of attrition risk. Regression analysis (Table 8) identifies autonomy deficit (B = 0.109, 95% CI [0.020, 0.198], $p = .017$) and poor organisational culture (B = −0.119, 95% CI [−0.226, −0.011], $p = .031$) as the only independent correlates of departure intention when all pressure and psychological variables are entered simultaneously ($R^2 = .142$). Structural pressure items and acute psychological outcomes do not independently predict departure once these variables are controlled, suggesting that autonomy and culture may be more proximal correlates of retention than workload measures alone.

These workforce outcomes demonstrate how the downstream effects of the pressure system manifest not through dissatisfaction but through autonomy deficit and cultural conditions, consistent with the JD-R-aligned framework.

Table 7. Intention to Leave: Current Organisation and Engineering Profession (N = 330–333)

Response	n	%
LEAVE CURRENT ORGANISATION		
No — intend to stay	182	55%
Considering / unsure	110	33%
Actively looking / planning	38	12%
LEAVE ENGINEERING PROFESSION		
No — intend to stay in engineering	254	76%
Considering / unsure	67	20%
Actively planning to leave	12	4%

Note. Prefer not to say excluded from denominators.

Table 8. OLS Regression: Independent Correlates of Departure Intention (Leave Organisation; n = 330, R^2 = .142)

Predictor	B	95% CI	p	
Unrealistic expectations	0.060	[−0.042, 0.162]	.248	
Hours pressure	−0.053	[−0.134, 0.028]	.202	
Role expansion	−0.001	[−0.084, 0.082]	.979	
Overwhelmed	0.026	[−0.095, 0.148]	.669	
Anxiety	0.053	[−0.064, 0.171]	.375	
Autonomy deficit	0.109	[0.020, 0.198]	.017*	Independent correlate
Organisational culture	−0.119	[−0.226, −0.011]	.031*	Independent correlate

Note. OLS regression. * p < .05. Structural pressure items and acute psychological outcomes do not independently predict departure intention once all variables are controlled. Findings are associational; the cross-sectional design does not support causal inference.

4.12 Country-Level Profiles

Table 9 presents descriptive pressure, culture, and departure intention profiles for the eight countries contributing more than eight respondents. These country-level figures are presented for exploratory illustration only. Each country sub-sample was recruited by convenience and is not nationally representative; within-country samples differ substantially in size, sector composition,

and role distribution. Cross-national comparisons should not be interpreted as reflecting genuine national differences in engineering workplace conditions. The purpose of this section is to illustrate the geographic scope of variation in the dataset and to identify patterns that may warrant future targeted investigation with nationally representative samples.

With those caveats noted, the descriptive variation is substantial. Hours pressure ranges from M = 3.12 in Australia to M = 4.17 in India. Anxiety ranges from M = 2.80 in Australia to M = 3.72 in India. Organisational culture ranges from M = 2.90 in India to M = 3.82 in Indonesia. Departure consideration from the current organisation ranges from 25% in Australia to 70% in Nigeria. The consistent pattern in which India and Nigeria report elevated pressure and anxiety alongside higher departure intention — while Australia reports lower levels across all dimensions — may reflect genuine differences in engineering workplace conditions or differences in sample composition; this cannot be resolved with the present data.

These exploratory differences illustrate the geographic breadth of the pressure–culture–outcome system but do not permit inference about national-level mechanisms.

Table 9. Country Profiles: Descriptive Illustration Only — Non-Representative Samples (N per country = 28–56)

Country	n	Hours M	Anxiety M	Culture M	Leave org %	Note
Australia	56	3.12	2.80	3.44	25%	Convenience sample
United Kingdom	44	3.59	3.16	2.98	30%	Convenience sample
Canada	35	4.03	3.46	3.44	43%	Convenience sample
Indonesia	34	3.68	2.94	3.82	50%	Convenience sample
United States	31	3.87	3.23	3.10	58%	Convenience sample
Malaysia	28	3.25	3.25	3.72	46%	Convenience sample
India	29	4.17	3.72	2.90	48%	Convenience sample
Nigeria	29	3.90	3.43	3.33	70%	Convenience sample

Note. Non-representative convenience samples. Descriptive figures only. Cross-national comparisons should not be interpreted as reflecting genuine national differences in engineering workplace conditions.

4.13 Open-Text Responses

The survey included an optional open-text field inviting respondents to describe their experience of workplace pressure in their own words. Of the 335 respondents, 187 (56%) provided substantive responses, totalling approximately 3,400 words of qualitative data. These responses are the subject of a separate qualitative analysis applying a 23-code, five-theme framework developed through systematic thematic analysis. The dominant themes are schedule compression and management disconnect — findings that are consistent with and provide explanatory depth to the quantitative

patterns reported here. The 56% response rate to an optional field is itself noteworthy, indicating that the conditions this survey addresses are ones that engineering professionals wish to articulate beyond structured items.

These qualitative themes provide narrative depth to the structural and social mechanisms identified quantitatively and form the basis for the companion qualitative analysis.

5. Discussion

5.1 The Systemic Nature of Engineering Workplace Pressure

The findings demonstrate that engineering workplace pressure is not only pervasive but structurally patterned. Across roles and sectors, most respondents report demands that exceed contracted terms, and nearly half report psychological strain. Yet the distribution of this pressure is not uniform. Commissioning and operations roles report substantially poorer organisational culture, oil and gas presents the highest sector-level pressure, and contractors experience greater hours exposure than employees. These patterns indicate that the layered pressure system described in Section 2.5 manifests most forcefully in delivery-facing roles where structural demand, cultural deficit, and proximity to physical execution converge. A workforce intervention aimed at the "average engineer" will therefore miss the roles where conditions are most adverse.

The organisational culture findings reinforce this system-level interpretation. Culture is associated with lower baseline distress, but it does not moderate the strength of the pressure–outcome relationship. In this sample, culture appears to suppress the baseline level of strain without altering the translation of structural pressure into psychological outcomes. This distinction matters: cultural improvement alone is unlikely to protect workers in high-demand environments from the consequences of structural overload. Structural interventions — workload governance, role boundary management, and delivery hold points — are required alongside cultural improvement. These findings extend JD-R predictions by indicating that organisational culture functions as a baseline suppressor rather than a moderator of the pressure–strain relationship (Bakker and Demerouti, 2007; Karasek, 1979). The purpose of this article is to establish the empirical baseline of the pressure system; the mechanism testing of individual pathways is undertaken in the companion papers.

5.2 Organisational Implications

The findings carry implications across workforce retention, engineering governance, project delivery, and safety culture. For retention, the data indicate that nearly half the workforce is at some level of departure risk, driven primarily by autonomy deficit and poor organisational culture rather than workload alone. Organisations seeking to improve retention must attend to autonomy conditions and cultural quality, particularly in site-based and delivery-facing roles where the culture gap is largest.

For engineering governance, the attribution findings are significant. Respondents simultaneously identify structural causes of project failure — documentation gaps, communication failures, information deficits — and assign blame to individuals and groups. This attribution gap suggests that governance interventions targeting individual behaviour will be insufficient without corresponding attention to the structural conditions that generate those behaviours (Reason, 1990).

For project delivery, the peer influence data indicate that professional compromise is prevalent and consequential across this sample: rework, workarounds, out-of-sequence work, and shortened testing are prevalent even among satisfied workers. Quality degradation appears to arise not from individual inadequacy but from systemic social and structural conditions that shape what individuals feel able to do.

For safety culture, the finding that 31% of commissioning engineers report that safety sign-off only slightly or not at all reflected actual system safety — alongside 9% of the full sample reporting frequent bypassing of approvals — indicates that safety governance mechanisms are operating imperfectly in a non-trivial proportion of cases, even before safety-specific pressures are examined.

5.3 Limitations

Four limitations are acknowledged. First, the cross-sectional design identifies associations between constructs but cannot establish causal relationships or the direction of effects. All findings should be interpreted as correlational rather than causal. Second, all data are self-reported and reflect perceived experiences rather than objectively verified behaviour. Self-report data are subject to common method bias, social desirability effects, and recall limitations; prevalence figures should be understood as indicative of professional perception rather than confirmed behavioural rates. Third, recruitment through self-selecting online channels introduces self-selection bias: respondents who engage with a survey on workplace pressure may experience higher-than-average pressure, making prevalence estimates likely conservative lower bounds rather than population-representative figures. Fourth, country-level comparisons are based on non-representative convenience samples within each country, differ substantially in size and composition, and should not be interpreted as reflecting genuine national differences in engineering workplace conditions. Role subgroup sizes are also unequal; comparisons involving small groups (HSE n = 19; QA n = 20) should be treated as indicative only.

5.4 Synthesis: A Layered Pressure System

Taken together, the findings indicate that engineering workplaces are characterised by a layered pressure system in which structural demands interact with social dynamics, producing behavioural compromises and downstream workforce effects. Structural pressures — hours, role expansion, unrealistic expectations — are widely reported and unevenly distributed, concentrated in delivery-facing roles and sectors. These conditions create the environment within which peer conformity operates, translating structural overload into process skipping, quality compromise, and rework. Organisational culture suppresses but does not interrupt this system (Asch, 1951; Cialdini, 1993). The downstream workforce consequences — anxiety, autonomy deficit, departure intention — are substantially predicted by the quality of the organisational environment rather than by workload volume alone. These system-level patterns provide the empirical foundation for the companion papers, each of which examines a specific mechanism or subgroup within this broader architecture.

6. Conclusion

This paper presents the primary empirical baseline from a 25-country survey of engineering workplace conditions and provides the dataset and methodological context for a series of companion analyses examining specific mechanisms and outcomes. Structural pressures — role expansion, hours pressure, and unrealistic expectations — are widely reported and unevenly distributed across roles, sectors, and employment types. Commissioning engineers and oil and gas workers report the most adverse profiles. Peer-pressure-driven professional compromise is widespread and consequential. Attribution of project failure is systematically directed at individuals despite simultaneous identification of structural causes. Gender differences in structural pressure and psychological outcomes are not significant at the full-sample level. Autonomy deficit and poor organisational culture independently predict departure intention, even after controlling for structural pressure.

Most significantly, the satisfaction paradox — 83% job satisfaction alongside 45% departure consideration and widespread dysfunction — indicates that satisfaction is an unreliable indicator of workforce health in engineering (Shanafelt et al., 2015). The profession requires systematic monitoring of psychological distress, autonomy conditions, and departure intention as primary workforce health indicators, not satisfaction proxies. Interventions need to target the structural conditions, cultural climate, and social dynamics that constitute the pressure system described in this paper, with particular attention to delivery-facing roles where the system operates most forcefully. This paper provides the empirical and methodological reference point for the companion studies that examine these mechanisms in depth.

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