

Supplementary Table S1. Questionnaire items, conceptual foundations, and measurement-development documentation

S1a. Documentation applicable to all items

Field	Documentation
Response anchors	1 = very low; 2 = low; 3 = moderate; 4 = high; 5 = very high.
Language of wording displayed below	English.
Administration language	Chinese.
Translation procedure	The English questionnaire was translated into Chinese and back-translated into English by a university English-language teacher. The back-translation was not independent.
Original validated item source and wording	Not established at the individual-item level in the available documentation. The conceptual references below should not be interpreted as authenticated sources of original item wording.
Final administered wording	The Chinese questionnaire was administered. Its exact wording was not available for verification in preparing this table; the English wording below is transcribed from the proposal appendix.
Item modifications and reasons	Item-specific changes from original published scales and their reasons were not documented in the available materials.
Expert-review changes	Specific item-level changes following expert review were not documented in the available materials.
Pilot testing and changes	Thirty eligible employees completed the pilot questionnaire. No feedback was reported, and no item revisions were made following the pilot.
Pilot sample inclusion	Pilot survey data were excluded from the main analytical sample of 500 employees.

S1b. Item-level documentation

Employee performance (EP)

Conceptual references cited in the manuscript: [54,55].

Item	Intended dimension	Documented English wording
C1	Task performance	I consistently meet the productivity targets set for my role.
C2	Task performance	I complete my core job responsibilities with high efficiency.
C3	Task performance	The quality of my work meets or exceeds organizational standards.
C4	Task performance	I effectively achieve the goals assigned to me within deadlines.
C5	Contextual performance	I voluntarily assist colleagues with their work when needed.
C6	Contextual performance	I take the initiative to address problems outside my job responsibilities.
C7	Contextual performance	I contribute positively to the overall work environment.
C8	Contextual performance	I go beyond my assigned duties to support organizational goals.
C9	Adaptive performance	I quickly adjust to changes in work conditions or job demands.
C10	Adaptive performance	I remain effective in my role during challenging or uncertain situations.
C11	Adaptive performance	I learn and adopt new skills to meet changing job requirements.
C12	Adaptive performance	I handle unexpected problems or challenges effectively at work.

Perceived digital transformation (DT)

Conceptual references cited in the manuscript: [1,51].

Item	Intended dimension	Documented English wording
D1	Strategic direction	I understand the organization's vision for digital transformation.
D2	Strategic direction	The strategic objectives of our digital initiatives are clearly communicated.
D3	Strategic direction	I see how digital strategies align with the organization's long-term goals.
D4	Strategic direction	I feel my work contributes to the successful implementation of the digital roadmap.
D5	Operational pillars	The workflows in my team are effectively digitized to enhance productivity.
D6	Operational pillars	I have received adequate training to adapt to new digital tools and processes.
D7	Operational pillars	Our team collaborates effectively with other departments for digital initiatives.
D8	Operational pillars	The technology platforms we use are efficient and well-integrated.
D9	Value generation	Digital transformation initiatives have improved my work efficiency.
D10	Value generation	The technologies adopted by my organization contribute to innovation in my role.
D11	Value generation	I can see tangible benefits from the digital changes in our processes.
D12	Value generation	Our digital initiatives support the organization's sustainability and growth.

Perceived technological innovation (TI)

Conceptual references cited in the manuscript: [52,53].

Item	Intended dimension	Documented English wording
E1	Incremental innovation	My organization consistently implements small improvements to enhance existing products or services.
E2	Incremental innovation	I observe frequent upgrades or refinements in the technologies used in my work.
E3	Incremental innovation	My organization prioritizes gradual cost reductions through continuous improvement efforts.
E4	Incremental innovation	I feel that ongoing product or service enhancements improve the user experience for customers.
E5	Radical innovation	My organization invests in groundbreaking technologies that have the potential to disrupt the market.
E6	Radical innovation	I have participated in or observed initiatives that aim to create entirely new business models.
E7	Radical innovation	My organization is proactive in exploring high-risk, high-reward innovation opportunities.
E8	Radical innovation	I believe the organization is at the forefront of pioneering advancements that open new markets.

Employee engagement (EE)

Conceptual reference cited in the manuscript: [35].

Item	Intended dimension	Documented English wording
F1	Cognitive engagement	I understand how my role contributes to achieving organizational goals.
F2	Cognitive engagement	I actively think about ways to improve my job performance.
F3	Cognitive engagement	I find my tasks intellectually stimulating and meaningful.
F4	Cognitive engagement	I align my efforts with the strategic objectives of the organization.
F5	Emotional engagement	I feel a strong emotional connection to my work.
F6	Emotional engagement	I enjoy collaborating with my colleagues and building positive relationships.
F7	Emotional engagement	I am committed to the success of my team and the organization.
F8	Emotional engagement	I experience a sense of satisfaction from accomplishing my job tasks.
F9	Behavioral engagement	I consistently go beyond the basic requirements of my job.
F10	Behavioral engagement	I take the initiative to improve processes or solve problems at work.
F11	Behavioral engagement	I maintain high levels of energy and dedication, even during challenging times.
F12	Behavioral engagement	I demonstrate resilience and perseverance in achieving my work goals.

Psychological well-being (PWB)

Conceptual references cited in the manuscript: [41,42].

Item	Intended dimension	Documented English wording
G1	Emotional well-being	I frequently experience feelings of happiness and contentment.
G2	Emotional well-being	I am able to effectively manage negative emotions like stress or anxiety.
G3	Emotional well-being	I feel satisfied with the balance between my personal and professional life.
G4	Emotional well-being	My work environment supports my emotional well-being.
G5	Psychological functioning	I feel confident in my ability to handle personal and professional challenges.
G6	Psychological functioning	I actively pursue opportunities for personal and professional growth.
G7	Psychological functioning	I find purpose and meaning in my work and daily activities.
G8	Psychological functioning	I have a sense of control and autonomy in my work environment.

G9	Social well-being	I have positive and supportive relationships with my colleagues.
G10	Social well-being	I feel a strong sense of belonging within my team and organization.
G11	Social well-being	I actively contribute to creating a collaborative work environment.
G12	Social well-being	My work allows me to make meaningful contributions to the broader community.

Notes. The documentation in S1a applies to every item in S1b. Intended dimensions describe questionnaire content and do not establish empirical dimensionality. Work-related content is embedded within the PWB items rather than listed as a separate fourth dimension in the proposal appendix. G1–G12 have the suffix “Mental_health” in the raw-data column names; psychological well-being is the manuscript label. The documentation does not establish equivalence to the original Employee Engagement Scale, a Ryff scale, or the Mental Health Continuum–Short Form. All constructs were analyzed at the individual employee level.

Supplementary Table S2. Comparison of alternative confirmatory factor analysis models.

Construct	Model	Scaled χ^2	df	p	Robust CFI	Robust TLI	Robust RMSEA	SRMR	AIC	BIC	Model assessment
EP	One-factor	64.027	54	.165	.997	.996	.020	.018	12016.06	12167.79	Admissible; retained
EP	Three correlated factors	61.800	51	.143	.996	.995	.021	.018	12019.99	12184.36	Converged; highly correlated dimensions
EP	Second-order	61.309	51	.153	—	—	—	.018	12021.70	12186.07	Improper boundary solution
DT	One-factor	35.447	54	.976	1.000	1.000	.000	.012	12001.70	12153.42	Admissible; retained
DT	Three correlated factors	33.827	51	.969	1.000	1.000	.000	.012	12006.08	12170.45	Improper solution
DT	Second-order	—	51	—	—	—	—	.012	12006.87	12171.24	Converged; degenerate solution
TI	One-factor	20.724	20	.414	1.000	1.000	.009	.013	8137.68	8238.83	Admissible; retained
TI	Two correlated factors	20.230	19	.381	.999	.999	.011	.013	8139.20	8244.56	Admissible; latent correlation = .991
EE	One-factor	51.635	54	.566	1.000	1.000	.000	.015	11847.64	11999.37	Admissible; retained
EE	Three correlated factors	46.322	51	.660	1.000	1.000	.000	.014	11848.26	12012.63	Improper solution
EE	Second-order	48.762	51	.563	—	—	—	.015	11853.64	12018.01	Boundary/degenerate solution
PWB	One-factor	51.105	54	.587	1.000	1.000	.000	.015	11954.61	12106.33	Admissible; retained
PWB	Three correlated factors	47.551	51	.611	1.000	1.000	.000	.015	11956.85	12121.22	Improper solution
PWB	Second-order	—	—	—	—	—	—	—	—	—	Nonconvergent
All constructs	Five-factor measurement model	1541.696	1474	.107	.996	.996	.010	.029	—	—	Retained measurement model

Notes. N = 500. Models were estimated using robust maximum likelihood (MLR). EP = self-reported employee performance; DT = perceived digital transformation; TI = perceived technological innovation; EE = employee engagement; PWB = psychological well-being. AIC and BIC comparisons apply only to models using the same indicators. TLI values above 1 are displayed as 1.000. — indicates unavailable or inapplicable results. Improper or degenerate solutions involved latent correlations exceeding 1, zero or near-zero residual variances, or unavailable robust fit indices. Favorable fit indices do not establish the validity of such solutions. Bifactor models and combined alternative measurement models were not tested.

Supplementary Table S3. Selected modification-index diagnostics for measurement models

Model	Parameter	MI	EPC	Standardized EPC
Primary five-factor model	C1 ~~ D7	14.616	.062	.188
Primary five-factor model	C6 ~~ E5	11.750	-.053	-.170
Primary five-factor model	C10 ~~ F11	11.383	.053	.164
Primary five-factor model	C5 ~~ E1	11.202	-.052	-.165
Primary five-factor model	D8 ~~ G8	10.790	-.051	-.159
Model separating task, contextual, and adaptive performance	D7 ~~ C1	14.504	.062	.190
Model separating task, contextual, and adaptive performance	C11 ~~ C12	12.430	-.066	-.188
Model separating task, contextual, and adaptive performance	E5 ~~ C6	11.844	-.055	-.176
Model separating task, contextual, and adaptive performance	E1 ~~ C5	11.318	-.055	-.172
Model separating task, contextual, and adaptive performance	F11 ~~ C10	10.975	.053	.162
Higher-order employee-performance model	MI unavailable: singular information matrix	—	—	—

Notes. MI = modification index; EPC = expected parameter change. The table reports the five largest item-residual covariance indices for each model with available output. Indices for fixed latent variances in the correlated performance-dimensions model were CP ~~ CP = 87.179, AP ~~ AP = 17.172, and TP ~~ TP = 17.117; these concern scaling constraints rather than item-residual covariances. This model was inadmissible because TP–CP and CP–AP correlations exceeded one (1.004 and 1.015, respectively); its indices are reported for transparency and should not guide respecification. The higher-order model showed near-unit latent correlations and a singular information matrix, preventing MI computation. These diagnostics neither establish theoretical unidimensionality nor rule out response-style bias.

Supplementary Table S4. Measurement-model specifications, standardized factor loadings, factor correlations, and ordinal CFA sensitivity analysis.

Panel A. Model specifications and fit

Specification / statistic	Primary CFA	Ordinal sensitivity CFA
Sample size	500	500
Number of items	56	56
Factor structure	Five correlated factors	Same five correlated factors
Software	R 4.5.1; lavaan 0.7-2	R 4.5.1; lavaan 0.7-2
Estimator	MLR	WLSMV
Item treatment	Continuous indicators	Ordered categorical indicators
Latent-variable scaling	Latent variances fixed to one	Latent variances fixed to one
Parameterization	Default continuous-indicator parameterization	Delta
Missing-data treatment	FIML specified; no missing responses	No missing responses
Cross-loadings	None	None
Correlated item residuals	None	None
Modification-index-driven respecification	None	None
Converged	Yes	Yes
Scaled χ^2	1,541.696	1,463.276
Degrees of freedom	1,474	1,474
p	.107	.574
Robust CFI	.996	.981
Robust TLI	.996	.981
Robust RMSEA	.010	.024
Robust RMSEA 90% CI	[.000, .015]	[.018, .029]
SRMR	.029	.032

Panel B. Complete standardized factor loadings

Construct	Item	Primary CFA: MLR	Ordinal CFA: WLSMV
Employee performance	C1	.778	.821
	C2	.679	.758
	C3	.752	.795
	C4	.729	.765
	C5	.760	.802
	C6	.727	.763
	C7	.729	.756
	C8	.746	.801
	C9	.674	.744
	C10	.720	.774
	C11	.705	.767
	C12	.739	.792
Perceived digital transformation	D1	.735	.767

	D2	.783	.814
	D3	.776	.809
	D4	.750	.819
	D5	.769	.822
	D6	.703	.747
	D7	.759	.814
	D8	.747	.797
	D9	.694	.737
	D10	.740	.801
	D11	.789	.829
	D12	.771	.825
Perceived technological innovation	E1	.732	.787
	E2	.765	.799
	E3	.720	.800
	E4	.780	.833
	E5	.769	.820
	E6	.707	.755
	E7	.758	.805
	E8	.755	.785
Employee engagement	F1	.781	.833
	F2	.769	.823
	F3	.733	.780
	F4	.732	.770
	F5	.765	.826
	F6	.761	.801
	F7	.798	.840
	F8	.757	.803
	F9	.732	.778
	F10	.763	.806
	F11	.789	.847
	F12	.722	.761
Psychological well-being	G1	.757	.804
	G2	.728	.768
	G3	.723	.764
	G4	.769	.801
	G5	.748	.801
	G6	.699	.756
	G7	.750	.817
	G8	.739	.790
	G9	.729	.772
	G10	.745	.796
	G11	.773	.821
	G12	.744	.790

Panel C. Complete latent factor correlations

Factor pair	Primary CFA: MLR	Ordinal CFA: WLSMV
EP-DT	.442	.452
EP-TI	.344	.349
EP-EE	.544	.551
EP-PWB	.464	.469
DT-TI	.153	.155
DT-EE	.549	.551
DT-PWB	.456	.460
TI-EE	.299	.305
TI-PWB	.176	.180
EE-PWB	.291	.293

Notes. N = 500. EP = employee performance; DT = perceived digital transformation; TI = perceived technological innovation; EE = employee engagement; PWB = psychological well-being. All measures were self-reported. Both models specified five correlated factors without cross-loadings, correlated item residuals, or post hoc modifications. All loadings were significant at $p < .001$. The WLSMV parameter covariance matrix had five near-zero eigenvalues (minimum = -6.34×10^{-17}); the information matrix was positive definite, with no negative estimated variances.