

Organizational Culture, Psychological Empowerment, and The Five Dimensions of Human Capital Management: A Structural Analysis in Tamil Nadu's Petroleum Sector

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The paper reviews the structural factors influencing effectiveness of Human Capital Management (HCM) and its implications for Organizational Effectiveness (OE) of the Tamil Nadu petroleum industry. The study is designed with a deductive and positivist approach using a survey that was completed by 400 stratified petroleum industry employees to develop and validate five-dimensional HCM measurement model that consists of Leadership Practices, Employee Engagement, Knowledge Accessibility, Workforce Optimization, and Learning Capacity. Confirmatory Factor Analysis (CFA) is used to test the psychometric validity of all constructs, which are found to be valid (Cronbach's α : 0.817–0.883; AVE: 0.544–0.617). The structural equation modeling (SEM) tests 15 directional hypotheses between Organizational Culture (OC), Psychological Empowerment (PE) and the five HCM dimensions and HCM and OE. All hypotheses are supported. Learning Capacity ($\beta = 0.443$ from OC; $\beta = 0.421$ from PE) and Employee Engagement ($\beta = 0.401$ from PE) are the most well determined dimensions of HCM. Learning Capacity ($\beta = 0.373$) and Employee Engagement ($\beta = 0.341$) are the strongest HCM predictors of OE. There are significant differences between PSU and the private sector on the perception of HCM. Diagnostic insights at the level of the dimension and intervention recommendations for HR are provided.

Keywords: HCM Dimensions, Organizational Culture, Psychological Hardiness, Organizational Effectiveness, Petroleum Industry, SEM, Factor Analysis, Tamil Nadu

1. Introduction And Research Context

The energy industry in Tamil Nadu is a blend of CPCL's Manali refinery, ONGC's upstream operations in the Cauvery Basin and various other downstream distribution and petrochemical companies that create a genuinely unique human capital management challenge. In the context of an industry where PSUs coexist with private and joint-venture firms, the nature of the industry provides a rich natural laboratory for the study of the impact of organizational context on HCM practice and effectiveness.

In this paper, the authors advance the literature in two main ways: (1) the development and validation of a psychometrically sound HCM construct designed for the petroleum industry context; and (2) the empirical mapping of pathway sequences of dimensions of cultural and psychological antecedents to specific dimensions of HCM to organizational

effectiveness outcomes that offer granular diagnostic information not found in generic HCM studies.

2. The Five-Dimensional Hcm Framework

HCM is operationalized as a second-order construct comprising five first-order dimensions. Table 1 presents the full dimensional structure:

Table 1: Five-Dimensional HCM Framework Conceptual and Measurement Summary

HCM Dimension	Core Constructs	Theoretical Basis	Items
Leadership Practices	Communication and developmental leadership, partnership and succession planning	Ulrich et al. (2009); Bass & Avolio (1994)	4
Employee Engagement	Being able to design jobs, recognition, workload balancing, retention systems.	Kahn (1990); Schaufeli & Bakker (2004)	4
Knowledge Accessibility	The use of information tools, cross-functional team working, best practice, and KM systems.	Nonaka & Takeuchi (1995); Davenport (1999)	4
Workforce Optimization	Process efficiency, resource sufficiency, accountability, selection, PM	Boudreau & Ramstad (2007)	5
Learning Capacity	The culture of innovation, training, development planning, leadership in learning, LMS	Senge (1990); Marsick & Watkins (2003)	5
Total HCM Items	—	22 items across 5 dimensions	22

Note: All items use 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). Second-order HCM construct confirmed via CFA with all first-order factor loadings ≥ 0.65 .

2.1 Theoretical Foundations of Each Dimension

Leadership Practices are based on Bass and Avolio's (1994) transformational leadership model and are seen as the basis for the development of all other HCM areas, namely, developmental leadership and vision-communicating leadership. The Employee Engagement is built on the basis of the concept of psychological safety and meaningfulness by Kahn (1990). The Knowledge Accessibility is based on the SECI model of Nonaka and Takeuchi (1995). Workforce Optimization is based on Boudreau and Ramstad's (2007) talentship framework. The model for Learning Capacity is a combination of two models, namely that of learning organization (Marsick & Watkins, 2003) and systems thinking (Senge, 1990).

3. Theoretical Antecedents Of Hcm Effectiveness

3.1 Organizational Culture

Four OC dimensions (Adaptability, Innovation Orientation, Participative Decision-Making, Strategic Flexibility) are hypothesized to predict HCM sub-dimensions in different ways. Learning Capacity and Knowledge Accessibility are expected to be most strongly predicted by Adaptability and Innovation Orientation, and Employee Engagement are most strongly predicted by Participative Decision-Making, through its effect on psychological safety and voice behaviour.

3.2 Psychological Empowerment

It is hypothesized that the three PE dimensions (Control, Commitment, Challenge) would predict sub-dimensions of HCM with differential prediction. The Challenge dimension that indicates employees' orientation towards learning and growth is anticipated to be the highest predictor of Learning Capacity and Knowledge Accessibility. The strongest predictors of Employee Engagement are Commitment, and Control is most strongly predicted by assertive, autonomous work behaviour as a predictor of Leadership Practices.

4. Research Methodology

4.1 Methodological Design

Table 2: Research Methodology Summary

Methodological Dimension	Adopted Approach	Justification
Research Philosophy	Positivism	Objective reality, hypothesis testing, quantitative measurement
Research Approach	Deductive	Theory-based, developed constructs, and literature-based hypothesis.
Research Strategy	Cross-Sectional Survey	These are the three key characteristics of a statistical model. The three characteristics of a statistical model are Breadth of coverage, Standardization, and Statistical tractability.
Sampling Technique	Stratified Random Sampling	100% Representativeness; 100% Organizational Diversity Coverage
Instrument	5-Point Likert Questionnaire	Granularity; widely validated; industry standard
Data Analysis	SPSS + AMOS (SEM)	Validating the measurement model; simultaneous path testing; mediation
Pilot Study	n = 50 respondents	Analysis of pre-test results; improving the instrument before the main survey;

Note: Research design choices informed by Creswell & Creswell (2018) and Sekaran & Bougie (2016). Cross-sectional design limitations acknowledged in Section 7.

4.2 Sample Demographic Profile

The demographic profile of survey respondents is shown in Table 3. The ratio of males to females in the sample (79.5% to 20.5%) mirrors that of the petroleum industry workforce. Most are in the 30 to 45 age group (49.5%) reflecting the industry's mid-career profile. The public sector workers (59.3%) are a representative sample of the accessible population.

Table 3: Demographic Profile of Respondents (N = 400)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	318	79.5%
	Female	82	20.5%
Age Group	Below 30 years	72	18.0%
	30–45 years	198	49.5%
	Above 45 years	130	32.5%
Education	Diploma / ITI	96	24.0%
	Undergraduate Degree	164	41.0%
	Postgraduate Degree	118	29.5%
	PhD / Doctoral	22	5.5%
Years of Service	Less than 5 years	68	17.0%
	5–15 years	162	40.5%
	15–25 years	124	31.0%
	More than 25 years	46	11.5%
Organization Type	Public Sector Undertaking (PSU)	237	59.3%
	Private / Joint Venture	163	40.7%
Total	—	400	100%

Note: Sample distribution reflects proportionate stratified random sampling across eight organizational strata. Female representation (20.5%) consistent with industry gender composition in Tamil Nadu petroleum sector.

5. Analytical Results

5.1 Factor Loadings Measurement Model

Selected factor loadings for the Confirmatory Factor Analysis are shown in Table 4. Indicator items all have factor loadings above the criterion value of 0.60, and most are above 0.75, indicating that indicator items adequately represent their respective constructs. The average factor loadings for all sub-items of the Learning Capacity dimension range from 0.70 to 0.83, these are the highest average loadings of all the sub items, with the average factor loadings of all sub items of the Psychological Empowerment Challenge dimension ranging from 0.65 to 0.77, which are in line with the multi-faceted nature of the Challenge dimension.

Table 4: Selected CFA Factor Loadings (Representative Items by Construct)

Item (Abbreviated)	Factor Loading	Std. Error	t-value	p	Status
OC1 – Adaptability: Embraces Change	0.812	0.051	15.92	***	Retained
OC2 – Innovation: Encourages New Ideas	0.784	0.054	14.52	***	Retained
OC3 – Participation: Joint Decisions	0.768	0.056	13.71	***	Retained
PE1 – Control: Influence over Work	0.791	0.052	15.21	***	Retained
PE2 – Commitment: Meaning in Work	0.808	0.049	16.49	***	Retained
PE3 – Challenge: Embraces Difficulty	0.653	0.062	10.53	***	Retained
HCM-LP1 – Vision Communication	0.849	0.047	18.06	***	Retained
HCM-EE1 – Job Design Quality	0.816	0.050	16.32	***	Retained
HCM-KA1 – Info Access Tools	0.799	0.053	15.08	***	Retained
HCM-WO1 – Process Efficiency	0.822	0.049	16.78	***	Retained
HCM-LC1 – Innovation Culture	0.831	0.048	17.31	***	Retained
OE1 – Quality Improvement	0.856	0.046	18.61	***	Retained

Note: *** $p < 0.001$. All 54 items retained after pilot testing. Items shown are representative; full loading matrix available from authors. Standard errors estimated using maximum likelihood estimation.

5.2 Discriminant Validity HTMT Analysis

All pairs of constructs are reported in the HTMT (Heterotrait-Monotrait) ratios, shown in Table 5. Each of the HTMT ratios is below the value of 0.85 (Henseler et al., 2015) indicating that all constructs are empirically different from each other. The highest ratio of HTMT is between HCM Overall and OE (0.718), similar to what is theoretically expected when looking at a strong yet separate relationship.

Table 5: Discriminant Validity HTMT Ratios

Construct Pair	HTMT Ratio	$\sqrt{\text{AVE}}$ (C1)	$\sqrt{\text{AVE}}$ (C2)	Threshold	Status
OC ↔ PE	0.614	0.749	0.738	< 0.85	Discriminant ✓
OC ↔ HCM (Overall)	0.683	0.749	0.762	< 0.85	Discriminant ✓
OC ↔ OE	0.592	0.749	0.785	< 0.85	Discriminant ✓

PE ↔ HCM (Overall)	0.649	0.738	0.762	< 0.85	Discriminant ✓
PE ↔ OE	0.574	0.738	0.785	< 0.85	Discriminant ✓
HCM (Overall) ↔ OE	0.718	0.762	0.785	< 0.85	Discriminant ✓

Note: HTMT threshold < 0.85 (Henseler et al., 2015). $\sqrt{\text{AVE}}$ values confirm Fornell-Larcker criterion for all construct pairs. All construct pairs demonstrate adequate discriminant validity.

5.3 OC Sub-Dimensions Predicting HCM Sub-Dimensions (β Matrix)

The standardized regression coefficient matrix of the influence of each OC sub-dimension on each HCM sub-dimension is presented in Table 6. The two most significant factors for Learning Capacity ($\beta = 0.38$, $p < 0.001$) and Knowledge Accessibility ($\beta = 0.34$, $p < 0.001$) are OC Adaptability and Knowledge Accessibility. It is found that the strongest relationship between the constructs is between OC Participative Decision-Making and Employee Engagement ($\beta = 0.33$, $p < 0.001$), which is mediated by the creation of participative culture for psychological safety for employee engagement, thereby supporting H1b.

Table 6: OC Sub-Dimension → HCM Sub-Dimension Regression Matrix (Standardized β)

OC Dimension → HCM Dimension ↓	Adaptability	Innovation	Participation	Strategic Flex.	Combined R^2
Leadership Practices	0.31 ***	0.28 ***	0.22 **	0.19 **	0.447
Employee Engagement	0.26 ***	0.24 **	0.33 ***	0.21 **	0.412
Knowledge Accessibility	0.34 ***	0.31 ***	0.27 ***	0.18 **	0.431
Workforce Optimization	0.29 ***	0.22 **	0.25 ***	0.27 ***	0.463
Learning Capacity	0.38 ***	0.35 ***	0.28 ***	0.24 ***	0.498

Note: *** $p < 0.001$; ** $p < 0.01$. All models control for demographic variables. R^2 represents combined variance explained by all four OC dimensions in each HCM sub-dimension.

5.4 PE Sub-Dimensions Predicting HCM Sub-Dimensions (β Matrix)

The following table (Table 7) shows the matrix of PE sub-dimensions. The Challenge dimension is found to be the best predictor of Learning Capacity ($\beta = 0.38$, $p < 0.001$) and Knowledge Accessibility ($\beta = 0.33$, $p < 0.001$) with positive results showing that theoretical expectations are fulfilled. The most consistent predictor of Employee Engagement is

Commitment ($\beta = 0.36$, $p < 0.001$), which is consistent with the motivational theory of commitment as a predictor of cognitive and emotional investment in work.

Table 7: PE Sub-Dimension → HCM Sub-Dimension Regression Matrix (Standardized β)

PE Dimension → HCM Dimension ↓	Control (β)	Commitment (β)	Challenge (β)	Combined R^2
Leadership Practices	0.28 ***	0.31 ***	0.24 **	0.388
Employee Engagement	0.30 ***	0.36 ***	0.27 ***	0.421
Knowledge Accessibility	0.24 **	0.29 ***	0.33 ***	0.394
Workforce Optimization	0.26 ***	0.28 ***	0.22 **	0.367
Learning Capacity	0.22 **	0.33 ***	0.38 ***	0.443

Note: *** $p < 0.001$; ** $p < 0.01$. PE operationalized through Kobasa (1979)/Maddi (2006) Hardiness Scale. Combined R^2 represents variance explained by all three PE dimensions in each HCM sub-dimension.

5.5 HCM Perceptions by Organization Type

The results of independent samples t-tests to examine the mean scores for HCM sub-dimensions and OE differ between PSU and private sector employees are displayed in Table 8. The mean scores on all dimensions of the HCM were significantly higher for private sector employees ($p < 0.001$ for all dimensions except Leadership Practices, which was $p = 0.001$). The biggest gap is in Learning Capacity (Mean Diff. = 0.35) followed by Knowledge Accessibility (0.33) indicating that the private petroleum structures which are more adaptive and innovative allow better HCM practices in learning and knowledge management.

Table 8: HCM and OE Mean Scores by Organization Type Independent Samples t-Test

HCM Dimension	PSU Mean	Private Mean	Mean Diff.	t-value	Sig.
Leadership Practices	3.61	3.84	0.23	3.84	0.001 **
Employee Engagement	3.48	3.78	0.30	4.71	< 0.001 ***
Knowledge Accessibility	3.41	3.74	0.33	5.12	< 0.001 ***
Workforce Optimization	3.56	3.82	0.26	4.18	< 0.001 ***
Learning Capacity	3.44	3.79	0.35	5.46	< 0.001 ***
HCM (Overall)	3.50	3.79	0.29	4.92	< 0.001 ***
Organizational Effectiveness	3.57	3.87	0.30	5.04	< 0.001 ***

Note: *** $p < 0.001$; ** $p < 0.01$. PSU = Public Sector Undertaking (CPCL, IOCL, BPCL, HPCL, ONGC; $n = 237$). Private = Private/JV entities ($n = 163$). Levene's test confirmed homogeneity of variance for all comparisons.

6. Dimension-Level Managerial Implications

Table 9 synthesizes the key analytical findings for each HCM dimension with targeted managerial recommendations derived from the empirical results:

Table 9: Dimension-Level HCM Findings and Managerial Recommendations

HCM Dimension	Key Finding ($\beta \rightarrow$ OE)	Recommended Managerial Intervention
Leadership Practices ($\beta = 0.318$)	A strong indicator that has a high loading score; sub-item is the strongest among the developmental leadership sub-items; developmental leadership is the strongest among the other sub-items.	Put in place coaching supervision; structured 360° feedback; succession planning frameworks
Employee Engagement ($\beta = 0.341$)	Job design and recognition are the most important, second strongest predictors	Implement job redesign, competency-based job recognition, conduct of stay interviews.
Knowledge Accessibility ($\beta = 0.287$)	Weakest, but important predictor; important are KM systems and cross-functional teamwork	Invest in enterprise KM platforms; develop Communities of Practice; facilitate knowledge elicitation from experts who are approaching retirement;
Workforce Optimization ($\beta = 0.304$)	The sub-items for process efficiency and process performance are the most predictive.	Adopt strict talent analytics, redefine performance management for developmental emphasis, enhance accountability systems
Learning Capacity ($\beta = 0.373$)	The most important factors in determining OE were found to be innovation culture (IC) and LMS sub-items (SI); both were the most influential factors.	Develop safety for experimenting; invest in customised LMS; create innovation challenge programs

Note: β values represent standardized path coefficients from SEM structural model (HCM dimension $\rightarrow$ Organizational Effectiveness). All paths significant at $p < 0.001$.

6.1 Priority Sequence for HCM Investment

Based on the combined strength of OC/PE antecedent effects and OE predictive effects, the recommended investment priority sequence for Tamil Nadu petroleum organizations is: (1) Learning Capacity highest antecedent sensitivity (OC: $\beta = 0.443$; PE: $\beta = 0.421$) and highest OE predictive power ($\beta = 0.373$); (2) Employee Engagement strong PE determination ($\beta = 0.401$) and second-strongest OE predictor ($\beta = 0.341$); (3) Workforce Optimization strong OC determination ($\beta = 0.428$) and moderate OE predictor ($\beta = 0.304$); (4) Leadership Practices foundational enabler for all other dimensions; (5) Knowledge Accessibility highest potential for improvement given current gap between private and PSU scores (Mean Diff. = 0.33).

6.2 PSU-Specific Interventions

With the large PSU-private disparity on all dimensions of HCM perceptions, interventions specific to the public sector petroleum organizations are needed to overcome the cultural and structural barriers to HCM effectiveness. The OC sub-dimension matrix (Table 6) shows that the sub-dimensions with the lowest scores in PSU contexts are the most significant predictors of Learning Capacity and Knowledge Accessibility. This highlights the need for rather than generic 'culture change' programs, culture change programs that focus on these particular cultural orientations.

7. Conclusion And Future Research

This paper provides two main contributions: a HCM measurement framework with validated five dimensions and good psychometric properties (AVE: 0.544–0.617, all HTMT < 0.85); and an empirical mapping at the dimension level of the HCM's consequence pathways (OE) and its antecedent pathways (OC and PE), for the purpose of diagnosing HCM in the petroleum industry to the level of dimension.

The conclusion that Learning Capacity is the most strongly influenced by OC/PE antecedents and the most predictive of OE reinforces the importance of the strategic focus on the investment in learning within the petroleum industry. Longitudinal relationships between these variables need to be explored, potential moderating effects of digital technology use in HCM-OE pathways should be investigated, and the framework should be extended to other South Asian contexts in the energy sector.

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