Manuscript ID:
TIJCMBLIR-2025-020404

Volume: 2

Issue: 4

Month: August

Year: 2025

E-ISSN: 3065-9191

Submitted: 05 July 2025

Revised: 25 July 2025

Accepted: 10 Aug 2025

Published: 31 Aug 2025

Address for correspondence:
Shyama Charan Dwivedi
Research Scholar, Department of Commerce and Management at Dr. C. V. Raman University, Bilaspur Chhattisgarh,
Email: dwivedi.shyam@gmail.com

DOI: 10.5281/zenodo.16810330

DOI Link:
https://doi.org/10.5281/zenodo.16810330

Digital Transformation and Employee Satisfaction: A Comparative and Interdisciplinary Study of Industrial Relations at Rourkela Steel Plant

Shyama Charan Dwivedi[1], Dr. Vivek Bajpai[2]
[1]Research Scholar, Department of Commerce and Management at Dr. C. V. Raman University, Bilaspur Chhattisgarh,
[2]Professor, Department of Commerce and Management at Dr. C. V. Raman University, Bilaspur Chhattisgarh,

Abstract

This study investigates the impact of both traditional and digital industrial relations policies on employee satisfaction at Rourkela Steel Plant (RSP), integrating insights from behavioral economics and organizational psychology. Using a mixed-methods approach, including surveys (n=200) and interviews (n=20), the study reveals that traditional policies (β=0.62) and digital interventions (β=0.48) significantly enhance employee satisfaction, mediated by fairness perceptions and fulfillment of psychological needs—autonomy, competence, and relatedness. Demographic variables and levels of automation further moderate these relationships. A comparative analysis with Bhilai and Tata Steel Plants highlights RSP's strengths in employee welfare, while also revealing lag in digital adoption and innovation. Key recommendations include strengthening digital grievance redressal mechanisms, enhancing e-training initiatives, and fostering participatory decision-making. The study contributes to industrial relations literature by providing interdisciplinary perspectives and actionable strategies for improving employee satisfaction in the context of digital transformation within the heavy industrial sector.The study contributes to industrial relations literature by integrating interdisciplinary theories—Dunlop's Systems Theory, Social Exchange Theory, Self-Determination Theory, and Nudge Theory—offering practical strategies for balancing tradition with digital transformation in heavy industries.

Keywords*: Industrial relations, employee satisfaction, digital transformation, Rourkela Steel Plant, behavioral economics, self-determination theory.*

Introduction

Industrial relations, defined as dynamic socio-economic processes governing employer-employee interactions, are pivotal for organizational success (Dunlop, 1958). The rise of Industry 4.0 has introduced digital tools like online grievance portals and AI-driven platforms, reshaping traditional policies on welfare, working conditions, and grievance handling (Schwab, 2016). This study examines how traditional and digital industrial relation policies impact employee satisfaction at Rourkela Steel Plant (RSP), a public-sector steel producer in India, while integrating behavioral economics and organizational psychology perspectives and benchmarking against Bhilai Steel Plant and Tata Steel. Established in 1959 with German collaboration, RSP produces 4.5 million tonnes of crude steel annually and employs thousands, making industrial relations critical for efficiency and morale (SAIL, 2025). Modernization, including automation, has introduced challenges like workforce diversity and union tensions. Employee satisfaction, encompassing job satisfaction and organizational commitment, drives productivity (Judge et al., 2001). Digital interventions enhance fairness and autonomy, aligning with Self-Determination Theory (Deci & Ryan, 1985) and Nudge Theory (Thaler & Sunstein, 2008).

Theoretical Framework

The study of industrial relations and employee satisfaction at Rourkela Steel Plant (RSP) is grounded in a robust theoretical framework that integrates classical industrial relations theories with contemporary perspectives from behavioral economics and organizational psychology. This multidisciplinary approach provides a comprehensive lens to examine how traditional and digital industrial relation policies influence employee satisfaction, offering novel insights into the dynamics of modern industrial workplaces.

How to Cite this Article:
Dwivedi, S. C., & Bajpai, V. (2025). Digital Transformation and Employee Satisfaction: A Comparative and Interdisciplinary Study of Industrial Relations at Rourkela Steel Plant. The International Journal of Commerce Management and Business Law in International Research, 2(4), 12–19. https://doi.org/10.5281/zenodo.16810330

Industrial Relations Theories

1. **Dunlop's Systems Theory** (Dunlop, 1958) provides a foundational framework for understanding industrial relations as a system comprising actors (management, employees, and government), a context (economic, technological, and social environments), and an ideology that binds the system together. The theory emphasizes the establishment of a "web of rules" through interactions among these actors, governing workplace relationships. At RSP, this translates to policies on welfare measures, grievance handling, and standing orders, which are shaped by negotiations between management, trade unions, and government regulations. Dunlop's framework is particularly relevant for analyzing how RSP's industrial relations system adapts to modernization and digital interventions, such as online grievance portals, to maintain stability and employee satisfaction.
2. **Social Exchange Theory** (Blau, 1964) posits that workplace relationships are based on reciprocal exchanges, where employees offer commitment and productivity in return for fair treatment, rewards, and support from management. This theory explains how positive industrial relation policies—such as timely grievance redressal or empowerment initiatives—foster trust and loyalty, enhancing employee satisfaction. At RSP, the theory suggests that transparent communication and equitable policies strengthen the employer-employee relationship, particularly when digital tools facilitate real-time feedback and engagement.
3. **Behavioral Economics -**Nudge Theory (Thaler & Sunstein, 2008) from behavioral economics offers insights into how subtle interventions can influence employee behavior without restricting choices. In the context of industrial relations, nudges such as user-friendly digital platforms for grievance reporting or personalized training modules can encourage employees to engage more actively with organizational processes. For example, at RSP, an AI-driven feedback system could nudge employees to voice concerns promptly, enhancing perceptions of fairness and responsiveness, which are critical for satisfaction. Nudge theory complements traditional industrial relations by suggesting low-cost, scalable interventions to improve workplace dynamics.
4. **Organizational Psychology-** Self-Determination Theory (SDT) (Deci & Ryan, 1985) emphasizes three psychological needs—autonomy, competence, and relatedness—as drivers of motivation and satisfaction. In industrial settings, autonomy is reflected in employees' ability to participate in decision-making, competence is enhanced through training and skill development, and relatedness is fostered through strong interpersonal connections with peers and management. At RSP, digital interventions like e-training platforms can enhance competence by providing accessible skill-building opportunities, while structured communication channels can strengthen relatedness by fostering collaboration. SDT suggests that satisfying these psychological needs through both traditional and digital policies will lead to higher employee satisfaction.

Literature Review

The study of industrial relations and their impact on employee satisfaction has evolved significantly, particularly with the advent of digital transformation and interdisciplinary approaches. This literature review synthesizes research on traditional industrial relation policies, emerging trends in digital HR tools and automation, and comparative studies in the steel industry, while identifying gaps in the literature, particularly the limited focus on digital interventions and interdisciplinary perspectives.

Traditional Industrial Relations

Industrial relations encompass the complex interactions between employers, employees, and regulatory bodies, shaping workplace dynamics and employee satisfaction (Dunlop, 1958). Key components include:

1. **Welfare Measures**: Welfare schemes, such as medical benefits, housing, and family support, are critical for fostering employee loyalty and satisfaction (Srivastava, 2004). Kumar (1961) emphasizes that welfare measures enhance the day-to-day relations within organizations, contributing to harmonious industrial relations. Studies show that public-sector organizations like Rourkela Steel Plant (RSP) often provide superior welfare facilities compared to private firms, positively impacting job satisfaction (Srivastava, 2004).
2. **Working Conditions**: Safe, clean, and comfortable working environments are essential for employee well-being. Lester (1964) notes that industrial relations balance conflicting objectives like discipline and worker autonomy, with working conditions playing a pivotal role. Chellappa and Jhoumey (1982) found that open interpersonal relations and supportive work environments reduce workplace tensions, enhancing satisfaction.
3. **Grievance Handling**: Effective grievance redressal mechanisms are vital for resolving employee concerns and maintaining trust. Sharma and Sundara Rajan (1983) identified grievance handling as a key factor explaining 58% of variance in labor-management relations in India. Timely and fair grievance resolution strengthens employee perceptions of organizational justice (Ratnam, 1998).
4. **Standing Orders**: These formalized rules ensure compliance with labor laws and provide clarity on workplace expectations. Nath (1995) argues for pragmatic industrial laws that align with economic growth, emphasizing the role of standing orders in maintaining discipline while protecting worker rights.
5. **Employee Involvement and Empowerment**: Involving employees in decision-making and empowering them through training and

recognition enhances motivation and satisfaction. Pandey (1999) highlights the role of industrial relations managers in fostering collective action for mutual growth. Studies suggest that empowerment initiatives, such as participatory forums, improve organizational commitment (Mamta Panda, 2004).

Emerging Trends

1. **Digital HR Tools**: Online grievance portals, AI-driven feedback systems, and e-training platforms have revolutionized workplace interactions. These tools enhance accessibility and responsiveness, fostering employee trust and autonomy (Kapoor, 2020). For instance, digital platforms can streamline grievance handling, reducing resolution times and improving satisfaction (Leelavathy, 2000).
2. **Automation**: Automation, such as robotic process automation in steel plants, poses both opportunities and challenges. Datta (1990) highlights the tension between automation and job security, suggesting that collaborative union-management strategies are essential for smooth adoption. Automation can enhance productivity but requires reskilling to maintain employee competence and satisfaction (Johri, 1990).
3. **Sustainability**: Green initiatives, such as RSP's pollution control measures, align industrial relations with corporate social responsibility (CSR). Studies indicate that sustainability efforts can boost employee morale by signaling organizational commitment to societal good (Aguinis & Glavas, 2012). Integrating sustainability into welfare measures, such as eco-friendly housing, can enhance employee satisfaction.

Comparative Studies in the Steel Industry

Comparative studies provide insights into industrial relations across steel industries globally. In India, public-sector plants like RSP and Bhilai Steel Plant emphasize welfare and job security, leading to higher satisfaction compared to private firms like Tata Steel, where flexibility and innovation drive policies (Khurana, 1972). Globally, steel industries in China (e.g., Baosteel) leverage digital HR tools extensively, enhancing employee engagement through real-time feedback systems (Wang & Xu, 2018). In contrast, U.S. steel plants have faced challenges due to workforce reductions and automation, leading to strained union-management relations (Budd, 2004). These comparisons highlight the need for RSP to balance traditional policies with digital innovations to remain competitive.

Methodology

To investigate the impact of traditional and digital industrial relation policies on employee satisfaction at Rourkela Steel Plant (RSP), a mixed-methods research design is employed, combining quantitative and qualitative approaches for a comprehensive analysis. This methodology ensures robust insights into employee perceptions and organizational dynamics, while benchmarking RSP against Bhilai Steel Plant and Tata Steel.

Research Design

The study adopts a **mixed-methods design**, integrating:

Quantitative Component: Surveys to measure the relationships between industrial relation policies (traditional and digital) and employee satisfaction, testing hypotheses through statistical analysis. Qualitative Component: Semi-structured interviews to explore employee, union, and management perspectives, providing contextual depth to quantitative findings.

Objective & Hypotheses

1. To assess the impact of traditional and digital industrial relation policies on employee satisfaction at RSP,
2. To compare RSP's practices with those of other leading steel plants, and
3. To propose innovative, digitally-enabled strategies for enhancing industrial relations.

The following hypotheses are tested:

H1: Traditional industrial relation policies (welfare measures, working conditions, grievance handling, standing orders, employee involvement) positively influence employee satisfaction.

H2: Digital industrial relation interventions (online grievance portals, AI-driven tools, e-training platforms, digital communication channels) positively influence employee satisfaction.

H3: Employee perceptions (fairness, trust) and psychological needs (autonomy, competence, relatedness) mediate the relationship between industrial relation policies and satisfaction.

H4: Demographic factors (age, gender, tenure, department) moderate the impact of industrial relation policies on satisfaction.

H5: Digital interventions have a stronger impact on satisfaction in departments with higher automation levels.

Sampling

The study employs stratified sampling to ensure representation across departments and demographics at RSP. The sampling units and sizes are: Employees from Supervisory and Below Level: 200 employees, stratified by department (e.g., production, maintenance, administration) and demographics (age, gender, tenure). Human Resource Personnel: 20 executives, including HR managers and welfare officers, to provide insights into policy implementation. Training and Development Heads: 10 representatives to assess training initiatives, particularly e-training platforms. Institution (Steel Industry): 20 key stakeholders (e.g., senior management, union leaders) for interviews.

Data Collection

Primary Data: **Surveys**: A structured questionnaire with Likert-scale questions (1=Strongly Disagree, 5=Strongly Agree) assesses traditional policies (e.g., welfare, grievance handling), digital interventions (e.g., online portals, e-training), and employee

satisfaction (job satisfaction, organizational commitment, work-life balance). The questionnaire is adapted from the original RSP study (Pal, 2015) and expanded to include digital interventions. **Interviews**: Semi-structured interviews with 10 employees, 5 union leaders, and 5 managers explore perceptions of automation, digital tools, and union-management dynamics. Interview guides focus on qualitative themes like trust, fairness, and technological adaptation.

Secondary Data: Benchmarking data from Bhilai Steel Plant and Tata Steel, sourced from company reports, industry publications, and websites. Literature from academic journals, books, and industry reports on industrial relations, digital HR, and employee satisfaction.

Data Analysis Tools

Quantitative Analysis: **Structural Equation Modeling (SEM)**: SEM is used to test the hypothesized relationships between traditional/digital policies, mediating factors (perceptions, psychological needs), and employee satisfaction. SEM accounts for latent constructs and complex interrelationships, providing robust insights (Kline, 2015). Reliability and Validity: Cronbach's alpha (>0.70) ensures internal consistency, while Kaiser-Meyer-Olkin (KMO>0.6) and Bartlett's test of sphericity (p<0.05) validate the suitability of the data for factor analysis. Moderation Analysis: Interaction terms in SEM assess the moderating effects of demographics and automation levels.

Qualitative Analysis: **Thematic Analysis**: Interview transcripts are coded using NVivo software to identify themes such as employee trust, automation concerns, and digital tool adoption (Braun & Clarke, 2006). Themes are triangulated with survey findings to provide contextual depth. Comparative Analysis: Benchmarking RSP against Bhilai Steel Plant and Tata Steel involves comparing key metrics (e.g., welfare schemes, grievance resolution times, digital tool adoption) using descriptive statistics and qualitative insights from secondary data.

Data Analysis

This section presents the results of the mixed-methods study investigating the impact of traditional and digital industrial relation policies on employee satisfaction at Rourkela Steel Plant (RSP). The analysis includes reliability and validity tests, Structural Equation Modeling (SEM) results for quantitative data, thematic analysis for qualitative data, and a comparative analysis of RSP with Bhilai Steel Plant and Tata Steel. These analyses test the hypotheses outlined in the methodology and provide insights into employee perceptions and organizational dynamics.

Reliability and Validity Tests

To ensure the robustness of the quantitative data collected from 200 employees via surveys, reliability and validity tests were conducted.

Cronbach's Alpha: The reliability of the survey instrument was assessed using Cronbach's alpha, which measures internal consistency. The overall alpha value for the questionnaire was 0.921, indicating excellent reliability (Nunnally, 1978). Subscales for traditional industrial relation policies (welfare measures, working conditions, grievance handling, standing orders, employee involvement) ranged from 0.892 to 0.934, and digital interventions (online grievance portals, AI-driven tools, e-training platforms, digital communication) ranged from 0.879 to 0.912, all exceeding the threshold of 0.70, confirming high reliability.

Kaiser-Meyer-Olkin (KMO) Measure: The KMO measure of sampling adequacy was 0.836, above the recommended threshold of 0.6, indicating that the data were suitable for factor analysis (Kaiser, 1974). This suggests that the survey items adequately capture the underlying constructs.

Bartlett's Test of Sphericity: The test yielded a chi-square value of 2,347.56 ($p < 0.001$), rejecting the null hypothesis that the correlation matrix is an identity matrix. This confirms that the data have sufficient correlations for factor analysis (Bartlett, 1950).

Structural Equation Modeling (SEM) Results

Structural Equation Modeling (SEM) was conducted using AMOS software to test the hypothesized relationships between traditional and digital industrial relation policies, mediating factors (employee perceptions and psychological needs), and employee satisfaction at Rourkela Steel Plant (RSP). The model assesses direct and indirect effects, with moderation by demographic factors and automation levels. The analysis is based on survey data from 200 employees, ensuring robust statistical power. The model fit indices indicate an acceptable fit: Chi-square/degrees of freedom (χ^2/df) = 2.34 (< 3), Comparative Fit Index (CFI) = 0.927 (> 0.90), Root Mean Square Error of Approximation (RMSEA) = 0.068 (< 0.08), and Standardized Root Mean Square Residual (SRMR) = 0.051 (< 0.08) (Kline, 2015). These indices confirm that the model adequately represents the data.

SEM Path Coefficients

The following table presents the standardized path coefficients (β), standard errors (SE), t-values, and p-values for the hypothesized relationships. The model explains 79.6% of the variance in employee satisfaction (R^2 = 0.796), indicating strong explanatory power.

Table 1: SEM Path Coefficients and Model Results

Path	Stand. Coeff.(β)	Standard Error (SE)	t-value	p-value	Hypothesis	Result
Direct Effects						
Traditional Policies → Employee Satisfaction	0.62	0.045	13.78	< 0.001	H1	Supported
Digital Interventions → Employee Satisfaction	0.48	0.052	9.23	< 0.001	H2	Supported

Mediating Effects						
Traditional Policies → Employee Perceptions (Fairness, Trust)	0.71	0.038	18.68	< 0.001	H3a	Supported
Digital Interventions → Psychological Needs (Autonomy, Competence, Relatedness)	0.65	0.041	15.85	< 0.001	H3b	Supported
Employee Perceptions → Employee Satisfaction	0.54	0.047	11.49	< 0.001	H3c	Supported
Psychological Needs → Employee Satisfaction	0.59	0.044	13.41	< 0.001	H3d	Supported
Moderating Effects						
Age × Traditional Policies → Employee Satisfaction	0.12	0.059	2.03	< 0.05	H4a	Supported
Tenure × Digital Interventions → Employee Satisfaction	0.15	0.061	2.46	< 0.05	H4b	Supported
Automation Level × Digital Interventions → Employee Satisfaction	0.22	0.055	4.00	< 0.01	H5	Supported

Direct Effects:

Traditional Industrial Relation Policies → Employee Satisfaction (β = 0.62, p < 0.001): Traditional policies, including welfare measures, working conditions, grievance handling, standing orders, and employee involvement, have a strong positive effect on employee satisfaction. This suggests that foundational policies remain critical in fostering job satisfaction and organizational commitment at RSP, supporting H1.

Digital Industrial Relation Interventions → Employee Satisfaction (β = 0.48, p < 0.001): Digital interventions, such as online grievance portals, AI-driven feedback tools, e-training platforms, and digital communication channels, significantly enhance satisfaction, though their effect is slightly weaker than traditional policies. This supports H2 and highlights the growing role of digital tools in industrial relations.

Mediating Effects:

Traditional Policies → Employee Perceptions (β = 0.71, p < 0.001): Traditional policies strongly influence perceptions of fairness and trust, indicating that equitable and transparent policies enhance employees' confidence in management.

Digital Interventions → Psychological Needs (β = 0.65, p < 0.001): Digital tools significantly fulfill psychological needs (autonomy, competence, relatedness), particularly through e-training platforms that boost competence and digital communication channels that foster relatedness.

Employee Perceptions → Employee Satisfaction (β = 0.54, p < 0.001) and **Psychological Needs → Employee Satisfaction (β = 0.59, p < 0.001)**: Both employee perceptions and psychological needs mediate the relationship between policies and satisfaction, supporting H3. These mediators explain how policies translate into satisfaction through fairness, trust, and psychological fulfillment.

Moderating Effects:

Age × Traditional Policies → Employee Satisfaction (β = 0.12, p < 0.05): Older employees show a slightly stronger positive response to traditional policies, possibly due to their preference for established welfare and grievance systems, supporting H4a.

Tenure × Digital Interventions → Employee Satisfaction (β = 0.15, p < 0.05): Employees with shorter tenure exhibit greater satisfaction with digital interventions, likely due to higher digital literacy, supporting H4b.

Automation Level × Digital Interventions → Employee Satisfaction (β = 0.22, p < 0.01): Departments with higher automation levels (e.g., production with continuous casting) show a stronger effect of digital interventions on satisfaction, supporting H5. This reflects the synergy between automation and digital tools like e-training.

Table 2: Comparative Metrics

Metric	RSP	Bhilai	Tata Steel
Welfare Approval	92%	90%	87%
Grievance Resolution	10 days	12 days	7 days
Digital Tool Adoption	65%	40%	85%
Satisfaction Score	4.1/5	4.0/5	4.3/5

Interpretation: RSP outperforms Bhilai in digital adoption but lags Tata Steel in efficiency and tool usage.

Findings

The mixed-methods study at Rourkela Steel Plant (RSP) provides comprehensive insights into the impact of traditional and digital industrial relation policies on employee satisfaction, moderated by demographic factors and contextualized through comparative and qualitative analyses.

Impact of Traditional Policies vs. Digital Interventions

Traditional Policies: The Structural Equation Modeling (SEM) results indicate that traditional industrial relation policies (welfare measures, working conditions, grievance handling, standing orders, employee involvement) have a strong direct effect on employee satisfaction (β = 0.62, p < 0.001). Welfare measures, such as housing and medical benefits, and

effective grievance handling were particularly influential, explaining 79.6% of variance in satisfaction alongside other factors. These policies foster perceptions of fairness and trust, aligning with Social Exchange Theory (Blau, 1964).

Digital Interventions: Digital interventions, including online grievance portals, AI-driven feedback tools, e-training platforms, and digital communication channels, also significantly enhance satisfaction ($\beta = 0.48$, $p < 0.001$). E-training platforms were highly valued for improving competence, while online portals reduced grievance resolution time from 15 days to 10 days since their 2023 introduction. Digital tools primarily influence satisfaction through psychological needs (autonomy, competence, relatedness), supporting Self-Determination Theory (Deci & Ryan, 1985).

Role of Demographic Factors

Age: Older employees (above 40 years) showed a stronger positive response to traditional policies ($\beta = 0.12$, $p < 0.05$), likely due to their preference for established welfare systems. Younger employees (below 30 years) reported higher satisfaction with digital interventions, reflecting greater digital literacy.

Tenure: Employees with shorter tenure (<10 years) exhibited greater satisfaction with digital tools ($\beta = 0.15$, $p < 0.05$), while longer-tenured employees valued traditional grievance mechanisms. This suggests that newer employees adapt more readily to digital platforms.

Departmental Automation: Departments with higher automation levels (e.g., production) showed a stronger effect of digital interventions on satisfaction ($\beta = 0.22$, $p < 0.01$), highlighting the synergy between technology and digital HR tools.

Comparative Insights

The comparative analysis of RSP, Bhilai Steel Plant, and Tata Steel reveals strengths and weaknesses:

Strengths of RSP: RSP's comprehensive welfare measures (92% employee approval) and recent digital initiatives (e.g., online grievance portal) position it favorably against Bhilai (90% approval, limited digital tools). RSP's employee satisfaction score (4.1/5) is higher than Bhilai's (4.0/5), reflecting the impact of digital adoption.

Weaknesses: Compared to Tata Steel (satisfaction score 4.3/5), RSP lags in grievance resolution efficiency (10 days vs. 7 days) and digital tool adoption (65% vs. 85%). Tata Steel's advanced AI-driven platforms and high automation levels enhance engagement, areas where RSP needs improvement.

Bhilai's Position: Bhilai's reliance on manual systems limits its efficiency, with a 12-day grievance resolution time and low digital adoption (40%), making it less competitive than RSP and Tata Steel.

Qualitative Insights

Thematic analysis of 20 interviews (10 employees, 5 union leaders, 5 managers) identified key themes:

Trust in Management: Trust challenges persist due to past labor disputes, with some employees skeptical of union-management collaboration (e.g., "Unions are too political sometimes" – Employee, Maintenance). Digital communication channels were noted to improve transparency, fostering trust.

Digital Tool Perceptions: Employees praised online grievance portals for accessibility but highlighted digital literacy barriers among older workers. AI-driven feedback tools enhanced engagement, particularly among younger employees.

Discussion

The findings align with the theoretical framework, integrating **Dunlop's Systems Theory**, **Social Exchange Theory**, **Self-Determination Theory**, and **Nudge Theory**:

Dunlop's Systems Theory: RSP's industrial relations system, shaped by management, unions, and government regulations, adapts to digital interventions, creating a new "web of rules" that includes online grievance systems (Dunlop, 1958). The strong effect of traditional policies reflects the system's stability, while digital tools indicate its evolution.

Social Exchange Theory: Traditional policies foster reciprocal trust and fairness, driving satisfaction (Blau, 1964). The mediating role of perceptions ($\beta = 0.54$, $p < 0.001$) confirms that equitable policies strengthen employer-employee bonds.

Self-Determination Theory: Digital interventions enhance autonomy (e.g., self-paced e-training), competence (skill development), and relatedness (digital communication), mediating satisfaction ($\beta = 0.59$, $p < 0.001$) (Deci & Ryan, 1985).

Nudge Theory: Digital tools act as nudges, encouraging engagement through user-friendly interfaces (Thaler & Sunstein, 2008). For instance, online portals simplify grievance reporting, increasing participation.

The literature supports these findings. Srivastava (2004) highlights the role of welfare measures in public-sector satisfaction, consistent with RSP's high approval (92%). Kapoor (2020) notes that digital HR tools improve engagement, aligning with RSP's digital intervention effects. However, the study extends the literature by integrating interdisciplinary perspectives and benchmarking against peers.

Conclusion

This study demonstrates that traditional industrial relation policies ($\beta = 0.62$) and digital interventions ($\beta = 0.48$) significantly enhance employee satisfaction at RSP, mediated by perceptions of fairness, trust, and psychological needs (autonomy, competence, relatedness). Demographic factors (age, tenure) and automation levels moderate these effects, with younger employees and automated departments showing greater responsiveness to digital tools. Comparative analysis highlights RSP's strengths in welfare but identifies gaps in digital adoption compared to Tata Steel. Qualitative insights reveal automation concerns and trust challenges, mitigated by digital tools. The study's novelty lies in its integration of digital interventions, interdisciplinary perspectives (behavioral economics,

organizational psychology), and benchmarking against peers, addressing literature gaps.

Future Research Directions

Longitudinal Studies: Conduct follow-up studies to assess the sustainability of digital interventions over time. Cross-Industry Comparisons: Extend the framework to other industries (e.g., automotive, mining) to test generalizability.

Acknowledgment

The authors express their sincere gratitude to the management, employees, and union representatives of Rourkela Steel Plant for their valuable cooperation during data collection. Special thanks are extended to the Human Resource Department for facilitating access to key documents and personnel. The authors also acknowledge the constructive feedback from faculty members at Dr. C. V. Raman University, Bilaspur, which significantly enhanced the quality of this research.

Financial support and sponsorship:

Nil.

Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

References

1. Aguinis, H., & Glavas, A. (2012). What we know and don't know about corporate social responsibility: A review and research agenda. *Journal of Management, 38*(4), 932–968. https://doi.org/10.1177/0149206311436079
2. Bartlett, M. S. (1950). Tests of significance in factor analysis. *British Journal of Statistical Psychology, 3*(2), 77–85. https://doi.org/10.1111/j.2044-8317.1950.tb00285.x
3. Blau, P. M. (1964). *Exchange and power in social life*. Wiley.
4. Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa
5. Budd, J. W. (2004). *Employment with a human face: Balancing efficiency, equity, and voice*. Cornell University Press.
6. Chellappa, R. K., & Jhoumey, A. (1982). Industrial relations and technological change. *Indian Journal of Industrial Relations, 18*(2), 221–237.
7. Datta, S. K. (1990). Automation and industrial relations: Implications for employment and working conditions. *Indian Journal of Labour Economics, 33*(3), 45–60.
8. Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Springer.
9. Dunlop, J. T. (1958). *Industrial relations systems*. Holt.
10. Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1–55. https://doi.org/10.1080/10705519909540118
11. Johri, C. K. (1990). Industrial relations and technological change in India. *Indian Journal of Industrial Relations, 25*(4), 345–360.
12. Judge, T. A., Thoresen, C. J., Bono, J. E., & Patton, G. K. (2001). The job satisfaction–job performance relationship: A qualitative and quantitative review. *Psychological Bulletin, 127*(3), 376–407. https://doi.org/10.1037/0033-2909.127.3.376
13. Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika, 39*(1), 31–36. https://doi.org/10.1007/BF02291575
14. Kapoor, R. (2020). Digital HR: Revolutionizing employee engagement in the Industry 4.0 era. *Journal of Human Resource Management, 23*(4), 56–72.
15. Khurana, R. (1972). Industrial relations in public and private sector enterprises: A comparative study. *Indian Journal of Industrial Relations, 8*(1), 45–62.
16. Kline, R. B. (2015). *Principles and practice of structural equation modeling* (4th ed.). Guilford Press.
17. Kumar, C. B. (1961). Development of industrial relations in India. *Indian Journal of Labour Economics, 4*(2), 112–125.
18. Leelavathy, M. (2000). Role of grievance redressal in promoting industrial harmony. *Indian Journal of Industrial Relations, 36*(3), 289–305.
19. Lester, R. A. (1964). *Economics of labor* (2nd ed.). Macmillan.
20. Mamta Panda. (2004). Empowerment through participation: A case study of industrial relations in India. *Journal of Labour Studies, 12*(3), 78–92.
21. Nath, S. (1995). Industrial relations and labour laws in India: A pragmatic approach. *Indian Journal of Labour Economics, 38*(2), 145–160.
22. Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). McGraw-Hill.
23. Pal, S. (2015). *Impact of industrial relation policies on satisfaction level of employees at Rourkela Steel Plant* [Unpublished doctoral dissertation]. Utkal University.
24. Pandey, S. N. (1999). Industrial relations management: Role of collective action. *Indian Journal of Industrial Relations, 34*(4), 412–428.
25. Porter, L. W., & Lawler, E. E. (1968). *Managerial attitudes and performance*. Irwin-Dorsey.
26. Ratnam, C. S. V. (1998). Grievance handling in Indian industries: Issues and challenges. *Indian Journal of Labour Economics, 41*(3), 321–336.
27. SAIL. (2025). *Annual report 2024–2025*. Steel Authority of India Limited. https://www.sail.co.in/en/annual-reports
28. Schwab, K. (2016). *The fourth industrial revolution*. World Economic Forum.
29. Sharma, B. R., & Sundara Rajan, P. S. (1983). Determinants of labour-management relations:

An empirical study. *Indian Journal of Industrial Relations, 19*(2), 167–182.
30. Srivastava, S. K. (2004). Impact of welfare measures on employee satisfaction in public sector enterprises. *Indian Journal of Labour Economics, 47*(3), 223–238.
31. Thaler, R. H., & Sunstein, C. R. (2008). *Nudge: Improving decisions about health, wealth, and happiness*. Yale University Press.
32. Wang, H., & Xu, L. (2018). Digital transformation in Chinese steel industry: Lessons from Baosteel. *Journal of Industrial Management, 15*(2), 89–104.