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Digital transformation and employee experience: A study on working conditions and job satisfaction in Tamil Nadu paper mills

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Abstract
The increasing integration of digital technologies in traditional manufacturing sectors has profoundly changed employee roles, working conditions, and overall job satisfaction. This study investigates the impact of digital transformation on employee experience, with a specific focus on working conditions and job satisfaction in Tamil Nadu paper mills. Drawing upon the Job Demands-Resources model and Routine-Based Technological Change theory, the research adopts a quantitative approach using a structured questionnaire administered to 502 employees across selected paper mills. Data were analyzed using correlation analysis and independent samples t-tests. Results indicate a significant positive relationship between digital transformation and job satisfaction, with employees exposed to higher levels of technological change reporting greater satisfaction. However, the findings also highlight that the impact varies based on the extent of transformation and available organizational support. The study bridges a critical gap in understanding digitalization's human implications in legacy industries and offers practical insights for implementing technology-driven change while preserving employee well-being.

Keywords: Tamil Nadu, digital transformation, employee experience, working conditions, job satisfaction

Introduction
The rapid evolution of production systems in India, particularly in the context of Industry 4.0, has raised significant concerns regarding the implications of technological change on the labour market. As Indian industries adopt automation, digital platforms, and artificial intelligence (AI), important questions have emerged about how these technologies are substituting human labour, altering job roles, and reshaping employee experiences. This issue is especially pertinent in traditional sectors such as the paper manufacturing industry in Tamil Nadu, where the workforce is adjusting to a blend of legacy operations and modern digital systems.

While global debates around technological change have largely focused on job losses and wage disparities recent research underscores the importance of assessing non-monetary aspects of employment. These include job quality, well-being, job security, and task satisfaction factors that are often overlooked in purely economic analyses. In the Indian context, where many workers are employed in informal or semi-formal settings, a broader evaluation of employee well-being is essential for developing relevant organizational and policy frameworks.

Digital transformation in India's paper mills has notably influenced both the nature and environment of work. On the one hand, automation has improved safety by minimizing exposure to hazardous environments and reducing the need for repetitive manual tasks (Gisbert *et al.*, 2014) [16]. On the other hand, employees are increasingly experiencing stress related to digital adaptation, role ambiguity, and work-life conflict (Tarafdar *et al.*, 2007; Mahapatra & Patil, 2018) [26, 20]. These challenges may negatively affect job satisfaction, particularly among employees who lack adequate digital skills or organizational support.

Although studies in India have examined the impact of digitalization on sectors such as IT and services, there is a notable lack of research on how digital work environments affect

working conditions and job satisfaction in medium-scale, traditional industries like paper manufacturing. This study addresses this research gap by focusing on how digital transformation influences employee experiences in Tamil Nadu's paper industry (Aghion *et al*., 2019) [4]. It explores employees' perceptions of the digital work environment, the quality of working conditions, and how these factors contribute to job satisfaction.

By taking a holistic approach beyond income-focused metrics, the study contributes to the expanding discourse on the social and psychological impacts of digital transformation in the workplace. Its findings hold value for policymakers, HR professionals, and industry leaders seeking to foster inclusive, supportive, and sustainable digital workplaces in India's industrial sectors.

2. Literature review

2.1 Digital transformation in traditional industries

Digitalization has reshaped traditional industries by embedding innovative technologies, automation systems, and digital monitoring tools into daily operations. In manufacturing, these changes are not merely technical upgrades but are deeply transformational, altering job structures, skill demands, and organizational hierarchies (Frey & Osborne, 2017) [13]. Tasks that are highly routine or manual are increasingly automated, creating a dual effect while specific roles become obsolete, new ones emerge that require advanced digital competencies and adaptability. The pace and unpredictability of these technological advancements, as discussed by (Gruetzemacher *et al*. 2021) [17] and (Aghion *et al*. 2019) [4], have heightened concerns around job displacement and income inequality (Goos, 2018) [14], particularly in economies with a high proportion of routine occupations.

2.2 Working conditions in digital evolving environments

Working conditions encompass a range of physical, psychological, and organizational factors that collectively influence employee performance and well-being. The digital shift can enhance work environments by improving efficiency, reducing manual strain, and increasing precision (Autor & Dorn, 2013) [5]. However, it simultaneously introduces challenges such as digital fatigue, surveillance stress, and the ongoing need for digital upskilling. These dynamics can be best understood through the Job Demands-Resources model (Bakker & Demerouti, 2007; Lesener *et al*., 2019) [8, 19], which posits that employee well-being is a function of the balance between job demands (e.g., pressure, role ambiguity, techno stress) and job resources (e.g., autonomy, feedback, learning opportunities). For instance, (Mahapatra and Pati, 2018) [20] identified five techno stress creators techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty as significant sources of job burnout. Conversely, technology can also foster job satisfaction when it enables autonomy and engagement, as shown by Carlson *et al*. (2017) [11].

2.3 Job Satisfaction and Organizational Support

Amidst rapid digital transitions, job satisfaction emerges as a crucial buffer and indicator of workforce adaptability. Organizational support in the form of training, clear communication, and psychological safety can significantly enhance satisfaction levels and ease the transition into technologically altered work environments (Goos *et al*., 2014) [15]. Notably, changes in satisfaction are not uniform across technology types. While earlier technologies (e.g., robotics, ICTs) tended to have a substitution effect on labor (Acemoglu & Restrepo, 2018) [2], AI introduces more nuanced dynamics. Unlike robots that replace muscle work and software that automates routine processing, AI handles high-skilled tasks such as judgment, decision-making, and pattern recognition (Webb, 2020) [28]. These advancements bring opportunity and risk, depending on how organizations manage skill transitions, autonomy, and emotional workload. Studies such as those by Felten *et al*. (2019) [12] underscore that the impacts of AI and automation vary significantly based on sectoral knowledge intensity and implementation strategy.

2.4 Research Gap

Existing research primarily focuses on digital transformation in the IT and service sectors. There is limited empirical evidence on how this transformation affects employee experience in traditional manufacturing sectors like the paper industry in India. Few studies have examined the dual impact of digital changes on working conditions and job satisfaction in the Tamil Nadu context. To address this research gap and explore the impact of digital transformation on employee outcomes, the following hypotheses are proposed:

- **H_1:** There is a significant positive relationship between digital transformation and job satisfaction among employees in paper mills.
- **H_2:** There is a significant difference in job satisfaction levels between employees exposed to high digital transformation and those exposed to low digital transformation.

3. Research Methodology

3.1 Research Design

This study adopts a quantitative, descriptive research design, aiming to systematically examine the impact of digital transformation on employee working conditions and job satisfaction in the paper manufacturing sector of Tamil Nadu. The study is cross-sectional in nature, collecting data at a single point in time using a structured questionnaire.

3.2 Sampling technique and sample frame

The sampling technique employed is purposive sampling, suitable for targeting employees who are directly experiencing or impacted by digital technologies in their workplaces. The sample frame includes full-time operational and administrative employees working in both public and private paper mills located across major industrial clusters in Tamil Nadu, such as Karur, Erode, Coimbatore, and Tiruchirappalli, where significant levels of automation and digitalization have been implemented.

3.3 Sample Size

The sample size was determined based on the "rule of thumb" of (Rayan, 2013) which recommends a minimum ratio of 1:10 between indicators and respondents. With approximately observed variables in the instrument (including latent constructs related to digital transformation, working conditions, and job satisfaction), a minimum sample of 350 was considered adequate. However, to ensure statistical power and account for incomplete responses, a total of 500 responses were collected, out of which 482

valid responses were retained after data cleaning.

3.4 Instrument Design

A structured questionnaire was developed using validated scales adapted from existing literature. The instrument was divided into four key sections: Demographics (age, gender, experience, department, etc.). Digital Transformation (measured via items on automation, digital monitoring, and ICT usage) Working Conditions (using constructs from the JD-R model such as job demands, resources, and techno stress creators)Job Satisfaction (using a modified version of the Job Satisfaction Survey by Spector)All items were measured using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

3.5 Data Collection Procedure

Primary data was collected using both online (Google Forms) and offline (paper-based) modes to account for digital literacy differences among respondents. A formal permission was obtained from the HR departments of selected paper mills before distributing the questionnaire. Data collection was conducted over a period of two months, from April to May 2025.

3.6 Data Analysis Techniques

The collected data was analyzed and the descriptive statistics and demographic breakdowns were conducted using SPSS 26.

4. Results

Table 1: Demographic profile of respondents

Demographic Variable	Categories	Percentage (%)
Gender	Male	78.5
	Female	21.5
Age (years)	21-30	25.3
	31-40	42.7
	41-50	24.1
	Above 50	7.9
Educational Qualification	Undergraduate (UG)	49.2
	Postgraduate (PG)	48.6
	Diploma/ITI	2.2
Company Size	Medium size companies (101-1000 employees)	62.5
	Large companies (>1000 employees)	37.5
Sector Type	Manufacturing (Paper Mills)	100
Total Work Experience (Years)	1-5	34.7
	6-10	40.6
	Above 10	24.7

The demographic distribution reveals that a majority of the workforce in Tamil Nadu's paper mills are male (78.5%), reflecting the traditional gender pattern in industrial sectors. The age group 31-40 years forms the largest segment (42.7%), indicating a relatively mature and experienced workforce actively navigating digital transitions. Educationally, there is an almost equal distribution between undergraduates (49.2%) and postgraduates (48.6%), highlighting a well-qualified employee base. Most respondents are employed in medium-sized firms (62.5%), often facing resource limitations in implementing large-scale digital initiatives. All participants belong to the manufacturing sector, specifically the paper industry, ensuring contextual relevance. Furthermore, the majority have 6-10 years of experience (40.6%), suggesting they are seasoned employees with sufficient exposure to both traditional and digital work environments, making them ideal respondents for assessing the impacts of digital transformation on employee experience.

Table 2: Independent samples test between digital transformation and job satisfaction

	Levene's Test for Equality of Variances	T-test for equality of means
	F	Sig.
Digital Transformation	28.763	.000
Equal variances not assumed		
Job Satisfaction	2.587	.112
Equal variances not assumed		

The Levene's test for equality of variances for digital transformation shows a significant result (F=28.763, P=.000), indicating variances are not equal, and thus the t-test assuming unequal variances is considered more appropriate.

The t-test results (t=2.067, DF=45.216, P=.044) indicate a statistically significant difference in job satisfaction levels between employees in high digital transformation environments and those in lower digital transformation settings. The mean difference is 4.81, suggesting that employees exposed to higher digital transformation report notably greater job satisfaction.

In contrast, for Job Satisfaction, the p-values (.069 and .099) are slightly above the 0.05 threshold, indicating marginal significance. While this suggests a trend towards increased job satisfaction with digital transformation, it is not conclusive at the 5% level in this case.

Table 3: Correlation between digital transformation and job satisfaction

	Digital Transformation (DT)	Job Satisfaction (JS)
Digital Transformation (DT)	Pearson Correlation	1
	Sig. (2-tailed)	
	N	150
Job Satisfaction (JS)	Pearson Correlation	.771**
	Sig. (2-tailed)	.000
	N	150

The Pearson correlation coefficient between Digital Transformation (DT) and Job Satisfaction (JS) is 0.771, indicating a strong positive relationship between the two variables. The significance value (P=.000) is less than 0.01, confirming that the correlation is statistically significant at the 1% level. This suggests that as digital transformation initiatives (such as automation, digital tools, and process digitization) increase within paper mills, employees tend to report higher levels of job satisfaction. These findings support the notion that well-implemented digital practices can positively influence the employee experience when accompanied by adequate organizational support.

- **H_1:** There is a significant positive relationship between digital transformation and job satisfaction among employees in paper mills.
  Supported by the correlation result ($r=.771$, $p<.01$), this hypothesis suggests that employee job satisfaction also tends to rise as digital transformation initiatives increase.
- **H_2:** There is a significant difference in job satisfaction levels between employees exposed to high digital transformation and those exposed to low digital transformation.
  This is based on the independent samples t-test which showed a statistically significant mean difference in job satisfaction (P=.044) depending on the extent of digital transformation.

5. Discussion

The findings of this study reveal a significant and positive relationship between digital transformation and job satisfaction among employees in Tamil Nadu's paper mills. The strong correlation suggests that digital technologies, when implemented effectively, can enhance the employee experience by improving work efficiency, reducing physical strain, and increasing task clarity. However, the independent samples t-test further emphasizes that the degree of digital transformation matters employees exposed to higher levels of digital integration reported significantly greater job satisfaction compared to those in less digitized settings. This supports prior literature grounded in the Job Demands-Resources (JD-R) model, indicating that digitalization, when accompanied by adequate job resources such as training, support, and autonomy, contributes positively to employee well-being. Conversely, the marginal results in some areas caution that not all aspects of digitalization are uniformly beneficial especially in traditional sectors where workforce adaptability and change management strategies may vary.

6. Conclusion

This study concludes that digital transformation plays a pivotal role in shaping employee experiences in traditional manufacturing environments like paper mills. The positive association between digital initiatives and job satisfaction underscores the potential of technology to improve not only operational performance but also employee morale and engagement. However, the transition must be supported by strategic human resource practices such as ongoing training, inclusive communication, and a balanced workload to mitigate the risks of techno stress and resistance. By bridging the research gap in low-digitization industrial sectors, this study offers valuable insights for both practitioners and policymakers aiming to implement human-centric digital transformation in legacy industries.

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