

Technology-Enabled Work Practices and Workforce Retention in Postpandemic Manufacturing

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ABSTRACT

This study examines changes in work practices across manufacturing plants in India, in the context of the postCOVID-19 pandemic and subsequent business transformations. The pandemic led to significant fluctuations in supply and demand, compelling organizations to rapidly adapt operations, enhance customer support, and implement cost-reduction strategies, including workforce downsizing. Grounded in the broader context of technological disruption and industrial restructuring, the study explores how manufacturing firms responded to these challenges.

The research adopts an empirical, descriptive design, with data collected from 160 employees working at leading manufacturing plants in India. Statistical tools such as SPSS and SmartPLS were used to analyze the data and examine relationships among key variables.

The findings reveal that the industry benefits from a strong demographic dividend, highlighting the urgent need for upskilling initiatives. Automation, digitalization, and emerging technologies are identified as transformative forces reshaping shop-floor dynamics. The results further indicate a positive relationship between job satisfaction, employee retention, and productivity. Technological advancement, coupled with accelerated upskilling, significantly contributes to improved organizational outcomes and workforce stability.

The study underscores the practical and social implications of smart manufacturing, in which increased automation and intelligent systems may reduce the need for a manual workforce while enhancing efficiency and performance. The originality of this research lies in its focus on the intersection of demographic advantage, technological transformation, and workforce readiness in the Indian manufacturing sector. The findings emphasize the need for substantial organizational investment in employee upskilling to prepare workers for AI-driven and robotics-enabled production environments.

Keywords- Digitalization, Productivity, Smart Manufacturing, Technology, Talent Acquisition, Upskilling

INTRODUCTION

Post-Pandemic Scenario in the Manufacturing Industry

The COVID-19 pandemic fundamentally reshaped the global manufacturing landscape, exposing structural vulnerabilities in supply chains, workforce management, and operational resilience. Lockdowns, labor shortages, and disruptions in logistics networks led to severe production slowdowns and highlighted the risks associated with overdependence on globalized supply systems (Ivanov & Dolgui, 2020; World Bank, 2022). As economies reopened, manufacturing firms entered a recovery phase characterized not merely by restoration, but by strategic transformation.

One of the most significant post-pandemic shifts has been the acceleration of digital transformation. Organization

have increasingly adopted Industry 4.0 technologies such as automation, robotics, artificial intelligence (AI), Internet of Things (IoT), and cloud-based systems to enhance operational flexibility and reduce human dependency in critical processes (Brynjolfsson et al., 2020). These technologies enable real-time monitoring, predictive maintenance, and data-driven decision-making, improving productivity and minimizing operational disruptions.

Supply chain resilience has also become a strategic priority. Manufacturers are redesigning supply networks through nearshoring, supplier diversification, and digital supply chain integration to mitigate future shocks (Ivanov & Dolgui, 2020). The shift from cost-efficiency to resilience-oriented models reflects a broader rethinking of manufacturing strategy in uncertain environments.

From a human resource perspective, the pandemic intensified the need for workforce agility and upskilling. As automation increases, demand for digitally skilled employees has grown, while routine manual roles are gradually declining (International Labour Organization [ILO], 2021). Organizations are therefore investing in reskilling initiatives to align employee capabilities with smart manufacturing requirements. Job satisfaction and employee engagement have emerged as critical determinants of retention in this evolving landscape, particularly as employees face technological change and role redefinition (Cascio & Montealegre, 2016).

Furthermore, hybrid work arrangements, digital collaboration tools, and enhanced workplace safety protocols have become embedded in post-pandemic manufacturing practices. Although shop-floor roles require physical presence, managerial, design, and support functions increasingly operate in digitally integrated environments. This blended operational model reflects a transition toward more flexible and technology-enabled production systems.

In emerging economies such as India, the post-pandemic period has amplified the importance of leveraging demographic dividends through structured skill development and technological adoption. Government initiatives promoting digital manufacturing and self-reliance have further accelerated industrial modernization efforts (World Bank, 2022). However, the success of this transition depends on balancing automation with inclusive workforce development to prevent displacement and maintain social stability.

Overall, the post-pandemic manufacturing industry is characterized by digital acceleration, supply chain reconfiguration, workforce transformation, and resilience-oriented strategy. Rather than a temporary disruption, COVID-19 has acted as a catalyst for structural change, redefining competitiveness and sustainability in global manufacturing systems

LITERATURE REVIEW

Post-Pandemic Manufacturing Industry: A Dynamic Capabilities and RBV Perspective

The COVID-19 pandemic disrupted global manufacturing systems, exposing structural fragilities in supply chains, production networks, and workforce configurations. From a Resource-Based View (RBV) perspective, firms that possessed valuable, rare, inimitable, and non-substitutable (VRIN) resources—such as advanced digital infrastructure, skilled human capital, and strong supplier relationships—were better positioned to withstand operational shocks (Barney, 1991). However, the pandemic demonstrated that possessing strategic resources alone was insufficient; firms required the ability to reconfigure and redeploy these resources rapidly in response to environmental turbulence.

This necessity aligns with Dynamic Capabilities Theory (DCT), which emphasizes a firm's ability to sense opportunities and threats, seize opportunities, and transform organizational resources to sustain competitive advantage in volatile environments (Teece et al., 1997; Teece, 2007). In the post-pandemic manufacturing landscape, digital transformation represents a clear manifestation of dynamic capability deployment. Manufacturers accelerated investments in Industry 4.0 technologies—including artificial intelligence (AI), industrial Internet of Things (IIoT), robotics, and advanced analytics—to enhance operational agility, predictive maintenance, and real-time decision-making (Frank et al., 2019). These technological investments reflect not merely resource acquisition but strategic reconfiguration aimed at long-term resilience.

Supply chain redesign further illustrates dynamic capability in action. Firms shifted from cost-centric global sourcing models toward resilience-oriented strategies such as supplier diversification, regionalization, and digital supply chain visibility systems (Ivanov & Dolgui, 2020). The ability to rapidly restructure supply networks during disruptions exemplifies transformation capability—central to DCT—while maintaining relational capital with suppliers reflects the strategic resource base emphasized by RBV.

Human capital has emerged as a critical strategic asset in the post-pandemic manufacturing context. According to RBV, employee skills, tacit knowledge, and organizational culture constitute intangible resources that generate sustained competitive advantage (Barney, 1991). As automation and smart manufacturing systems redefine shop-floor roles, firms must invest in upskilling and reskilling to preserve the value of their human capital base. However, dynamic capabilities are required to integrate new technological competencies with existing organizational routines (Teece, 2007). Studies indicate that digital transformation success depends on employee engagement, adaptive learning systems, and managerial capability to orchestrate technological change (Cascio & Montealegre, 2016).

Moreover, the post-pandemic shift toward hybrid operational models—combining on-site production with digital monitoring and remote diagnostics—reflects organizational transformation capability. Firms that effectively integrated digital platforms with physical production processes demonstrated superior agility and performance. This integration highlights the interplay between tangible assets (machinery, infrastructure), intangible assets (knowledge systems, culture), and dynamic managerial capabilities.

In emerging economies such as India, leveraging demographic advantages through structured skill development represents both a strategic resource accumulation (RBV) and a long-term capability-building process (DCT). The post-pandemic manufacturing sector thus illustrates that sustainable competitiveness is not derived solely from resource ownership but from the firm’s ability to continuously renew, recombine, and reconfigure resources in response to environmental shifts.

Overall, the post-COVID manufacturing landscape underscores the complementary relevance of RBV and Dynamic Capabilities Theory. While RBV explains the importance of strategic assets such as technology, human capital, and relational networks, DCT provides insight into how firms adapt, transform, and sustain performance amid systemic disruptions. The pandemic has therefore reinforced agility, technological integration, and workforce development as central pillars of manufacturing competitiveness.

Figure 1: Conceptual Framework



Interpretation of the conceptual framework: refer figure 1. The proposed conceptual framework integrates the Resource-Based View (RBV) and Dynamic Capabilities Theory (DCT) to explain how digital transformation influences employee retention in post-pandemic manufacturing firms. The model positions digital transformation as a foundational strategic resource that enables firms to build higherorder dynamic capabilities, which subsequently drive workforce outcomes.

At the core of the framework is Digital Transformation (DT), representing the adoption of Industry 4.0 technologies such as artificial intelligence, robotics, IoT-enabled systems, advanced analytics, and smart manufacturing platforms. From an RBV perspective, digital infrastructure constitutes a valuable and difficult-to-imitate resource that enhances operational efficiency and competitiveness. However, the model argues that resource possession alone does not guarantee superior performance. Instead, firms must develop dynamic capabilities to leverage these technological investments effectively.

Organizational Agility (OA) represents the firm's dynamic capability to sense environmental changes, seize technological opportunities, and reconfigure internal resources. In the post-pandemic manufacturing environment characterized by supply chain disruptions and fluctuating demand, agility enables firms to adapt production systems and realign workforce structures. The framework proposes that digital transformation strengthens agility by providing real-time information, predictive insights, and operational flexibility.

The next stage in the model is Employee Upskilling (EU), which reflects the transformation microfoundation of DCT. Agile firms invest in training and skill development to ensure that employees can operate advanced technologies and adapt to evolving production systems. From an RBV standpoint, human capital becomes a strategic intangible asset when continuously renewed and aligned with technological change. Upskilling, therefore, acts as a mechanism through which technological resources are converted into sustainable organizational advantage.

Employee Upskilling positively influences Job Satisfaction (JS). Skill development enhances employee confidence, career growth perceptions, and role clarity, particularly in digitally evolving manufacturing environments. When employees feel competent and supported during transformation processes, their psychological attachment to the organization increases.

Finally, Job Satisfaction drives Employee Retention (ER). Retaining skilled employees preserves tacit knowledge, reduces recruitment costs, and protects firm-specific capabilities. The framework highlights that digital transformation affects retention indirectly through the sequential mechanisms of agility, upskilling, and satisfaction. Thus, technology influences workforce stability only when supported by capability development and positive employee experiences.

The model further incorporates contextual moderators. Firm Size strengthens the relationship between digital transformation and organizational agility, as larger firms often possess greater resource slack. Technological Intensity enhances the impact of agility on upskilling, given the higher training demands in automated environments. Workforce Demographic Dividend strengthens the link between upskilling and job satisfaction, as younger or adaptable workforces may respond more positively to development opportunities.

Overall, the framework demonstrates that sustainable competitive advantage in manufacturing arises not merely from technological adoption but from the firm's ability to dynamically reconfigure resources and develop human capital in response to environmental turbulence.

RESEARCH METHODOLOGY

The study is based on theoretical and empirical research. A survey was conducted among employees of manufacturing plants in India to collect data, and a sample of 160 was collected to analyse the data. Primary and secondary data were collected, a structured questionnaire was formulated, and the sample was collected via LinkedIn (Google Form). The sample was drawn from the leading manufacturing plants; simple random sampling techniques were used to collect the data. An evaluation of questionnaire linkage was conducted as part of the pilot study. In order to check the internal consistency and relationship between the indicators, SPSS and

Smart PLS were used to test the data. Cronbach's Alpha and Discriminant validity were also tested. Using SEM (Structural Equation Modeling), the hypothesis was tested.

Hypotheses Development and Theoretical Positioning

This study extends the post-pandemic manufacturing discourse by integrating the **Resource-Based View (RBV)** (Barney, 1991) and **Dynamic Capabilities Theory (DCT)** (Teece et al., 1997; Teece, 2007) to explain how manufacturing firms sustain performance and employee retention amid technological disruption. While prior studies emphasize digital transformation and supply chain resilience, limited research has theoretically linked these changes to workforce outcomes using strategic management perspectives. By combining RBV and DCT, this study advances a multi-level explanation connecting technological capability, human capital development, job satisfaction, and employee retention in the manufacturing context.

Under RBV, competitive advantage stems from valuable, rare, inimitable, and non-substitutable (VRIN) resources such as skilled labor, organizational knowledge, and advanced technological infrastructure (Barney, 1991). However, in highly turbulent environments like the post-pandemic manufacturing landscape, static resource possession is insufficient. DCT argues that firms must continuously sense environmental changes, seize opportunities, and transform resource configurations to maintain competitiveness (Teece, 2007). Thus, digital transformation and workforce upskilling represent not merely resource investments but dynamic reconfiguration processes.

This study contributes theoretically in three ways:

- **Bridging Strategy and HRM:** It links macro-level dynamic capabilities (technology adoption, supply chain reconfiguration) with micro-level employee outcomes (job satisfaction and retention).
- **Extending RBV:** It conceptualizes human capital not only as a strategic asset but as a renewable capability enhanced through digital upskilling.
- **Operationalizing DCT in Manufacturing:** It empirically connects sensing (recognizing digital disruption), seizing (adopting Industry 4.0 technologies), and transforming (workforce reskilling) to organizational and employee-level outcomes.

Digital Transformation and Organizational Agility

Post-pandemic manufacturing firms have accelerated the adoption of Industry 4.0 technologies such as AI, robotics, IoT, and advanced analytics (Frank et al., 2019). From a DCT perspective, digital transformation reflects a firm's sensing and seizing capability, enabling rapid response to supply chain disruptions and demand fluctuations (Teece, 2007). Firms that effectively integrate digital technologies are likely to enhance operational flexibility and productivity. Digital transformation in manufacturing—through AI, robotics, IoT, and smart analytics—constitutes a strategic resource base (Barney, 1991). Firms leveraging Industry 4.0 technologies demonstrate superior responsiveness to environmental turbulence.

H1: Digital transformation positively influences organizational agility in manufacturing firms.

Organizational Agility and Employee Upskilling

Dynamic capability theory emphasizes transformation capability—reconfiguring internal resources to match environmental change (Teece et al., 1997). In manufacturing settings, this involves upskilling and reskilling employees to operate advanced technologies. Human capital, viewed through RBV, constitutes a strategic intangible resource that strengthens firm competitiveness (Barney, 1991). Organizational agility is therefore expected to drive structured workforce development initiatives. Agile firms invest more in structured training and reskilling programs to align workforce capabilities with digital systems.

H2: Organizational agility positively influences employee upskilling.

Employee Upskilling and Job Satisfaction

RBV posits that investment in human capital enhances employee value and organizational performance. Upskilling not only increases technical competence but also improves employees' perceived career growth opportunities, role clarity, and self-efficacy. Prior research indicates that learning opportunities and developmental support significantly enhance job satisfaction (Cascio & Montealegre, 2016). In technologically evolving environments, employees who receive adequate training are more likely to adapt positively. RBV emphasizes human capital as a valuable and inimitable resource. When employees receive continuous training, they experience higher role clarity, competence, and perceived career growth.

H3: Employee upskilling positively influences job satisfaction in manufacturing firms.

Job Satisfaction and Employee Retention

Job satisfaction remains a critical predictor of employee retention, particularly in high-skill manufacturing environments undergoing technological change. According to RBV, retaining skilled employees preserves firmspecific knowledge and reduces the loss of valuable tacit capabilities (Barney, 1991). In dynamic contexts, satisfied employees are more willing to embrace transformation, thereby strengthening organizational resilience.

H4: Job satisfaction positively influences employee retention in manufacturing firms.

Mediation Role of Upskilling and Job Satisfaction

From a DCT perspective, the transformation of technological investments into sustained performance outcomes requires effective orchestration of human capital (Teece, 2007). Digital transformation alone may not directly reduce turnover unless it is accompanied by structured upskilling and enhanced job satisfaction. Thus, employee development mechanisms serve as mediating pathways linking technological capability to retention outcomes.

H5: Employee upskilling mediates the relationship between organizational agility and job satisfaction.

H6: Job satisfaction mediates the relationship between employee upskilling and employee retention.

Hypotheses Testing

The six hypotheses were tested using Partial Least Squares Structural Equation Modeling (PLS-SEM) with bootstrap resamples in SmartPLS 4. Path coefficients (β), t-values, and p-values were examined to determine statistical significance. A two-tailed test with a significance level of 0.05 was applied.

H1: Digital Transformation → Organizational Agility

The results indicate a significant positive relationship between digital transformation and organizational agility ($\beta = 0.54$, $t = 7.21$, $p < 0.001$).

Interpretation: This finding supports the argument that digital transformation enhances a firm's ability to respond quickly to environmental changes. In manufacturing firms, the adoption of Industry 4.0 technologies strengthens operational flexibility and adaptive capacity. The relatively high β value (0.54) suggests that digital transformation is a strong predictor of organizational agility.

H1 Supported.

H2: Organizational Agility → Employee Upskilling

Organizational agility significantly influences employee upskilling ($\beta = 0.48$, $t = 6.34$, $p < 0.001$).

Interpretation: Agile manufacturing firms invest more actively in reskilling and training initiatives. This result confirms that agility extends beyond structural flexibility to include human capital reconfiguration. Firms capable of rapid adaptation prioritize workforce capability development.

H2 Supported.

H3: Employee Upskilling → Job Satisfaction

Employee upskilling demonstrates a strong positive impact on job satisfaction ($\beta = 0.52$, $t = 8.02$, $p < 0.001$).

Interpretation: Training and skill development enhance employees' perceived competence, career growth prospects, and psychological empowerment. In technology-intensive manufacturing environments, upskilling reduces uncertainty and improves role clarity, thereby increasing job satisfaction. The high t-value (8.02) indicates a robust effect.

H3 Supported.

H4: Job Satisfaction → Employee Retention

Job satisfaction significantly predicts employee retention ($\beta = 0.46$, $t = 6.88$, $p < 0.001$).

Interpretation: Satisfied employees are more likely to remain with the organization. In manufacturing contexts, retention of skilled employees preserves tacit knowledge and reduces turnover costs. The moderate-to-strong coefficient ($\beta = 0.46$) indicates that satisfaction is a key retention driver.

H4 Supported.

Sequential Mediation Hypotheses

H5: Organizational Agility Mediates the Relationship between Digital Transformation and Employee Upskilling

The indirect effect of digital transformation on employee upskilling through organizational agility is significant ($\beta = 0.26$, $t = 5.88$, $p < 0.001$).

Interpretation: Digital transformation enhances employee upskilling primarily through increased organizational agility. This suggests that agility acts as an enabling mechanism, translating technological investments into workforce development.

H5 Supported.

H6: Job Satisfaction Mediates the Relationship between Employee Upskilling and Employee Retention

The indirect effect of employee upskilling on employee retention via job satisfaction is significant ($\beta = 0.24$, $t = 6.10$, $p < 0.001$).

Interpretation: Upskilling improves retention by enhancing job satisfaction. This confirms that workforce development initiatives reduce turnover only when they positively influence employees' work attitudes.

H6 Supported.

Overall Model Evaluation

The structural model demonstrates strong explanatory power:

- R^2 for Employee Retention = 0.39 (moderate)
- R^2 for Job Satisfaction = 0.47 (substantial)
- R^2 for Employee Upskilling = 0.41 (substantial)
- R^2 for Organizational Agility = 0.29 (moderate)

Effect sizes (f^2) range from medium to large (0.27–0.35), indicating meaningful practical significance. Predictive relevance values ($Q^2 > 0$) confirm that the model possesses strong predictive capability.

Hypothesis Testing Summary

All six hypotheses are statistically supported at $p < 0.001$. The results confirm that:

1. Digital transformation enhances agility.
2. Agility promotes workforce upskilling.
3. Upskilling improves job satisfaction.
4. Job satisfaction increases employee retention.
5. Agility mediates technology–upskilling linkage.
6. Job satisfaction mediates the upskilling–retention linkage.

The findings collectively validate the sequential mechanism through which digital transformation strengthens employee retention in manufacturing firms.

PLS-SEM results confirm that digital transformation significantly enhances organizational agility ($\beta = 0.54, p < 0.001$), which promotes employee upskilling ($\beta = 0.48, p < 0.001$), leading to higher job satisfaction ($\beta = 0.52, p < 0.001$) and employee retention ($\beta = 0.46, p < 0.001$). Sequential mediation effects are significant, with the model explaining 39% of the variance in retention. The findings validate the RBV–Dynamic Capabilities framework in post-pandemic manufacturing.

Structural Model Assessment and Hypothesis Testing

Following confirmation of measurement reliability and validity, the structural model was evaluated using bootstrapping with 5,000 resamples in SmartPLS 4. Path coefficients (β), t-values, and p-values were examined to test the six hypotheses.

Table 1. Measurement Model Results					
Construct	Cronbach’s α	CR	AVE	HTMT Max	VIF Max
DT	>0.70	>0.80	>0.50	<0.85	<3.3
OA	>0.70	>0.80	>0.50	<0.85	<3.3
EU	>0.70	>0.80	>0.50	<0.85	<3.3
JS	>0.70	>0.80	>0.50	<0.85	<3.3
ER	>0.70	>0.80	>0.50	<0.85	<3.3

Table 1 presents the reliability and validity assessment of the measurement model for the five constructs: Digital Transformation (DT), Organizational Agility (OA), Employee Upskilling (EU), Job Satisfaction (JS), and Employee Retention (ER).

Internal Consistency Reliability

All constructs report Cronbach’s alpha (α) values greater than 0.70 and Composite Reliability (CR) values above 0.80. These results indicate strong internal consistency reliability. The indicators within each construct consistently measure the same underlying concept. The CR values exceeding 0.80 further confirm that the measurement items exhibit high reliability without redundancy.

Convergent Validity

The Average Variance Extracted (AVE) for all constructs exceeds the recommended threshold of 0.50. This indicates that each latent variable explains more than 50% of the variance in its associated indicators. Therefore, convergent validity is established, confirming that the items converge adequately to represent their respective constructs.

Discriminant Validity

Discriminant validity was assessed using the Heterotrait–Monotrait (HTMT) ratio. All HTMT values are below 0.85, satisfying the conservative threshold for discriminant validity. This confirms that the constructs are empirically distinct and measure different conceptual domains. There is no evidence of construct overlap between digital transformation, agility, upskilling, satisfaction, and retention.

Multicollinearity Assessment

Variance Inflation Factor (VIF) values for all constructs are below 3.3. This indicates the absence of critical multicollinearity issues among indicators. Additionally, VIF values below 3.3 suggest that common method bias is unlikely to threaten the validity of the measurement model.

Overall Interpretation : The measurement model demonstrates:

- Strong internal consistency reliability
- Adequate convergent validity
- Clear discriminant validity
- No multicollinearity concerns

Collectively, these results confirm that the constructs are statistically reliable and valid. Therefore, the measurement model satisfies PLS-SEM evaluation criteria and supports proceeding to structural model assessment.

Final Integrated Model Structure (SmartPLS)

Direct Paths

- DT → OA
- OA → EU
- EU → JS
- JS → ER

Indirect Paths

- DT → OA → EU
- OA → EU → JS
- EU → JS → ER
- DT → OA → EU → JS → ER

Moderation

- Firm Size × DT → OA
- Tech Intensity × OA → EU
- Demographic Dividend × EU → JS

Direct Effects

The structural path estimates are presented in Table 2.

Table 2 . Structural Path Results					
Hypothesis	Path	β	t-value	p-value	Decision
H1	DT → OA	0.54	7.21	<0.001	Supported
H2	OA → EU	0.48	6.34	<0.001	Supported
H3	EU → JS	0.52	8.02	<0.001	Supported
H4	JS → ER	0.46	6.88	<0.001	Supported
H5	DT → OA → EU	0.26	5.88	<0.001	Supported
H6	EU → JS → ER	0.24	6.1	<0.001	Supported

Refer Table 2: All hypothesized relationships are positive and statistically significant at $p < 0.001$.

Table 3: Explanatory Power (R²)

Endogenous Construct	R ²	Interpretation
Organizational Agility	0.29	Moderate
Employee Upskilling	0.41	Substantial
Job Satisfaction	0.47	Substantial
Employee Retention	0.39	Moderate

Refer to Table 3: The model explains 39% of the variance in employee retention, indicating meaningful predictive strength in the manufacturing context.

Table 4 Effect Size (f ²)		
Path	f ²	Effect Size
DT → OA	0.32	Large
OA → EU	0.27	Medium
EU → JS	0.35	Large
JS → ER	0.29	Medium

Refer to Table 4: Effect sizes indicate practical significance. The results show that digital transformation and employee upskilling exert strong substantive effects.

Table 5 Predictive Relevance (Q ²)	
Construct	Q ²
Organizational Agility	0.21
Employee Upskilling	0.29

Job Satisfaction	0.31
Employee Retention	0.24

Refer to Table 5: Blindfolding results confirm predictive relevance. All Q^2 values exceed zero, indicating strong predictive capability.

Theory-Driven Interpretation (RBV and DCT Integration)

The results strongly support the integrated Resource-Based View (RBV) and Dynamic Capabilities Theory (DCT) framework.

Digital Transformation as a Strategic Resource (RBV)

The significant effect of digital transformation on organizational agility ($\beta = 0.54$) confirms that technological infrastructure constitutes a valuable and strategic organizational resource. However, consistent with RBV, resources alone do not create advantage unless effectively deployed.

Organizational Agility as a Dynamic Capability (DCT)

The positive relationship between agility and employee upskilling ($\beta = 0.48$) demonstrates transformation capability — the firm’s ability to reconfigure internal competencies in response to environmental turbulence. This finding operationalizes the “seizing” and “transforming” dimensions of DCT.

Human Capital as an Inimitable Asset (RBV)

Employee upskilling significantly enhances job satisfaction ($\beta = 0.52$). This suggests that capability enhancement strengthens the value and uniqueness of human capital, reinforcing RBV’s emphasis on intangible assets.

Sequential Capability Orchestration (DCT Microfoundations)

The mediation results confirm that digital transformation influences retention indirectly through agility and workforce development. This validates DCT’s microfoundations:

- Sensing → Digital transformation
- Seizing → Organizational agility
- Transforming → Employee upskilling and job satisfaction

Retention outcomes emerge only when technological investments are embedded within dynamic organizational processes.

PLS-SEM results confirm that digital transformation significantly enhances organizational agility ($\beta = 0.54, p < 0.001$), which promotes employee upskilling ($\beta = 0.48, p < 0.001$), leading to higher job satisfaction ($\beta = 0.52, p < 0.001$) and employee retention ($\beta = 0.46, p < 0.001$). Sequential mediation effects are significant, with the model explaining 39% of the variance in retention. The findings validate the RBV–Dynamic Capabilities framework in post-pandemic manufacturing.

Limitations

Despite its theoretical and empirical contributions, this study has several limitations that open avenues for future research. First, the cross-sectional design restricts causal inference among digital transformation, organizational agility, workforce upskilling, job satisfaction, and employee retention; although PLS-SEM and bootstrapping enhance robustness, longitudinal or panel designs would better capture the evolving processes emphasized in Dynamic Capabilities Theory. Second, data collected solely from the manufacturing sector may limit generalizability to other industries and national contexts. Third, reliance on self-reported survey data may

introduce common method bias despite procedural and statistical controls; future studies should incorporate multi-source and archival data. Fourth, the model emphasizes selected mediators and moderators, potentially overlooking contextual factors such as organizational culture, leadership, and digital maturity. Finally, retention was measured using intention-based indicators rather than actual turnover behavior.

Directions for Future Research

Building on these limitations, future research should adopt longitudinal designs to examine how digital transformation investments evolve into sustained dynamic capabilities over time and test recursive capability development more rigorously. Multi-level studies using hierarchical modeling could explore cross-level effects, such as how team agility shapes individual satisfaction and retention. Incorporating objective performance indicators—productivity, defect rates, cycle time, and actual turnover—would strengthen empirical validation. Comparative cross-industry and cross-country research can assess contextual differences in technological intensity and demographic effects. Future models may also examine moderators such as digital leadership, learning orientation, psychological safety, innovation culture, and union presence.

Integrating ESG perspectives and human-machine collaboration research would further enrich understanding of sustainable, digitally enabled manufacturing systems.

DISCUSSION

This study examined how digital transformation enhances employee retention in post-pandemic manufacturing firms through sequential pathways of organizational agility, employee upskilling, and job satisfaction, providing strong support for the integrated RBV-Dynamic Capabilities framework. Consistent with Dynamic Capabilities Theory, digital transformation significantly strengthens organizational agility ($\beta = 0.54$), indicating that Industry 4.0 investments build adaptive capacity rather than merely improving operations.

Agility, in turn, drives workforce upskilling, reflecting resource reconfiguration and human capital renewal. From an RBV perspective, upskilling enhances the strategic value and inimitability of human capital, positively influencing job satisfaction ($\beta = 0.52$). Importantly, digital transformation affects retention indirectly through these capability-building mechanisms. Moderation results further show that firm size, technological intensity, and workforce demographics strengthen these relationships, underscoring that sustainable competitiveness depends on continuous capability renewal rather than static resource accumulation.

Managerial Implications

The findings offer clear guidance for manufacturing leaders navigating digital transformation.

First, technology adoption alone does not ensure improved retention or performance. Investments in AI, robotics, and IoT must be strategically integrated with organizational agility and workforce capability development.

Second, agility should be institutionalized through cross-functional teams, modular production systems, and realtime data monitoring. Such systems enhance responsiveness to supply chain disruptions and operational volatility.

Third, employee upskilling must be viewed as a strategic investment rather than a cost. Structured Industry 4.0 training programs, digital certification pathways, and continuous learning initiatives strengthen job satisfaction and reduce turnover by preserving tacit knowledge.

Fourth, HR strategies should align with technological intensity. Highly automated plants require advanced technical competencies, making targeted skill development essential.

Finally, managers must minimize technology-induced anxiety through transparent communication and participatory change management. Digital transformation should be managed as a socio-technical system that integrates technology, people, and processes holistically.

Theoretical Contributions

This study makes four key theoretical contributions.

First, it extends the Resource-Based View by demonstrating that digital infrastructure and human capital must be continuously renewed to sustain competitive advantage in turbulent manufacturing environments.

Second, it operationalizes Dynamic Capabilities Theory by empirically mapping its microfoundations: sensing (digital transformation), seizing (organizational agility), and transforming (employee upskilling and satisfaction).

Third, it bridges strategic management and human resource management by linking Industry 4.0 investments to employee retention outcomes through capability development.

Fourth, by incorporating contextual moderators such as firm size, technological intensity, and demographic dividend, the study situates dynamic capabilities within emerging manufacturing ecosystems.

Overall, the findings affirm that sustainable advantage in post-pandemic manufacturing depends not on technology ownership alone, but on the firm's ability to reconfigure resources, develop human capital, and institutionalize agility. Digital transformation becomes strategic only when embedded within adaptive systems and supported by skilled, engaged employees.

CONCLUSION

This study examined how digital transformation influences employee retention in post-pandemic manufacturing firms through the sequential mechanisms of organizational agility, employee upskilling, and job satisfaction. The PLS-SEM results confirm strong direct and indirect relationships across the proposed framework. Digital transformation enhances organizational agility, which drives workforce upskilling, leading to improved job satisfaction and ultimately higher employee retention. The findings demonstrate that technology does not directly reduce turnover; rather, its impact is capability-driven and mediated through human capital development processes.

The study further establishes that evolving employment trends and digital work practices positively influence job satisfaction and retention. Transformational shifts in manufacturing—such as AI-enabled recruitment, automated performance management systems, hybrid work arrangements, enhanced workplace safety measures, and end-to-end digital sales—have fundamentally redefined organizational practices. Increased shop-floor automation, smart factories, robotics, and AI-supported logistics systems have improved productivity, reduced waste, enhanced cycle time, and strengthened supply chain visibility.

These technological advancements have simultaneously increased the demand for advanced technical competencies, making structured upskilling initiatives essential. Organizations that align digital investments with employee capability development foster stronger engagement, higher performance, and sustainable organizational culture. Automation and smart systems improve operational efficiency while enhancing employees' quality of work life by reducing repetitive tasks and physical strain.

The findings align with existing literature emphasizing that employee retention management is a strategic imperative supported by continuous training, engagement, and adaptive work practices. In the context of India's manufacturing growth and high-technology investments, competitiveness will increasingly depend on agile systems and skilled human capital rather than workforce volume alone.

In conclusion, sustained success in post-pandemic manufacturing environments requires integrating digital transformation with dynamic capability development and strategic workforce investment. Technology creates opportunity, but long-term advantage emerges from how effectively organizations develop, engage, and retain their people

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