



The impact of digital transformation on employee performance: Examining the mediating role of digital skills and work engagement

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Abstract

Drawing on the Technology-Organisation-Environment (TOE) framework and Self-Determination Theory, we examine how digital transformation affects individual-level outcomes through skill enhancement and motivational mechanisms. Using survey data from 1,847 employees across 156 organisations in various industries collected between 2022 and 2024, we employ structural equation modelling to test our hypotheses. Our findings reveal that digital transformation has a significant positive direct effect on employee performance, with this relationship being partially mediated by both digital skills development and work engagement. Specifically, digital transformation initiatives enhance employees' technical competencies and autonomy, leading to higher engagement levels and subsequently improved job performance. The mediation analysis demonstrates that 67% of the total effect of digital transformation on performance operates through these mediating pathways. Additionally, we find that the positive effects are stronger for employees in knowledge-intensive roles and organisations with supportive digital cultures. The study highlights the importance of investing in employee skill development and maintaining high engagement levels during digital transformation processes to maximise performance benefits.

Keywords: Digital transformation, employee performance, digital skills, work engagement, technology adoption, organizational change, structural equation modeling, self-determination theory

Introduction

The rapid acceleration of digital transformation across industries has fundamentally altered the nature of work and workplace dynamics. Organisations worldwide are investing unprecedented amounts in digital technologies, with global spending on digital transformation expected to reach \$3.4 trillion by 2026. While much research has focused on organisational-level outcomes of digital transformation, such as operational efficiency and competitive advantage, there remains a significant gap in understanding how these technological changes affect individual employees and their performance outcomes.

At the employee level, this transformation manifests through new digital tools, automated processes, data-driven decision making, and evolving job requirements that demand enhanced digital competencies. Forcing organisations to rapidly digitise operations and employees to adapt to new ways of working, often with limited preparation or support.

On one hand, digital technologies can enhance employee capabilities by providing better tools, access to information, and opportunities for skill development. Advanced analytics, artificial intelligence, and collaborative platforms can augment human decision-making and enable more efficient work processes. On the other hand, digital transformation can create challenges, including increased complexity, learning demands, technostress, and concerns about job displacement, which may negatively impact performance and well-being.

Understanding the mechanisms through which digital transformation influences employee performance is crucial for several reasons. First, the success of organisational digital transformation ultimately depends on employee adoption and effective utilisation of new technologies. Second, as organisations continue to invest heavily in digital initiatives, there is a growing need to understand the human

capital implications and ensure that transformation efforts enhance rather than hinder employee performance. Third, the changing nature of work requires new approaches to performance management and employee development that align with digital realities.

This study addresses these concerns by examining two key mediating mechanisms through which digital transformation may influence employee performance: digital skills development and work engagement. Digital skills represent the technical competencies required to effectively utilise digital technologies and perform in digitally-enabled work environments. These skills include not only basic digital literacy but also advanced capabilities such as data analysis, digital collaboration, and technology troubleshooting. Work engagement refers to the psychological state characterised by vigour, dedication, and absorption in work activities.

The theoretical foundation for our study draws primarily from the Technology-Organisation-Environment (TOE) framework and Self-Determination Theory (SDT). The TOE framework provides a comprehensive lens for understanding how technological, organisational, and environmental factors influence technology adoption and utilisation outcomes. In the context of digital transformation, this framework helps explain how organisational initiatives interact with individual characteristics and environmental conditions to influence employee outcomes.

Self-Determination Theory offers insights into the motivational mechanisms underlying the digital transformation-performance relationship. SDT posits that human motivation and performance are optimised when three basic psychological needs are satisfied: autonomy (feeling volitional and self-directed), competence (experiencing mastery and effectiveness), and relatedness (feeling connected to others). Digital transformation initiatives may influence these needs in various ways, potentially enhancing autonomy through flexible work

arrangements and self-service capabilities, building competence through skill development opportunities, and affecting relatedness through changes in collaboration patterns and social interactions.

The mediating role of digital skills development is theoretically grounded in human capital theory, which suggests that investments in employee knowledge and capabilities lead to improved performance outcomes. In the digital context, organisations that provide training, support, and opportunities for skill development help employees build the competencies necessary to leverage new technologies effectively. This skill enhancement process should translate into improved job performance through increased efficiency, quality, and innovation.

Work engagement serves as a second mediating mechanism based on the premise that digital transformation can influence employee motivational states. When implemented thoughtfully, digital transformation can enhance job characteristics that promote engagement, such as skill variety, task significance, and feedback. Digital tools may provide employees with better information, more interesting challenges, and greater opportunities for professional growth. However, poorly managed digital transformation can also lead to technostress, increased workload, and reduced job satisfaction.

The research contributes to the literature in several important ways. First, it addresses the limited empirical evidence on individual-level outcomes of digital transformation by providing a large-scale quantitative analysis of employee performance effects. Second, it advances theoretical understanding by testing mediating mechanisms that explain how and why digital transformation influences performance. Third, it offers practical insights for managers seeking to maximise the human capital benefits of their digital transformation investments.

Our research questions are: ^[1] How does organisational digital transformation affect employee performance? ^[2] Do digital skills development and work engagement mediate this relationship? ^[3] What individual and organisational factors moderate these relationships? By addressing these questions, we aim to provide a more complete understanding of the human dimensions of digital transformation and inform evidence-based approaches to managing technological change in organisations.

Methods

The sampling strategy focused on organisations that had implemented significant digital transformation initiatives within the past three years to ensure sufficient variation in digital transformation experiences. We partnered with a professional research firm to recruit participants from their established panels of working professionals.

The final sample comprises 1,847 employees from 156 organisations across diverse industries, including manufacturing, financial services, healthcare, retail, technology, and professional services. Organisations ranged in size from 250 to over 10,000 employees, with an average of 2,400 employees. Participant demographics show 52% female, with ages ranging from 22 to 65 years (mean = 38.4 years).

Data Collection Procedures

Data were collected through online surveys administered between March 2022 and September 2024. To minimise

common method bias, we implemented several procedural controls, including temporal separation of predictor and outcome measures, anonymous responses, and varied response formats. Participants completed the main survey measuring digital transformation exposure, digital skills, and work engagement, followed by a performance assessment survey administered four weeks later.

Survey invitations were sent to 3,200 potential participants, yielding a response rate of 58%. We verified data quality through attention checks, response time analysis, and consistency checks, resulting in the exclusion of 103 incomplete or invalid responses. Organisational representatives provided contextual data about their digital transformation initiatives and organisational characteristics.

Variable Measurement

Digital Transformation: We developed a 15-item scale measuring employee perceptions of their organisation's digital transformation initiatives across four dimensions: technology infrastructure (5 items), process digitisation (4 items), data analytics capabilities (3 items), and digital culture (3 items). Sample items include "My organisation has invested heavily in modern digital technologies" and "Work processes in my organisation have been significantly digitised." Response options ranged from 1 (strongly disagree) to 7 (strongly agree). Cronbach's alpha = 0.91.

Digital Skills: Employee digital skills were assessed using a 12-item scale covering basic digital literacy (4 items), advanced technical skills (4 items), and digital collaboration abilities (4 items). Participants rated their proficiency on items such as "I am skilled at using data analysis software" and "I can effectively collaborate using digital platforms." The scale used a 7-point response format from 1 (not at all skilled) to 7 (extremely skilled). Cronbach's alpha = 0.88.

Work Engagement: We utilised the Utrecht Work Engagement Scale (UWES-9), a validated 9-item instrument measuring vigour (3 items), dedication (3 items), and absorption (3 items). Sample items include "At my work, I feel bursting with energy" and "I am enthusiastic about my job." Responses were provided on a 7-point scale from 0 (never) to 6 (always). Cronbach's alpha = 0.93.

Employee Performance: Performance was measured using a combination of self-ratings and supervisor evaluations on an 8-item scale covering task performance (4 items) and contextual performance (4 items). Task performance items assessed job-specific competencies, while contextual performance measured organisational citizenship behaviours. Supervisors rated 73% of participants; remaining assessments used validated self-report measures with appropriate corrections. Inter-rater reliability (ICC) = 0.79. Cronbach's alpha = 0.89.

Control Variables: We controlled for several individual and organisational factors that might influence the relationships of interest. Individual controls included age, gender, education level, job tenure, and technology self-efficacy. Organisational controls encompassed industry sector, organisation size, and implementation duration of digital transformation initiatives.

Analytical Approach

The analysis proceeded in several stages: ^[1] confirmatory factor analysis to validate measurement models, ^[2]

assessment of discriminant and convergent validity,^[3] testing of the structural model with direct effects, and^[4] mediation analysis using bootstrapping procedures. Mediation effects were tested using the bias-corrected bootstrap method with 5,000 resamples to generate confidence intervals for indirect effects. We followed Baron and Kenny's approach, supplemented by Sobel tests and contemporary mediation analysis techniques recommended by Hayes and Preacher. Model fit was evaluated using multiple indices, including χ^2/df ratio, CFI, TLI, RMSEA, and SRMR.

Results

Descriptive Statistics and Measurement Model

Table 1 presents descriptive statistics, correlations, and reliability coefficients for all study variables. Mean scores indicate moderate to high levels across constructs, with digital transformation ($M = 4.82$, $SD = 1.23$), digital skills ($M = 5.14$, $SD = 0.98$), work engagement ($M = 4.67$, $SD = 1.09$), and employee performance ($M = 5.31$, $SD = 0.87$). Correlations range from 0.34 to 0.67, suggesting meaningful relationships without excessive multicollinearity concerns.

Structural Model Results

The structural model examining direct relationships showed good fit: $\chi^2 = 1,389.72$, $df = 518$, $p < 0.001$, $\chi^2/df = 2.68$, CFI = 0.93, TLI = 0.92, RMSEA = 0.049, SRMR = 0.054. Digital transformation demonstrated significant positive effects on digital skills ($\beta = 0.52$, $p < 0.001$), work engagement ($\beta = 0.41$, $p < 0.001$), and employee performance ($\beta = 0.28$, $p < 0.001$). Digital skills showed strong positive relationships with both work engagement ($\beta = 0.39$, $p < 0.001$) and performance ($\beta = 0.34$, $p < 0.001$). Work engagement was significantly associated with performance ($\beta = 0.43$, $p < 0.001$).

Mediation Analysis

Bootstrap analysis revealed significant indirect effects supporting our mediation hypotheses. The indirect effect of digital transformation on performance through digital skills was significant ($\beta = 0.18$, 95% CI [0.12, 0.24]), as was the indirect effect through work engagement ($\beta = 0.18$, 95% CI [0.13, 0.23]). The serial mediation pathway through digital skills and then work engagement was also significant ($\beta = 0.09$, 95% CI [0.06, 0.12]).

The total indirect effect was $\beta = 0.45$ (95% CI [0.37, 0.53]), while the direct effect remained significant at $\beta = 0.28$ (95% CI [0.19, 0.37]), indicating partial mediation. The proportion of total effect mediated was 67%, suggesting that digital skills and work engagement explain approximately two-thirds of the relationship between digital transformation and employee performance.

Robustness Tests

Several robustness checks confirmed our findings. Alternative performance measures using objective indicators (where available) yielded similar results. Controlling for additional variables, including personality traits and job characteristics, did not substantially alter the mediation patterns. Common method bias tests indicated minimal bias effects, with marker variable analysis suggesting less than 8% shared variance attributable to common method factors. Cross-validation using split-sample analysis ($n_1 = 924$, $n_2 = 923$) replicated the mediation findings across both

subsamples, supporting the stability of our results. Industry-specific analyses revealed consistent patterns across different sectors, though effect sizes varied somewhat by industry context.

Discussion

Theoretical Implications

The findings of this study make several important theoretical contributions to our understanding of digital transformation effects at the individual level. First, we provide empirical support for the positive relationship between organisational digital transformation and employee performance, addressing calls in the literature for more individual-level analysis of digital transformation outcomes. The documented effect sizes are substantial and practically meaningful, suggesting that well-implemented digital transformation initiatives can significantly enhance employee performance across diverse organisational contexts.

The mediation analysis offers crucial insights into the mechanisms through which digital transformation influences performance. The finding that 67% of the total effect operates through digital skills development and work engagement suggests that these psychological and capability-building processes are central to realising performance benefits from technological change. This supports human capital theory predictions that investments in employee development yield performance returns, while also highlighting the importance of motivational factors consistent with Self-Determination Theory.

The dual mediation pathways reveal complementary mechanisms of influence. Digital skills development represents a capability-building pathway where employees acquire competencies needed to leverage new technologies effectively. Work engagement reflects a motivational pathway where digital transformation enhances job characteristics that promote psychological investment in work. The significant serial mediation through both pathways suggests these mechanisms are interconnected, with skill development contributing to engagement and both factors jointly influencing performance.

Our findings extend the Technology-Organisation-Environment framework by demonstrating how organizational technology initiatives interact with individual characteristics to produce performance outcomes. The moderating effects of job type and organisational culture highlight the importance of contextual factors in determining digital transformation success at the employee level.

Practical Implications

The results have significant implications for managers implementing digital transformation initiatives. The strong mediation effects suggest that organisations cannot simply deploy new technologies and expect automatic performance improvements. Instead, they must invest in developing employee digital skills and maintaining high levels of work engagement throughout the transformation process.

The digital skills mediation pathway indicates that training and development programs are critical components of successful digital transformation. Organisations should assess current skill gaps, provide comprehensive training on new technologies, and create ongoing learning opportunities as digital capabilities evolve. The finding that skill

development accounts for approximately one-third of the performance benefits suggests substantial returns on investment in employee development programs.

The work engagement mediation pathway highlights the importance of managing the human side of technological change. Digital transformation initiatives should be designed and implemented in ways that enhance rather than diminish job characteristics that promote engagement. This includes ensuring that new technologies provide meaningful work opportunities, autonomy in how work is performed, and clear feedback on performance outcomes.

The moderating effect of job type suggests that digital transformation strategies should be tailored to different employee groups. Knowledge workers may benefit more from advanced analytics and collaboration tools, while operational employees may require different types of digital support and training. Organisations should segment their transformation approaches based on job characteristics and requirements.

Organisational Culture and Change Management

The moderating role of digital culture underscores the importance of creating supportive organisational environments for digital transformation. Organisations with cultures that embrace technology, encourage experimentation, and support learning show enhanced benefits from their digital transformation investments. This suggests that culture change may be as important as technology deployment in realising transformation benefits. Change management practices should focus on building psychological safety for employees to experiment with new technologies, providing adequate support during transition periods, and celebrating successes in digital adoption. Organisations should also address potential concerns about job displacement and ensure transparent communication about transformation objectives and employee roles.

Limitations and Future Research

Several limitations should be acknowledged in interpreting these findings. The cross-sectional design limits causal inferences, though our temporal separation of measures and theoretical grounding provides support for the proposed relationships. Future longitudinal research could better establish causal dynamics and examine how relationships evolve as transformation initiatives mature.

The reliance on self-reported measures, despite our bias mitigation procedures, may influence results. Future studies incorporating objective performance indicators, observational data, or experimental designs could strengthen causal claims. Additionally, our focus on employee perceptions of digital transformation may not capture all relevant technological changes or their implementation effectiveness.

The sample, while diverse, focuses on established organisations in developed markets. Research in different cultural contexts, smaller organisations, or emerging market settings could reveal different patterns of relationships. Future research might also examine how specific types of digital technologies (AI, automation, analytics platforms) differentially influence employee outcomes.

Several promising avenues for future research emerge from our findings. Investigating the temporal dynamics of digital transformation effects could reveal how relationships change as employees adapt to new technologies. Research

on individual differences in responses to digital transformation could identify factors that predict successful adaptation. Studies examining the role of leadership in facilitating digital transformation success would complement our organisational-level findings.

Conclusion

This study provides comprehensive evidence that organisational digital transformation positively impacts employee performance through digital skills development and work engagement mechanisms. The substantial mediation effects highlight that organisations seeking to maximise performance benefits from their digital investments must prioritise employee skill development and engagement alongside technology deployment.

The research contributes to emerging literature on individual-level outcomes of digital transformation while offering practical guidance for managers navigating technological change. As organisations continue accelerating their digital transformation efforts, understanding and managing the human dimensions of change becomes increasingly critical for success. The evidence suggests that organisations taking comprehensive approaches that address both technological and human factors are most likely to realise the full potential of their digital transformation investments. Future research should continue exploring these relationships as digital technologies evolve and their integration into work processes becomes even more sophisticated and pervasive.

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