

Examining the Impact of Digitalization on Employees' Future Competencies with the Moderating Role of Human Resource Development

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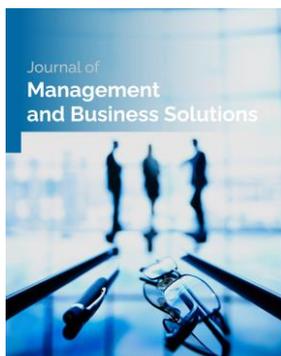
ABSTRACT

The purpose of this study was to examine the impact of digitalization on employees' future competencies, considering the moderating role of human resource development (case study: employees of Golrang Distribution Company in Isfahan Province). In terms of objective, the research is applied, and in terms of nature, it is descriptive-causal. The statistical population of this study included all employees of Golpakhsh Company, one of the subsidiaries of Golrang Distribution Companies in Isfahan Province, totaling 103 individuals. Due to the limited size of the population, the entire population was examined as the sample using the census method. The data collection instrument was a standardized questionnaire (Pivarasalej et al., 2024) consisting of 18 items. The content validity of the questionnaire was confirmed by the academic supervisor and management experts, and its reliability was verified through the calculation of Cronbach's alpha coefficient, which exceeded 0.70 for all constructs. Based on the literature review and the conceptual model, two hypotheses were proposed in this study. Data analysis was conducted using descriptive statistics (with SPSS software) and inferential statistics (with PLS software). The findings confirmed all hypotheses and indicated a good fit of the research model. The results demonstrated that digitalization has a significant positive effect on employees' competencies, such that investment in human resource development programs contributes to enhancing employees' capabilities and adaptability. This study identified new key competencies that have gained importance as a result of digitalization and emphasized that the continuity of training programs and the improvement of organizational culture have led to enhanced performance and service quality in Golrang Distribution Company. Therefore, it is recommended that managers pay adequate attention to the developmental needs of their employees in order to achieve organizational success and growth.

Keywords: Human resource development; Digitalization; Employees' future competencies.

Introduction

In recent decades, digitalization has emerged as one of the most profound and far-reaching transformations affecting organizations, reshaping not only business models and value creation mechanisms but also the nature of work, employment relations, and the competencies required of employees. The rapid diffusion of digital technologies such as artificial intelligence, big data analytics, cloud computing, and algorithmic management systems has fundamentally altered how organizations design processes, coordinate activities, and manage human resources (1,



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2). As a result, organizations increasingly recognize that their competitive advantage depends less on physical assets and more on the digital readiness and future-oriented competencies of their workforce, making human resources a central pillar of digital transformation strategies (3, 4).

Digital transformation goes beyond the mere adoption of new technologies and entails a systemic reconfiguration of organizational structures, cultures, and capabilities. Scholars emphasize that digitalization affects job content, skill requirements, and patterns of employee interaction, creating new opportunities while simultaneously posing challenges related to skill obsolescence, job insecurity, and unequal access to digital resources (5, 6). Within this context, employees are expected to continuously update their competencies, develop digital literacy, and demonstrate adaptability, learning agility, and innovative behavior in technology-rich environments (7, 8). Consequently, understanding how digitalization influences employees' future competencies has become a critical issue for both scholars and practitioners in the field of management.

The concept of future competencies refers to a broad set of knowledge, skills, attitudes, and cognitive orientations that enable employees to perform effectively in uncertain, dynamic, and digitally mediated work environments. These competencies typically include technical and analytical skills related to digital tools, as well as transversal competencies such as problem solving, critical thinking, collaboration, creativity, and learning orientation (9, 10). Research suggests that digital transformation intensifies the demand for such competencies by increasing task complexity, autonomy, and interdependence, while reducing reliance on routine manual activities (11, 12). Therefore, organizations that fail to invest in the development of future competencies risk falling behind in an increasingly competitive and innovation-driven landscape.

Human resource management and development scholars argue that digitalization fundamentally redefines the role of HR functions, shifting them from administrative support units toward strategic partners that facilitate capability building and organizational learning (13, 14). Digital HR processes, including e-learning platforms, data-driven talent management, and AI-supported performance systems, offer new opportunities to personalize development paths and enhance employee engagement, yet they also require employees to possess sufficient digital competence to benefit from such systems (15, 16). This reciprocal relationship suggests that digitalization and employee competencies mutually reinforce each other, underscoring the need for integrated analytical frameworks.

A growing body of literature highlights the importance of human resource development as a critical mechanism through which organizations can harness the positive effects of digitalization on employee outcomes. Strategic HR development focuses on systematic learning interventions, continuous training, and knowledge management practices designed to enhance employees' current and future capabilities (17, 18). Empirical evidence indicates that organizations with strong HR development systems are better positioned to cope with technological change, as they foster a culture of learning, experimentation, and adaptability (19, 20). In digitally transforming organizations, HR development thus plays a potentially moderating role by shaping how employees perceive, adopt, and utilize digital technologies.

Recent studies further emphasize that not all employees benefit equally from digitalization, and that individual competencies, organizational support, and learning opportunities significantly influence outcomes such as productivity, well-being, and innovative behavior (21, 22). For instance, research on digital competence demonstrates that employees with higher levels of digital literacy are more likely to leverage digital autonomy and engage in innovative work behaviors (7, 23). Conversely, insufficient training and weak HR development practices may exacerbate resistance to change and undermine the effectiveness of digital initiatives (24, 25). These findings

point to the necessity of examining HR development not merely as a direct predictor of performance, but as a contextual factor that conditions the impact of digitalization on employee competencies.

From a strategic perspective, digital leadership and organizational learning have also been identified as key enablers of successful digital transformation. Leaders who promote digital vision, experimentation, and employee empowerment can strengthen the alignment between digital technologies and human capabilities (26, 27). Organizational learning processes, both formal and informal, facilitate the continuous acquisition and integration of new knowledge required for future competencies, particularly in environments characterized by rapid technological change (12, 28). These insights reinforce the view that the development of future competencies is embedded within broader organizational systems and cannot be separated from HR development strategies.

Despite the expanding literature on digital transformation and human resource management, several gaps remain. First, much of the existing research has focused either on technological aspects of digitalization or on isolated HR practices, without sufficiently integrating the two perspectives to explain how digitalization shapes future employee competencies through HR development mechanisms (1, 5). Second, empirical studies have predominantly been conducted in Western or high-technology contexts, limiting the generalizability of findings to other organizational and cultural settings. Third, there is limited evidence on the moderating role of HR development in the relationship between digitalization and future competencies, particularly in distribution and service-oriented organizations where digital transformation takes distinct forms (2, 11).

In emerging and transitional economies, organizations face additional challenges related to resource constraints, uneven digital infrastructure, and varying levels of employee preparedness. Studies conducted in such contexts highlight the importance of tailored HR development interventions that align digital initiatives with employees' existing competencies and learning needs (29, 30). Moreover, the increasing integration of AI-based systems into HR and operational processes raises new questions regarding human–AI interaction, employee autonomy, and self-regulation, all of which have implications for future competencies (31, 32). These developments underscore the relevance of examining digitalization and HR development within specific organizational contexts.

The distribution sector, in particular, has experienced significant digital disruption through the adoption of integrated information systems, data-driven logistics, and digital customer interfaces. Such changes require employees to possess not only technical skills but also analytical thinking, problem-solving ability, and adaptive attitudes to manage complex workflows and respond to market volatility (4, 33). In this sector, HR development can serve as a strategic lever to ensure that digital investments translate into sustainable improvements in workforce competence and organizational performance.

Building on these theoretical and empirical insights, the present study positions digitalization as a key driver of employees' future competencies and conceptualizes human resource development as a moderating factor that shapes the strength and direction of this relationship. By integrating perspectives from digital transformation, HR development, and competency theory, the study responds to calls for more holistic and context-sensitive analyses of workforce transformation in the digital era (16, 34). Furthermore, by focusing on employees of a distribution company in Isfahan Province, the study contributes empirical evidence from a less-examined context, thereby enriching the international literature.

The aim of this study is to examine the effect of digitalization on employees' future competencies, with particular emphasis on the moderating role of human resource development.

Methods and Materials

The present study is applied in terms of purpose and, in terms of nature, adopts a descriptive–survey–causal design. The statistical population of the research included all employees of Golpakhsh Company, one of the subsidiaries of Golrang Distribution Companies in Isfahan Province, totaling 103 individuals. Due to the limited size of the statistical population, the entire population was studied as the sample using the census method. To collect the information required for conducting the research, extensive studies were carried out, including library research (journal articles, online sources, and translations) and a field method for collecting questionnaire data. The research instrument was a standardized questionnaire consisting of 18 items designed to measure three variables and their indicators. The items were developed based on a five-point Likert scale ranging from “very low” to “very high.” These items were sequentially formulated to measure the study variables (Table 1). To determine the validity of the questionnaire, face validity based on the opinions of management experts (academic supervisor), as well as convergent and discriminant validity, were employed. Confirmatory factor analysis was used to assess construct validity. To determine data reliability, Cronbach’s alpha coefficient and composite reliability were calculated (Table 2).

Table 1. Questionnaire Items

Source	Variable	Number of Items
Pivarasalej et al. (2024)	Digitalization	6 items
	Human Resource Development	3 items
	Human Resource Competencies – Technical and Analytical Skills	3 items
	Human Resource Competencies – Attitudes and Soft Skills	3 items
	Human Resource Competencies – Thinking Style	3 items

Table 2. Cronbach’s Alpha Coefficients

Variable	Cronbach’s Alpha	Composite Reliability
Thinking Style	0.757	0.862
Human Resource Development	0.812	0.888
Digitalization	0.790	0.851
Employees’ Future Competencies	0.919	0.933
Technical and Analytical Skills	0.851	0.910
Attitudes and Soft Skills	0.877	0.924

Findings and Results

Based on the results obtained, the majority of the sample members were men, accounting for 68% of the participants. The analysis of the collected data indicated that most of the sample members were married; out of the 103 respondents, 87 were married and 16 were single. In terms of educational level, among the participants, 19 held an associate degree, 64 held a bachelor’s degree, 19 held a master’s degree, and 1 held a doctoral degree or higher. Regarding age distribution, among the 103 participants, 15 were under 30 years old, 22 were between 31 and 40 years old, 36 were between 41 and 50 years old, and 30 were aged 51 years and above.

Table 3. Descriptive Statistics of the Research Variables

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Digitalization	103	3.163	0.657	1.67	4.83
Human Resource Development	103	3.171	0.824	1.00	5.00
Employees’ Future Competencies	103	3.270	0.782	1.00	5.00

Based on the obtained results, the KMO value was 0.724, and the significance level was 0.000, indicating statistical significance. Therefore, based on both criteria, it can be concluded that the data were adequate for analysis.

Table 4. Kolmogorov–Smirnov Test for the Research Variables

Index	Mean	Standard Deviation	Significance Level	Result
Digitalization	3.163	0.657	0.000	Non-normal
Human Resource Development	3.171	0.824	0.000	Non-normal
Employees' Future Competencies	3.270	0.782	0.000	Non-normal

According to the above analysis, the significance level for all variables was less than the error value of 0.05. Consequently, the data did not follow a normal distribution. Therefore, nonparametric methods were required for inferential statistics, and the partial least squares (PLS) approach was used for structural equation modeling.

Figure 1 presents the results of structural equation modeling in the significance state. In the significance state, the t-value (path coefficient in the significance state) must be greater than 1.96 for the relationship between the variables to be considered significant.

The path coefficient indicates the existence, direction, and strength of a linear causal relationship between two latent variables. In the standardized state, the path coefficient ranges from -1 to +1; if it equals zero, it indicates the absence of a linear causal relationship between the two latent variables.

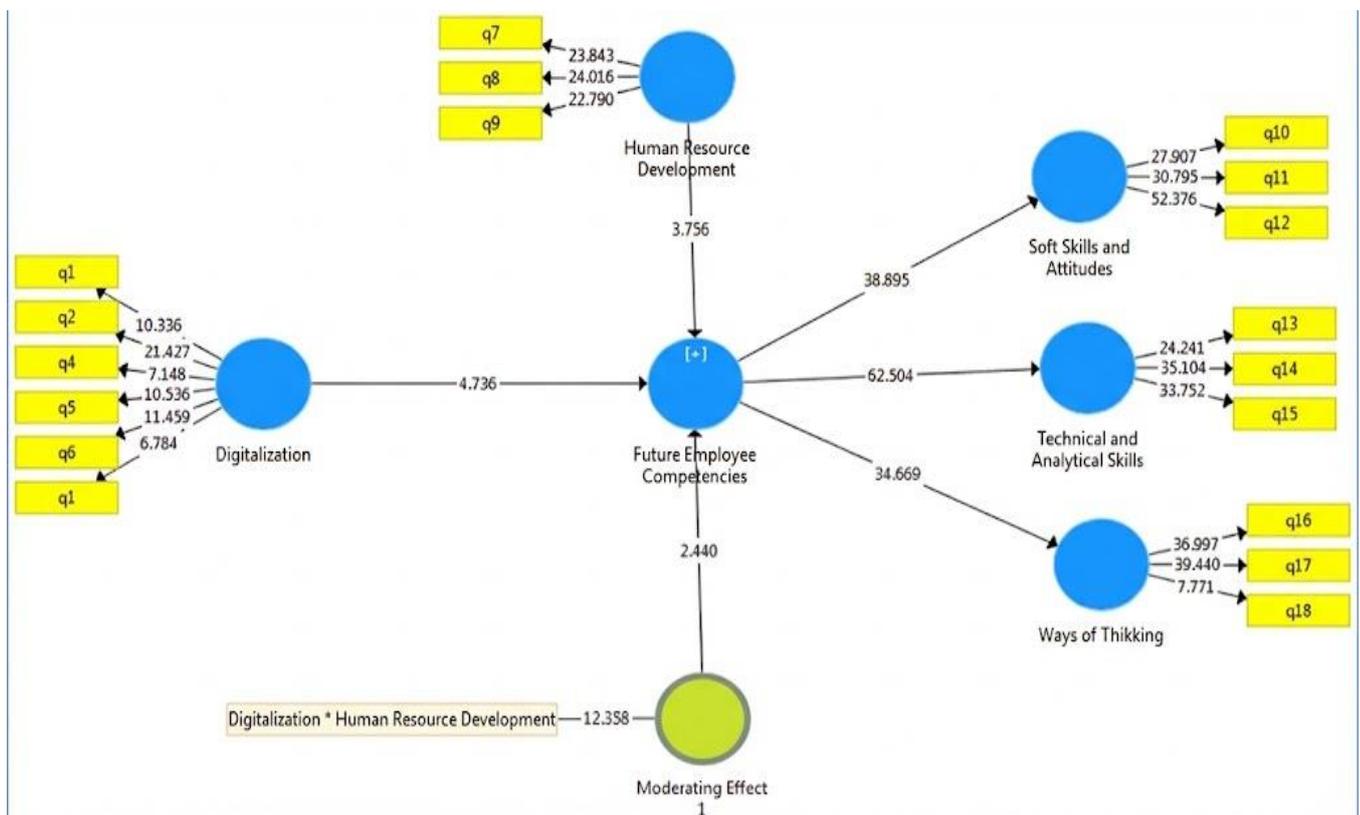


Figure 1. Research Model in the Significance State

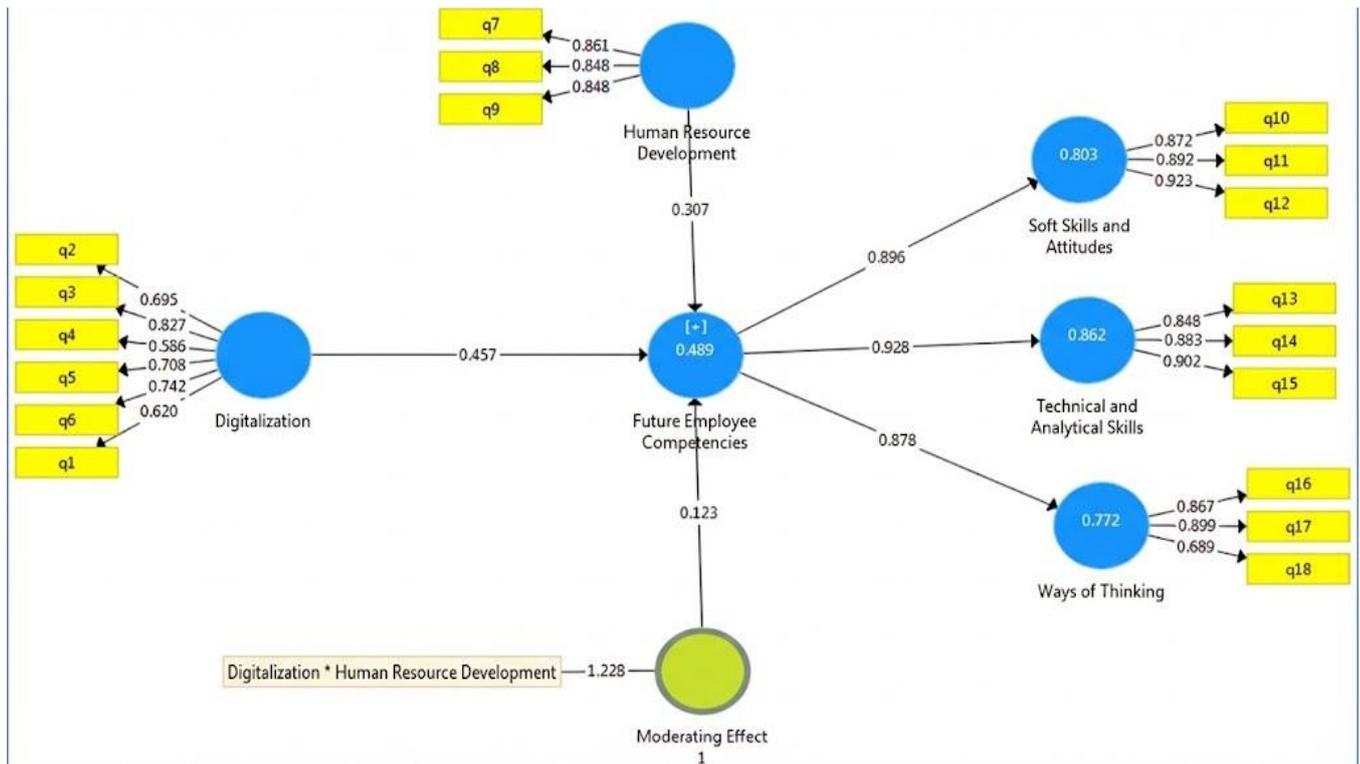


Figure 2. Research Model in the Standardized State

Table 5. Community and R² Values of the Research Variables

Variable	Community	R ²
Thinking Style	0.364	0.772
Human Resource Development	0.417	—
Digitalization	0.291	—
Employees' Future Competencies	0.496	0.489
Technical and Analytical Skills	0.493	0.862
Attitudes and Soft Skills	0.539	0.803
Mean	0.433	0.731

$$GOF = \sqrt{(\text{mean communality} \times \text{mean } R^2)} = \sqrt{(0.731 \times 0.433)} = 0.562$$

The obtained GOF value was 0.562, indicating a good predictive power of the model for the endogenous latent variable.

Table 6. Summary of Research Results

Hypothesis	Standardized Coefficient	t-value	Result
Hypothesis 1: Digitalization has a significant effect on employees' future competencies in Golrang Distribution Company in Isfahan Province.	0.457	4.736	Supported
Hypothesis 2: Human resource development moderates the effect of digitalization on employees' future competencies in Golrang Distribution Company in Isfahan Province.	0.123	2.44	Supported

In the first hypothesis, it was claimed that digitalization has a significant effect on employees' future competencies. Statistical analysis between these two variables, based on Figures 1 and 2, showed that the t-value of the path between the variables was 4.736. Since this value exceeds 1.96, the hypothesis was supported. Moreover, because the obtained t-value was positive, the effect was direct. The magnitude of the effect of digitalization on employees' future competencies was 0.457.

In the second hypothesis, it was claimed that human resource development plays a moderating role in the relationship between digitalization and employees' future competencies. Statistical analysis based on Figures 1 and 2 showed that the t-value of the path between the variables was 2.44. Since this value exceeds 1.96, the hypothesis was supported. Additionally, because the obtained t-value was positive, the effect was direct. The magnitude of the moderating effect of human resource development on the relationship between digitalization and employees' future competencies was 0.123.

Discussion and Conclusion

The purpose of this study was to examine the effect of digitalization on employees' future competencies and to analyze the moderating role of human resource development in this relationship. The empirical findings demonstrated that digitalization has a statistically significant and positive effect on employees' future competencies. This result indicates that as organizations intensify the use of digital technologies, employees are more likely to develop the technical, analytical, cognitive, and behavioral competencies required to function effectively in digitally transformed work environments. This finding is consistent with the theoretical argument that digital transformation reshapes job structures and task demands, thereby necessitating continuous competency development among employees (1, 5).

The positive relationship between digitalization and future competencies aligns with prior research emphasizing that digital technologies act as catalysts for skill upgrading and learning acceleration. Colbert et al. argue that the digital workforce is characterized by higher demands for adaptability, problem-solving, and digital fluency, which naturally fosters the development of future-oriented competencies when employees are exposed to technology-rich contexts (3). Similarly, Charles et al. highlight that digitalization reshapes employment by increasing the relative importance of cognitive and analytical skills compared to routine tasks, thereby pushing employees toward more advanced competency profiles (4). The present findings empirically support these arguments by showing that digitalization is not merely a technological phenomenon but also a human capability-building process.

The results also corroborate studies that emphasize the role of digital competence and technological exposure in enhancing employees' innovative and adaptive capacities. Research by Huu demonstrates that employees with higher levels of digital competence are better able to translate digital autonomy into innovative work behavior, suggesting that digital environments stimulate competency growth when employees actively interact with technology (7). Likewise, Mei et al. found that the implementation of digital technologies in organizational settings necessitates a new combination of technical, analytical, and transversal competencies, reinforcing the idea that digitalization directly contributes to the evolution of future workforce skills (8). The current study extends these insights by confirming this relationship in the context of a distribution company, where digital systems increasingly shape operational and decision-making processes.

Beyond the direct effect of digitalization, a key contribution of this study lies in demonstrating the moderating role of human resource development. The findings revealed that human resource development significantly strengthens the positive effect of digitalization on employees' future competencies. This result suggests that digitalization alone is insufficient to guarantee competency development; rather, its effectiveness depends on the presence of structured learning, training, and developmental mechanisms. This finding is theoretically grounded in strategic human resource development literature, which views HRD as a critical infrastructure for translating environmental and technological changes into individual and organizational capabilities (17, 18).

The moderating role of human resource development is consistent with empirical evidence indicating that training and development practices enhance employees' ability to cope with technological change. Pasandidehkar et al. showed that targeted training programs significantly improve digital competencies, enabling employees to utilize digital tools more effectively (25). Similarly, Gholami et al. reported that human resource development initiatives positively influence employee productivity by enhancing skills and motivation, particularly in public and service-oriented organizations (22). The present study adds to this body of knowledge by empirically confirming that HR development amplifies the competency-building effects of digitalization.

Furthermore, the findings resonate with research emphasizing the strategic transformation of HR functions in the digital era. Kolahi argues that the transition from traditional HR cycles to technology-driven HR systems requires parallel investments in employee development to avoid capability gaps (13, 14). Abbasi and Esmaili similarly highlight that digital HR processes, including AI-based systems, can only be effective when employees possess adequate competencies to engage with them (15). The moderating effect observed in this study empirically supports these arguments by demonstrating that HR development acts as a bridge between digital infrastructure and human capability.

Another important implication of the findings is their alignment with organizational learning theory. Studies suggest that digital transformation accelerates learning cycles by increasing access to information and enabling knowledge sharing, but only in organizations that foster learning-oriented cultures (19, 20). Schoenherr et al. further argue that digital transformation enables organizational learning when it is embedded in supportive structures and developmental practices (12). The present study's results reinforce this perspective by showing that HR development strengthens the competency outcomes of digitalization, likely by institutionalizing learning opportunities and reinforcing positive learning behaviors.

The findings are also consistent with research on digital leadership and strategic alignment. Wang et al. demonstrated that digital leadership influences employee digital performance through HR management practices and dynamic capabilities (16). Zare and Pashazadeh similarly emphasized that digital leadership and strategic flexibility contribute to digital transformation outcomes by shaping employees' competencies and innovative behaviors (26). Although leadership variables were not directly examined in the present study, the significant moderating role of HR development suggests that managerial and strategic commitment to employee development is essential for realizing the full benefits of digitalization.

From a contextual perspective, the results are particularly relevant for distribution and service-oriented organizations operating in environments characterized by operational complexity and market volatility. Delke et al. argue that Industry 4.0 technologies redefine roles and competencies in supply chain and distribution functions, increasing the demand for analytical thinking and cross-functional skills (11). The current findings provide empirical support for this argument by showing that digitalization in a distribution company context is positively associated with future competencies, especially when supported by HR development initiatives.

Overall, the discussion underscores that digitalization is a double-edged process: while it creates opportunities for competency enhancement, it also requires deliberate organizational interventions to prevent skill gaps and resistance to change. The significant moderating role of human resource development highlights the importance of viewing digital transformation as a socio-technical process in which technology and human capabilities co-evolve. By integrating insights from digital transformation, HR development, and competency theory, this study contributes to a more holistic understanding of workforce transformation in the digital era (27, 34).

Despite its contributions, this study has several limitations that should be acknowledged. First, the research was conducted within a single organization and a specific industry context, which may limit the generalizability of the findings to other sectors or organizational settings. Second, the cross-sectional design restricts the ability to draw causal inferences about the long-term effects of digitalization and human resource development on future competencies. Third, the study relied on self-reported data, which may be subject to common method bias and respondents' subjective perceptions. Finally, the focus on aggregated competency dimensions may overlook more nuanced differences among specific types of digital and non-digital competencies.

Future studies are encouraged to adopt longitudinal designs to examine how digitalization and human resource development influence competency development over time. Comparative research across industries and cultural contexts could provide deeper insights into contextual differences in digital competency formation. Additionally, future research may incorporate other moderating or mediating variables such as digital leadership, organizational culture, or employee psychological factors to develop more comprehensive explanatory models. Qualitative approaches could also be employed to explore employees' lived experiences of digital transformation and learning processes in greater depth.

From a practical perspective, managers should recognize that investments in digital technologies must be accompanied by systematic human resource development initiatives. Organizations are advised to design continuous training programs aligned with digital strategy and future skill requirements. Creating a supportive learning culture, encouraging experimentation, and providing resources for skill development can help employees adapt more effectively to digital change. Managers should also assess employees' developmental needs regularly and tailor HR development interventions to ensure that digital transformation leads to sustainable improvements in workforce competence and organizational performance.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

All ethical principles were adhered in conducting and writing this article.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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