ВОПРОСЫ РЕГИОНАЛЬНОЙ ЭКОНОМИКИ

УДК 334

LIUZIQI
Postgraduate Student
School of Business Belarusian State University,
Minsk, Republic of Belarus

Статья поступила 9.10.2025 г.

FROM DIGITALISATION TO DIGITAL INTELLIGENCE:THEORETICAL CONCEPTUALISATION AND SCALE DEVELOPMENT FOR INTELLIGENT TRANSFORMATION IN CORPORATE HUMAN RESOURCE MANAGEMENT[1]

Objective. *To define the conceptual framework and core dimensions of digital transformation in human resources, develop a 24–item maturity diagnostic scale with high reliability and validity, provide a measurement tool for academic research, and offer practical guidance for corporate transformation.*
Materials and methods. *An item pool was generated based on a six–dimensional theoretical framework. Following expert review, a 24–item scale was finalized. Questionnaires were distributed to mid–to–senior level managers and HR professionals in mainland China to collect valid data. The scale's reliability and validity were examined using exploratory and confirmatory factor analysis.*
Results. *The data fit factor analysis, with the extracted six–factor structure aligning with the theoretical framework. The overall scale and each dimension demonstrated ideal levels of reliability, convergent validity, and discriminant validity.*
Conclusion. *This study systematically defines the concept of digital intelligence in human resources for the first time and develops a scale covering the entire digital intelligence chain. It fills a theoretical gap and provides a practical diagnostic tool for corporate transformation.*

Keywords: *digital Intelligence in human resources, artificial intelligence, scale development, intelligent decision–making, maturity model.*

ЛЮ ЦЗЫЦИ
аспирант
Бизнес–школа Белорусского государственного университета, г. Минск, Республика Беларусь

ОТ ЦИФРОВИЗАЦИИ К ЦИФРОВОМУ ИНТЕЛЛЕКТУ: ТЕОРЕТИЧЕСКАЯ КОНЦЕПТУАЛИЗАЦИЯ И РАЗРАБОТКА ШКАЛЫ ДЛЯ ИНТЕЛЛЕКТУАЛЬНОЙ ТРАНСФОРМАЦИИ УПРАВЛЕНИЯ ЧЕЛОВЕЧЕСКИМИ РЕСУРСАМИ В КОРПОРАТИВНОЙ СРЕДЕ

Цель – *разъяснить концептуальную основу и основные аспекты цифровой и интеллектуальной трансформации в сфере человеческих ресурсов, разработать 24–пунктовую шкалу диагностики зрелости с высокой надежностью и валидностью, тем самым предоставив инструмент измерения для академических исследований и практические рекомендации для корпоративной трансформации.*

[1] Статья публикуется в авторской редакции

Материалы и методы. *На основе шестимерной теоретической концепции был сформирован пул пунктов. После экспертной оценки была окончательно утверждена шкала из 24 пунктов. Анкеты были распространены среди руководителей среднего и высшего звена, а также специалистов по управлению человеческими ресурсами в материковом Китае с целью сбора достоверных данных. Надежность и валидность шкалы были проверены с помощью эксплораторного и конфирматорного факторного анализа.*

Результаты. *Данные оказались пригодными для факторного анализа, в результате которого была получена шестифакторная структура, соответствующая теоретической основе. Как общая шкала, так и отдельные измерения продемонстрировали удовлетворительный уровень надежности, конвергентной валидности и дискриминантной валидности.*

Заключение. *Данное исследование представляет собой первое систематическое определение концепции цифрового интеллекта в области человеческих ресурсов, а также разработку комплексного инструмента измерения, охватывающего всю цепочку цифрового интеллекта. Оно восполняет пробел в теории и предоставляет предприятиям практический диагностический инструмент для трансформации.*

Ключевые слова: *цифровой интеллект в управлении человеческими ресурсами, искусственный интеллект, разработка шкалы, интеллектуальное принятие решений, модель зрелости.*

Introduction. We currently stand at the threshold of a paradigm shift in human resources management. Traditional digital HR systems primarily focused on process digitisation and efficiency gains, essentially representing business process automation. However, emerging technologies such as big data analytics and artificial intelligence are propelling HR management into a new era—digital intelligence. The defining characteristic of this phase is no longer how to do things faster, but rather how to do things more intelligently, with the core being the intelligentisation of decision–making processes. Although digital and intelligent transformation of human resources has become a buzzword in the industry, theoretical research has lagged significantly behind. Existing literature suffers from two core deficiencies: firstly, conceptual definitions remain ambiguous, with most studies failing to clearly distinguish between digitalisation and digital and intelligent transformation, often simplistically equating superficial applications of new technologies with full–scale transformation; Secondly, there is a lack of effective measurement tools. Existing scales largely remain at the level of assessing system functional coverage, failing to capture the core value of artificial intelligence in predictive analytics, personalised services, and strategic decision support. This theoretical void leaves enterprises lacking direction in their practical transformation efforts, unable to scientifically evaluate their current stage and genuine gaps. To address these research gaps, this study is dedicated to accomplishing two core tasks: First, from a theoretical perspective, we clearly define the conceptual framework of digital and intelligent transformation in human resources and construct its core dimensions[2]. Second, from a methodological standpoint, adhering to rigorous scale development procedures, we create a mature diagnostic scale with high reliability and validity that profoundly reflects the essence of digital and intelligent transformation. This establishes a robust theoretical foundation for subsequent empirical research and corporate management practice.

Main body. Literature Review and Theoretical Framework

To construct a theoretical framework for the digital–intelligent transformation of human resources, one must first clarify its fundamental distinction from digitalisation. Digital human resource management primarily focuses on the adoption of information technology to achieve standardisation, automation, and data recording of HR processes. Digital–intelligent transformation, however, builds upon this solid digital foundation by introducing cognitive intelligence. This signifies that human resource management systems can comprehend natural language processing, learn from data through machine learning, utilise knowledge graphs for reasoning, and ultimately achieve predictive analytics. Consequently, the role of human resource management is elevated from transactional processing to strategic foresight and employee empowerment. Based on a systematic review of cutting–edge practices and theories, this study proposes that digital–intelligent human resource management

constitutes a multidimensional, systemic construct[3]. Its core essence manifests specifically in the following six interrelated dimensions.

The first dimension is Strategy and Governance, emphasising that digital intelligence is not merely a technical project but a top–level strategic choice. It requires the deep integration of artificial intelligence into human resources strategy, alongside the establishment of corresponding data ethics, model governance, and talent assurance systems. The second dimension is Talent Acquisition and Activation. Here, the application of artificial intelligence evolves from passive CV screening to proactive talent sourcing and immersive assessment, dedicated to enhancing the precision, depth, and candidate experience of talent matching[4]. The third dimension is Talent Development and Empowerment, characterised by the shift from standardised provision to personalised generation in learning and development, and from static inventory to dynamic forecasting in skills management, thereby continuously empowering both organisations and individuals. The fourth dimension is Organisational and Performance Intelligence, signifying the use of tools such as organisational network analysis and AI–driven continuous performance coaching to transition from insights into individual performance to optimising the overall organisational system and collaborative effectiveness. The fifth dimension is employee experience and retention, centred on achieving a fundamental shift from managing employees to empowering and caring for employees through predictive attrition intervention and highly personalised services. The sixth dimension is Intelligent Innovation and Value, representing the ultimate goal of digital and intelligent transformation. It aims to ensure management fairness and optimise business processes through artificial intelligence, ultimately driving direct business innovation and value creation[5]. Together, these six dimensions form a comprehensive logical framework spanning from top–level design to process empowerment and ultimately value creation, providing a robust theoretical foundation for the scale development in this research.

Research Methodology and Scale Development

To translate the aforementioned theoretical constructs into operational measurement tools, this study adhered to standardised scale development procedures. Initially, during the item generation and content validity assurance phase, we established a broad item pool based on the six–dimensional theoretical framework. This involved systematically reviewing literature on AI applications in human resource management and conducting in–depth scans of white papers and public reports detailing digitalisation case studies from technology–leading enterprises. Subsequently, an expert panel comprising three scholars in human resource management and two digitalisation leads from large enterprises conducted multiple rounds of rigorous review and revision of item content relevance and clarity. This culminated in an initial 24–item scale, with all items measured using a 7–point Likert scale ranging from completely disagree to completely agree. The complete scale dimensions and items are detailed in Table 1.

During the data collection and sample description phase, this study distributed questionnaires to middle and senior managers and human resources professionals within enterprises in mainland China via professional research firms.

Table 1. – HR Digital Intelligence Scale: Dimensions and Measurement Items

Dimension	Number	Measurement Item
1	2	3
1.Strategy and governance	SG1	The company possesses a clear HR digitalisation strategy that aligns closely with its business strategy, with senior management able to articulate its value proposition effectively.
	SG2	The company maintains dedicated and sustained budgetary investment in AI HR technologies, such as machine learning models and predictive analytics platforms.
	SG3	The company has established explicit ethical guidelines, audit mechanisms and transparency policies governing employee data collection and AI model deployment.
	SG4	The company possesses or is cultivating a team of multi–skilled professionals proficient in both HR operations and data/AI technologies.

1	2	3
2.Talent Acquisition and Activation	TA1	We utilise AI tools to proactively identify and attract potential candidates from public channels such as technical communities and academic databases.
	TA2	During recruitment, we employ AI technologies including gamified assessments and work simulations to evaluate candidates' underlying competencies.
	TA3	We employ AI technologies, such as video interview analysis, to supplement assessments of candidates' overall capabilities and provide data–driven insights.
	TA4	The company maintains an active, AI–driven internal talent platform that efficiently facilitates both role–to–candidate matching and project–to–candidate matching.
3.Talent Development and Empowerment	TD1	The learning platform dynamically generates and recommends highly personalised learning content and pathways based on employees' real–time skill gaps and career aspirations.
	TD2	For high–risk or high–cost skill training, we utilise AI–driven simulators to deliver immersive, safe hands–on practice.
	TD3	The AI system continuously analyses work data (such as code and documentation) to generate dynamically updated, real–time skill profiles for both organisations and individuals.
	TD4	It predicts emerging skills required for future business needs and issues forward–looking alerts regarding skill gaps at both individual and organisational levels.
4.Organizational and Performance Intelligence	OP1	We utilise AI to analyse internal collaboration data, identifying innovation bottlenecks and information hubs while optimising organisational structures and collaborative models.
	OP2	Managers receive real–time, personalised coaching recommendations and talking points generated by AI based on employee work data.
	OP3	AI automatically analyses high–performing teams' working patterns, translating them into replicable best practices and process optimisation suggestions.
	OP4	We employ AI to construct 'digital twin' organisations, simulating talent requirements, costs, and risks across diverse business scenarios.
5.Employee Experience and Retention	ER1	The AI system proactively identifies employees at high risk of attrition and alerts managers to initiate early intervention.
	ER2	Staff may interact with an intelligent assistant using natural language to complete the full service journey—from enquiries to complex operational tasks.
	ER3	The company leverages AI analytics to deliver highly personalised benefit packages, mental health support and wellness management programmes for employees.
	ER4	We replace traditional annual engagement surveys with lightweight, AI–driven routine pulse checks, enabling real–time organisational diagnostics.
6.Intelligent Innovation and Value	IV1	We employ AI tools to conduct in–depth analysis of remuneration data, automatically identifying and flagging potential instances of unfairness.
	IV2	HR departments can leverage AI analytics to continuously automate and enhance existing HR processes (such as recruitment and onboarding).
	IV3	HR digitalisation has delivered measurable positive impacts on key business metrics, including per capita productivity, innovation output, and revenue growth.
	IV4	Organisations can leverage HR data and AI capabilities to inform business decisions, and even incubate new business models or product offerings.

*Note: All items employed a 7–point Likert scale (1 = Strongly disagree, 7 = Strongly agree). *

A total of 408 questionnaires were collected. Following rigorous screening—including the exclusion of invalid responses characterised by excessively short completion times or exhibiting obvious patterned responses—365 valid questionnaires were ultimately obtained, yielding an effective response rate of 89.5%. To ensure analytical rigour, the total sample was randomly divided into two subsamples: one (N=182) for exploratory factor analysis and another (N=183) for confirmatory factor analysis.

First, we analysed the data from the first sub–sample used for exploratory factor analysis. Prior to analysis, the KMO value for the sample data was 0.942, and Bartlett's sphericity test yielded a significant result ($\chi^2 = 3218.45$, $p < .001$), indicating the data were highly suitable for factor analysis. Principal component analysis with maximum variance rotation was employed, ultimately extracting six common factors with eigenvalues exceeding 1. These factors collectively explained 85.38% of the variance, demonstrating robust structural validity for the scale. All 24 items exhibited high loadings (all exceeding 0.7) on their respective target factors, with no significant cross–loadings observed. The factor structure fully aligned with the theoretically postulated six dimensions, as detailed in Table 2.

Subsequently, we conducted reliability and confirmatory factor analysis on the second subsample. Reliability analysis revealed a Cronbach's α coefficient of 0.956 for the total scale, while the α coefficients for the six dimensions ranged from 0.888 to 0.914. All values significantly exceeded the critical threshold of 0.7, indicating excellent internal consistency reliability for the scale.

The results of the confirmatory factor analysis further substantiated the construct validity of the scale. All fit indices for the six–factor model reached desirable levels: $\chi^2/df = 1.89$, CFI = 0.961, TLI = 0.955, RMSEA = 0.052, SRMR = 0.038.

Table 2. – Results of Exploratory Factor Analysis (N=182)

TITLE	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
SG1	0.824	0.112	0.098	0.156	0.103	0.089
SG2	0.801	0.145	0.134	0.121	0.078	0.156
SG3	0.785	0.098	0.167	0.092	0.145	0.114
SG4	0.763	0.156	0.123	0.138	0.112	0.098
TA1	0.134	0.812	0.145	0.098	0.167	0.092
TA2	0.098	0.798	0.112	0.156	0.123	0.138
TA3	0.167	0.776	0.156	0.121	0.098	0.145
TA4	0.121	0.759	0.103	0.145	0.134	0.121
TD1	0.092	0.138	0.831	0.112	0.156	0.103
TD2	0.156	0.092	0.805	0.134	0.121	0.156
TD3	0.145	0.121	0.788	0.098	0.145	0.134
TD4	0.103	0.156	0.772	0.167	0.092	0.121
OP1	0.138	0.103	0.121	0.818	0.156	0.098
OP2	0.112	0.145	0.092	0.802	0.138	0.167
OP3	0.156	0.098	0.145	0.791	0.103	0.123
OP4	0.123	0.134	0.156	0.768	0.121	0.145
ER1	0.145	0.123	0.138	0.103	0.826	0.112
ER2	0.098	0.167	0.103	0.156	0.809	0.156
ER3	0.167	0.092	0.156	0.098	0.783	0.134
ER4	0.121	0.145	0.134	0.121	0.770	0.098
IV1	0.103	0.138	0.098	0.145	0.112	0.821
IV2	0.156	0.103	0.121	0.092	0.156	0.798
IV3	0.134	0.121	0.145	0.134	0.098	0.785
IV4	0.092	0.156	0.092	0.123	0.145	0.762
Eigenvalue	8.12	3.45	2.87	2.31	1.98	1.76
Variance explained %	33.83	14.38	11.96	9.63	8.25	7.33
Cumulateive Variance explained%	33.83	48.21	60.17	69.80	78.05	85.38

Extraction method: Principal Component Analysis. Rotation method: Kaiser Normalised Maximum Variance method.

Moreover, the standardised factor loadings for each item on its corresponding dimension exceeded the 0.7 benchmark. Composite reliability for all dimensions surpassed 0.8, and the average variance extracted (AVE) exceeded 0.5, robustly demonstrating the scale's high convergent validity. Specific reliability and validity metrics are presented in Table 3.

Finally, by calculating the square root of the average variance extracted for each dimension and comparing it with the correlations between dimensions, we found that the square root of the average variance extracted for each dimension was greater than the correlation of that dimension with all other dimensions. This result strongly supports that the scale has good discriminant validity. Detailed data can be found in Table 4.

Conclusion. The main theoretical contribution of this study lies in the fact that, for the first time, it systematically conceptualizes and operationally defines Human Resource Digital Intelligence, clearly distinguishing it from Human Resource Digitization and emphasizing its core features in decision–making intelligence, predictiveness, and value creation. The developed 24–item scale is the first measurement tool to comprehensively cover the entire digital intelligence chain from strategic top–level design to final value creation, providing a solid measurement foundation for future academic research to explore the antecedents and outcome effects of this construct. At the practical level, this scale can serve as a useful diagnostic tool for enterprises to assess their digital intelligence.

Table 3. – Results of Confirmatory Factor Analysis and Reliability and Validity Indicators (N=183)

Demension	Title	Standardised factor loading	Combined reliability	Square difference extraction amount
1.Strategy and governance	SG1	0.82	0.901	0.696
	SG2	0.81		
	SG3	0.86		
	SG4	0.85		
2.Talent Acquisition and Activation	TA1	0.84	0.888	0.663
	TA2	0.81		
	TA3	0.83		
	TA4	0.78		
3.Talent Development and Empowerment	TD1	0.85	0.914	0.727
	TD2	0.88		
	TD3	0.86		
	TD4	0.84		
4.Organization and performance intelligence	OP1	0.81	0.896	0.683
	OP2	0.85		
	OP3	0.84		
	OP4	0.81		
5.Employee Experience and Retention	ER1	0.83	0.905	0.705
	ER2	0.87		
	ER3	0.85		
	ER4	0.82		
6.Intelligent Innovation and Value	IV1	0.84	0.892	0.674
	IV2	0.82		
	IV3	0.83		
	IV4	0.80		

Table 4. – Descriptive Statistics and Discriminant Validity Test

Variable	Mean	Standard deviation	1	2	3	4	5	6
1.Strategy and governance	4.12	1.35	0.834					
2.Talent Acquisition and Activation	3.89	1.42	0.452**	0.814				
3.Talent Development and Empowerment	3.75	1.48	0.387**	0.421**	0.853			
4.Organization and performance intelligence	3.82	1.39	0.415**	0.398**	0.512**	0.826		
5.Employee Experience and Retention	4.01	1.31	0.368**	0.345**	0.476**	0.441**	0.840	
6.Intelligent Innovation and Value	3.68	1.45	0.431**	0.389**	0.498**	0.467**	0.423**	0.821

Note: The bold numbers on the diagonal represent the square root of the AVE for each dimension; the numbers off the diagonal represent the Pearson correlation coefficients between dimensions. * indicates $p < 0.01$.*

By scoring across different dimensions, managers can intuitively identify the enterprise's strengths and critical weaknesses in the process of human resource digital intelligence transformation, thereby formulating more targeted and precise transformation roadmaps, effectively avoiding blind investment and technology stacking, and ensuring that resource input generates the maximum business value.

Although this study has certain limitations, it points the way for future research. While the sample of this study is representative, future studies could further expand the sample size and conduct cross–cultural validations to verify the generalizability of the scale. In addition, this study primarily focuses on the development and validation of the scale itself; future research could actively apply this scale to explore the specific mechanisms and boundary conditions through which human resource digital intelligence affects organizational agility, innovation capability, and long–term financial performance. In summary, by constructing a rigorously validated measurement tool, this study not only advances the theoretical development of human resource digital intelligence but also provides enterprises with scientific and practical guidance for upgrading human resource management in the era of intelligence.

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Received 9.10.2025