Banking Antecedents of Human Resource Quality for Digital Transformation in Banking: Evidence from Vietnam

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ABSTRACT:
Digital transformation is reshaping commercial banks' operating models, customer interfaces, risk-management systems, and competency requirements. Technology investment alone, however, does not ensure successful transformation; banks also require employees who possess the knowledge, applied skills, health, psychological resources, and professional conduct needed to use digital systems effectively. This study examines seven antecedent dimensions of human resource quality in Vietnamese commercial banks: knowledge, professional skills, behavioral skills, cognitive skills, work attitude and professional conduct, physical capacity and health status, and mental and social well-being. Survey data from 603 employees across 13 commercial banks were analyzed using partial least squares structural equation modeling (PLS-SEM) in SmartPLS 4. The measurement model demonstrates strong indicator reliability, internal consistency, convergent validity, and discriminant validity. The model explains 75.9% of the variance in overall human resource quality. Knowledge shows the strongest positive association ($\beta = 0.304$, $p < 0.001$), followed by work attitude and professional conduct ($\beta = 0.179$, $p < 0.001$), professional skills ($\beta = 0.158$, $p < 0.001$), physical capacity and health status ($\beta = 0.141$, $p < 0.001$), mental and social well-being ($\beta = 0.114$, $p = 0.002$), and behavioral skills ($\beta = 0.103$, $p = 0.003$). Cognitive skills do not exhibit a statistically significant direct association ($\beta = 0.044$, $p = 0.189$). The findings indicate that a high-quality digital banking workforce depends on an integrated combination of technical, professional, behavioral, health, and attitudinal resources rather than technology-related skills alone.

Keywords: human resource quality; commercial banks; digital transformation; digital competence; Vietnam

1. Introduction

Digital transformation has become a strategic imperative for commercial banks. Banking services are increasingly delivered through mobile applications, digital platforms, automated customer interfaces, data-driven credit processes, and technology-enabled risk-control systems. These changes do not only reshape banks' technological infrastructure; they also transform

the nature of banking work. Employees are now expected to combine traditional financial and banking expertise with data literacy, digital-product knowledge, emerging-technology awareness, digital-risk awareness, and the ability to collaborate and serve customers in technology-mediated environments (Mazurchenko et al., 2022; Vuorikari et al., 2022).

The human-resource implications of digital transformation are particularly important in banking because the sector is knowledge-intensive, highly regulated, and exposed to operational, financial, cyber, and reputational risks. Although digital systems can accelerate transactions, standardize procedures, and improve service accessibility, their effectiveness still depends heavily on employees' ability to interpret information, understand products, recognize risks, exercise professional judgment, and maintain service quality. From a competency-based perspective, employee effectiveness results from the alignment between individual competencies, job requirements, and the organizational environment (Boyatzis, 2008). Digital transformation changes this alignment by introducing new requirements related to technology use, data-driven work, digital financial products, remote collaboration, customer interaction, risk awareness, and continuous learning.

Existing studies have examined employee competencies in banking, digital competence, and the changing skill requirements associated with Banking 4.0 (Salman et al., 2020; Shinde et al., 2022; Mazurchenko et al., 2022). However, the literature remains fragmented in two important ways. First, many studies focus on selected competencies, such as digital skills, technology readiness, or knowledge, while paying less attention to broader employee resources such as professional conduct, behavioral capability, health, and psychological well-being. Second, prior research often treats workforce capability as a general requirement for digital transformation, but provides limited empirical evidence on the relative importance of different employee-level dimensions in shaping overall human resource quality. As a result, it remains unclear which employee resources matter most for building a high-quality digital banking workforce.

This gap is especially relevant in the Vietnamese commercial-banking context. Vietnamese banks have invested substantially in digital banking platforms, mobile applications, automated processes, and technology-enabled service channels. However, technological investment alone is insufficient if employees lack the integrated knowledge, skills, attitudes, health, and psychological resources required to work effectively in a digital environment. A narrow focus on digital knowledge or technical training may overlook the importance of professional discipline, customer-oriented behavior, work motivation, well-being, and adaptability. Therefore, a broader and more integrated understanding of human resource quality is needed. Accordingly, this study positions human resource quality as a workforce capability required for digital transformation in banking. In this context, human resource quality reflects not only employees' formal qualifications or technical skills, but also their knowledge, applied skills, behavioral capabilities, cognitive resources, health status, psychological well-being, and professional conduct needed to perform effectively in digitally enabled banking environments

To address this gap, the present study examines seven employee-level antecedent dimensions of overall human resource quality in Vietnamese commercial banks: knowledge, professional skills, behavioral skills, cognitive skills, work attitude and professional conduct, physical capacity and health status, and mental and social well-being. The study addresses two research questions. First, which of these dimensions are significantly associated with overall human resource quality in Vietnamese commercial banks during digital transformation? Second, which dimensions appear most important for managerial priorities in recruitment, training, development, and employee support?

This study makes three main contributions. First, it reframes human resource quality in banking as

a workforce capability for digital transformation, thereby extending prior research beyond narrow views of digital skills or technical competence. Second, it integrates intellectual, applied, behavioral, physical, psychological, and attitudinal resources into one empirical model, allowing the relative contribution of different employee-level antecedents to be assessed. Third, by analyzing survey data from 603 employees across 13 Vietnamese commercial banks, the study provides emerging-market evidence on how banks can develop human resources capable of supporting digital transformation.

2. Literature Review and Hypothesis Development

2.1. Theoretical foundation and digital transformation workforce quality

This study conceptualizes human resource quality in commercial banks as workforce quality for digital transformation. In digitally transforming banks, human resource quality refers to the extent to which employees possess the integrated intellectual, professional, behavioral, physical, psychological, and ethical resources required to perform banking work effectively in a technology-enabled environment. This conceptualization is grounded in four complementary theoretical perspectives: the competency-based view, human capital theory, digital competence frameworks, and the work ability and well-being perspective.

First, the competency-based view explains employee effectiveness through the alignment between individual competencies, job demands, and the organizational environment. Competencies include not only observable skills but also underlying attributes such as knowledge, motives, attitudes, values, and personal capabilities (Boyatzis, 2008). This perspective is particularly relevant to digital banking because digital transformation changes the work environment in which employees perform. Bank employees are increasingly required to use digital systems, interpret data, understand digital financial products, recognize cyber and operational risks, collaborate through technology-mediated channels, and maintain service quality under changing work conditions. Therefore, workforce quality in digital banking cannot be understood only through formal qualifications or narrowly defined technical skills. It should instead be understood as the broader alignment between employee resources and the evolving requirements of digital banking work.

Second, human capital theory provides a foundation for understanding why employee knowledge, skills, abilities, and other productive attributes are valuable organizational resources. Schultz (1961) and Becker (1964) argue that investment in people through education, training, and skill development increases productive capacity. In banking, human capital is especially important because employees are required to process information accurately, comply with regulations, advise customers, manage risks, and use digital platforms responsibly. From this perspective, knowledge and professional skills represent core productive resources that allow banks to convert digital investment into effective service delivery, operational reliability, and organizational adaptability.

Third, digital competence frameworks broaden the understanding of workforce capability in digital transformation. Digital competence is not limited to the basic ability to operate technology. It also includes information and data literacy, digital communication and collaboration, digital-content creation, safety, problem solving, and the ability to learn and adapt to emerging technologies (Ala-Mutka, 2011; Vuorikari et al., 2022). In banking, these competencies are closely linked to digital financial products, customer data protection, digital-risk awareness, fraud prevention, technology-enabled customer service, and data-driven decision processes. Accordingly, a high-quality digital banking workforce requires both digital knowledge and the applied ability to use that knowledge safely, effectively, and responsibly in banking workflows.

Fourth, the work ability and well-being perspective highlights that employees' capacity to perform depends not only on knowledge and skills but also on health, psychological resources,

and social functioning. Work ability reflects the balance between individual resources and work demands, while well-being research emphasizes the role of job demands, job resources, strain, motivation, and sustainable performance (Tuomi et al., 2001; Bakker & Demerouti, 2007). This perspective is important in digital banking because employees may face prolonged screen exposure, high concentration demands, workload peaks, frequent system changes, customer pressure, and increased responsibility for data security and operational accuracy. Employees with better physical capacity, mental resilience, confidence, optimism, and social integration may be more capable of sustaining performance, adapting to new systems, and maintaining service quality during digital transformation.

Based on these theoretical perspectives, the present study distinguishes between seven employee-level antecedent dimensions and the overall human-resource-quality outcome. This specification is intentional. The seven dimensions are not treated as interchangeable manifestations of a single higher-order construct. Rather, knowledge, professional skills, behavioral skills, cognitive skills, work attitude and professional conduct, physical capacity and health status, and mental and social well-being are conceptualized as distinct employee resources that may vary independently and contribute unequally to overall human resource quality. A higher-order construct approach would mainly assess whether these dimensions jointly represent a broader latent concept. By contrast, the antecedent-outcome specification adopted in this study allows the relative contribution of each dimension to be examined. This approach is better aligned with the study's objective of identifying which employee resources are most strongly associated with workforce quality for digital transformation in Vietnamese commercial banks and which areas should be prioritized in recruitment, training, development, and employee support.

2.2. Knowledge

Knowledge provides the cognitive foundation for performing and adapting to digital banking work. Employees require specialized banking knowledge, computer knowledge, knowledge of digital financial products and services, familiarity with emerging technologies, and awareness of digital financial risks. Human-resource management literature treats job-relevant knowledge as a core component of employee capability (Armstrong & Taylor, 2020), while digital-competence frameworks emphasize information, technology, safety, and risk-related knowledge as prerequisites for effective participation in digitally transformed workplaces (Ala-Mutka, 2011; Vuorikari et al., 2022).

In banking, this knowledge has direct operational value. Specialized knowledge supports accurate transactions and regulatory compliance; computer knowledge enables employees to use digital systems; digital-product knowledge improves customer advice; emerging-technology knowledge supports adaptation and innovation; and awareness of fraud, phishing, spyware, and related threats strengthens operational resilience. Employees with a stronger knowledge base should therefore be better positioned to perform digital tasks accurately, learn new systems, and contribute to service quality.

H1: Knowledge is positively associated with human resource quality in Vietnamese commercial banks in the context of digital transformation.

2.3. Professional skills

Professional skills refer to the applied abilities required to convert knowledge into effective work outcomes. The present study covers data management, analysis and processing; efficient task performance; the creation and development of digital content; and the confident and safe use of emerging technologies. These capabilities are increasingly important as banking processes become more data intensive and customer services shift toward digital channels (Berruti et al., 2017; Vuorikari et al., 2022).

Professional skills operationalize digital transformation. Data-related skills support evidence-informed decisions, digital-content skills improve communication and service delivery, and the safe use of technology can

reduce operational errors. Employees who can apply such skills are therefore expected to receive higher evaluations of overall human resource quality.

H2: Professional skills are positively associated with human resource quality in Vietnamese commercial banks in the context of digital transformation.

2.4. Behavioral skills

Behavioral skills concern how employees communicate, coordinate, decide, serve customers, and solve problems. Digital banking does not eliminate interpersonal work; rather, it changes its channels and coordination demands. Employees must communicate across physical and digital interfaces, collaborate with technology and business units, explain digital products to customers, and respond effectively when systems or customer journeys do not operate as expected (Salman et al., 2020; Mazurchenko et al., 2022).

Strong behavioral skills can improve service quality and organizational coordination, help translate technical information into customer-oriented solutions, and support employees in managing ambiguity during digital change. Behavioral competence is therefore expected to contribute positively to overall human resource quality.

H3: Behavioral skills are positively associated with human resource quality in Vietnamese commercial banks in the context of digital transformation.

2.5. Cognitive skills

Cognitive skills comprise logical, creative, and critical thinking. These capacities help employees analyze information, evaluate alternatives, question assumptions, and generate solutions. Their relevance may increase during digital transformation because employees must interpret data, understand unfamiliar systems, and exercise judgment in situations that cannot be fully standardized.

Logical thinking supports structured problem analysis, creative thinking facilitates innovation, and critical thinking assists in evaluating the reliability and consequences of information. Employees with stronger cognitive skills are therefore expected to display higher overall human resource quality.

H4: Cognitive skills are positively associated with human resource quality in Vietnamese commercial banks in the context of digital transformation.

2.6. Work attitude and professional conduct

Work attitude and professional conduct reflect organizational discipline, compliance with rules, responsibility, motivation, autonomy, accountability, dynamism, creativity, innovation, and commitment to learning and self-improvement. These attributes are particularly important in banking, where employees operate under strict regulatory, confidentiality, and risk-control requirements (Kumar & Jain, 2010).

Digital transformation requires employees to accept new responsibilities and update their competencies continuously. Although technology can automate procedures, it does not remove the need for responsible conduct, compliance, motivation, and learning orientation. A positive work attitude and professional conduct should therefore strengthen employees' overall quality and adaptability.

H5: Work attitude and professional conduct are positively associated with human resource quality in Vietnamese commercial banks in the context of digital transformation.

2.7. Physical capacity and health status

Physical capacity and health status refer to employees' ability to undertake assigned tasks, sustain work when additional effort is required, maintain appropriate health, and avoid health-related limitations. Although digitalization reduces some manual activities, banking work still involves prolonged concentration, screen use, workload peaks, and the need to maintain accuracy under time pressure.

Adequate health can support attendance, endurance, concentration, and stable performance. It also enables employees to

participate in training and adapt to changes in tasks and work arrangements. Physical capacity and health status are therefore expected to be positively associated with overall human resource quality.

H6: Physical capacity and health status are positively associated with human resource quality in Vietnamese commercial banks in the context of digital transformation.

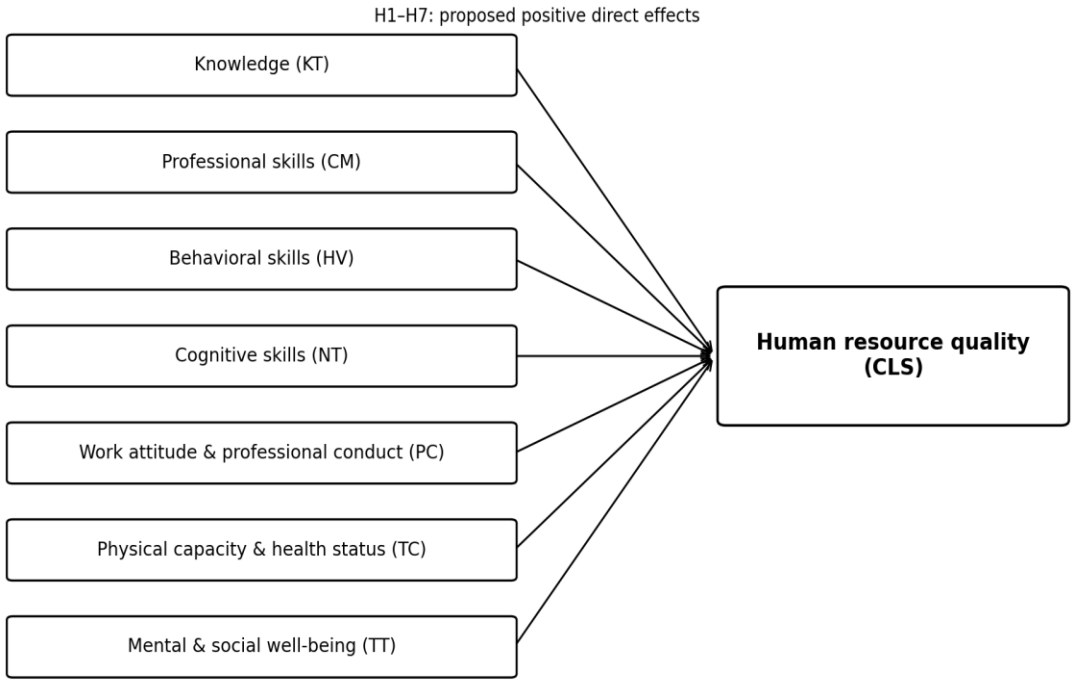
2.8. Mental and social well-being

Mental and social well-being includes self-confidence, calmness when facing stress, optimism and a positive attitude, and integration into the work community. Banking employees may experience pressure arising from sales targets, compliance requirements, customer expectations, technological change, and the consequences of operational mistakes.

Employees with stronger psychological and social resources are better positioned to cope with change, learn from mistakes, cooperate with colleagues, and sustain service quality. Mental and social well-being should therefore improve employees' capacity to perform effectively in a digitally transforming bank.

H7: Mental and social well-being is positively associated with human resource quality in Vietnamese commercial banks in the context of digital transformation.

Figure 1. Proposed research model



Source: Proposed by the authors

3. Research Methodology

3.1. Research design and sample

The study adopts a quantitative, cross-sectional research design to examine the proposed relationships. Primary data were collected through a structured questionnaire administered to employees of Vietnamese commercial banks. The final dataset comprises 603 valid responses from employees working at 13 commercial banks.

A non-probability convenience sampling approach was used because a complete sampling frame of employees across the participating banks was unavailable. This approach facilitated access to respondents across multiple institutions, but it also creates a potential for self-

selection bias and limits the statistical generalizability of the findings. These limitations are considered when interpreting the results.

The sample size is adequate for the reported PLS-SEM model. Under the ten-times heuristic, the endogenous construct receives seven structural paths, implying a minimum of 70 observations. The sample also exceeds the inverse-square-root requirement discussed by Kock and Hadaya (2018). Using a minimum relevant path coefficient of 0.20, a 5% significance level, and 80% statistical power, the approximate minimum sample is 155 observations; the final sample of 603 is therefore well above this benchmark.

The data were analyzed in SmartPLS 4. The assessment proceeded in three stages: evaluation of indicator reliability and construct reliability/validity; assessment of explanatory and predictive statistics for the endogenous construct; and bootstrapping with 5,000 resamples to test the seven direct hypotheses. Because the data are self-reported and cross-sectional, the estimated structural paths are interpreted as associations rather than definitive causal effects.

3.2. Measurement scales

The measurement model includes 38 indicators: six global indicators of human resource quality (CLS1–CLS6) and 32 indicators across the seven proposed antecedent constructs. The antecedent scales were adapted from prior research and digital-competence frameworks and adjusted to the Vietnamese banking context. All survey items were measured on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. Table 1 summarizes the constructs and measurement sources

Table 1. Measurement constructs and source

Construct	Source
Knowledge (KT1-KT5)	Boyatzis (2008), Armstrong & Taylor (2020); Shinde et al. (2022), Morgan et al. (2019); Remund, (2010); Ala-Mutka (2011); Spires et al. (2017)
Professional skill (CM1-CM4)	Armstrong & Taylor (2020); Ala-Mutka (2011); Spires et al. (2017), Vuorikari et al. (2022); Berruti (2017)
Cognitive skills (NT1-NT3)	Yahya S and Goh WK (2002)
Behavioral skills (HV1-HV5)	Armstrong & Taylor (2020), Salman, M., Ganie, S. A., & Saleem, I. (2020), Vuorikari et al (2022); Shinde et al (2022); Yahya S & Goh WK (2002); Mazurchenko et al. (2022)
Physical capacity and health status (TC1-TC4)	Nguyen P.T.H (2017)
Mental and social well-being (TT1-TT4)	Boyatzis (2008); Nguyen P.T.H (2017)Nguyen et al. (2019)
Work attitude and professional conduct (PC1-PC7)	Nguyen P.T.H (2017); Nguyen et al. (2019), Kumar & Jain (2010)
Human resource quality in digital transformation (CLS1-CLS6)	Le & Nguyen (2022)

Source: Compiled by the authors

4. Results

4.1. Sample description

The 603 valid responses were distributed across 13 Vietnamese commercial banks. Agribank contributed the largest share of observations (11.94%), followed by Vietcombank (10.28%) and BIDV (9.95%). The sample therefore covers both large state-linked banks and joint-stock commercial banks, providing a broader empirical base than a single-bank case study.

Table 2. Distribution of respondents by bank

No.	Bank's name	Samples	Percentage (%)
1	Vietnam Bank for Agriculture and Rural Development - Agribank	72	11.94
2	Joint Stock Commercial Bank For Foreign Trade Of Vietnam - Vietcombank	62	10.28
3	Joint Stock Commercial Bank for Investment and Development of Vietnam - BIDV	60	9.95
4	Vietnam Joint Stock Commercial Bank for Industry and Trade - Vietinbank	57	9.45
5	An Binh Commercial Joint Stock Bank - ABB	50	8.29
6	Southeast Asia Commercial Joint Stock Bank	51	8.46
7	Military Commercial Joint Stock Bank - MB	51	8.46
8	Asia Commercial Joint Stock Bank - ACB	45	7.46
9	Vietnam Technological and Commercial Joint – Stock Bank - Techcombank	42	6.97
10	Vietnam Prosperity Joint Stock Commercial Bank - VPBank	39	6.47
11	Vietnam International Commercial Joint Stock Bank - VIB	28	4.64
12	TienPhong Commercial Joint Stock Bank – TPBank	24	3.98
13	National Citizen Bank - NCB	22	3.65
	Total	**603**	**100**

Source: Authors' survey data.

4.2. Measurement model assessment

4.2.1. Indicator reliability

The reliability of the observed variables was evaluated using Outer Loadings. According to Hair et al. (2010), observed variables are considered acceptable when the Outer Loading value exceeds 0.70. The results indicate that the Outer Loadings ranged from 0.814 to 0.930, all exceeding the threshold of 0.70. Therefore, all observed variables satisfied the required criteria and were retained for further analysis

Table 3. Outer loadings

	CLS	CM	HV	KT	NT	PC	TC	TT
CLS1	0.858							
CLS2	0.891							
CLS3	0.847							
CLS4	0.890							
CLS5	0.881							
CLS6	0.861							
CM1		0.845						
CM2		0.888						
CM3		0.913						
CM4		0.903						
HV1			0.898					
HV2			0.909					
HV3			0.906					
HV4			0.909					
HV5			0.879					
KT1				0.919				
KT2				0.907				
KT3				0.924				
KT4				0.915				
KT5				0.818				
NT1					0.911			
NT2					0.925			
NT3					0.930			
PC1						0.913		
PC2						0.914		
PC3						0.916		
PC4						0.919		
PC5						0.823		
PC6						0.908		
PC7						0.814		
TC1							0.888	
TC2							0.921	

TC3	0.912	
TC4	0.817	
TT1		0.927
TT2		0.906
TT3		0.911
TT4		0.885

Source: Authors' survey data.

4.2.2. Internal consistency and convergent validity

Internal consistency and convergent validity were assessed using Cronbach's alpha, composite reliability (rho_a and rho_c), and average variance extracted (AVE). Cronbach's alpha ranges from 0.908 to 0.955; rho_a ranges from 0.912 to 0.956; rho_c ranges from 0.935 to 0.963; and AVE ranges from 0.759 to 0.851. These values indicate high internal consistency and satisfactory convergent validity across all constructs.

Table 4. Reliability and convergent validity

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
CLS	0.937	0.937	0.950	0.759
CM	0.910	0.912	0.937	0.787
HV	0.942	0.942	0.955	0.811
KT	0.939	0.942	0.954	0.806
NT	0.912	0.913	0.945	0.851
PC	0.955	0.956	0.963	0.788
TC	0.908	0.912	0.935	0.784
TT	0.928	0.929	0.949	0.823

Source: Authors' survey data.

4.2.3. Discriminant validity

Discriminant validity was assessed using the heterotrait-monotrait ratio (HTMT) criterion (Henseler et al., 2015). All reported HTMT values are below 0.90; the highest value is 0.829 between knowledge and overall human resource quality. The results therefore support empirical distinctiveness among the constructs.

Table 5. HTMT ratios

	CLS	CM	HV	KT	NT	PC	TC	TT
CLS								
CM	0.786							
HV	0.756	0.741						
KT	0.829	0.737	0.719					
NT	0.704	0.723	0.711	0.690				
PC	0.753	0.634	0.641	0.653	0.589			
TC	0.739	0.645	0.624	0.635	0.602	0.660		
TT	0.779	0.699	0.703	0.708	0.629	0.729	0.724	

Source: Authors' survey data.

Structural Model Assessment

Structural Model Assessment was evaluated to examine the relationships among the constructs and test the proposed hypotheses. The assessment included the examination of multicollinearity, explanatory power (R^2), and path coefficients through the bootstrapping procedure in SmartPLS 4.

The indicator VIF values are all below the threshold of 5.0, suggesting that indicator-level collinearity is not a serious concern. In addition, the endogenous constructs achieved acceptable explanatory power, suggesting that the proposed model adequately explains variations in human resource quality

Table 6. Indicator VIF values

	VIF		VIF
CLS1	2.811	KT5	2.493
CLS2	3.421	NT1	2.711
CLS3	2.576	NT2	3.374
CLS4	3.413	NT3	3.512
CLS5	3.369	PC1	4.169
CLS6	3.046	PC2	4.743

CM1	2.303	PC3	3.975
CM2	2.841	PC4	3.956
CM3	4.145	PC5	2.715
CM4	3.758	PC6	4.440
HV1	3.537	PC7	2.518
HV2	3.896	TC1	2.853
HV3	3.620	TC2	3.738
HV4	3.789	TC3	3.375
HV5	2.937	TC4	1.987
KT1	4.868	TT1	3.988
KT2	4.393	TT2	3.323
KT3	4.747	TT3	3.420
KT4	4.259	**TT4**	2.744

Source: Authors' research results

4.3. Structural model results

4.3.1. Explanatory power

The endogenous construct, overall human resource quality (CLS), has an R^2 of 0.759 and an adjusted R^2 of 0.756. Thus, the seven proposed predictors jointly account for 75.9% of the variance in overall human resource quality in the reported sample. This represents substantial explanatory power for the model, while the small difference between R^2 and adjusted R^2 suggests limited inflation from model complexity.

Table 7. Coefficient of determination

	R-square	R-square adjusted
CLS	0.759	0.756

Source: Authors' survey data.

In addition to the R^2 coefficient, this research employs the f^2 effect size to determine the contribution level of each independent variable to the dependent variables in the model. The f^2 results show that knowledge has the largest effect size on human resource quality (f^2 = 0.148), followed by work attitude and professional conduct (f^2 = 0.059), professional skills (f^2 = 0.040), physical capacity and health status (f^2 = 0.039), mental and social well-being (f^2 = 0.020), behavioral skills (f^2 = 0.017), and cognitive skills (f^2 = 0.004).

Table 8: F square

	CLS
CM	0.040
HV	0.017
KT	0.148
NT	0.004
PC	0.059
TC	0.039
TT	0.020

Source: Authors' research results

4.3.2. Model fit and predictive assessment

The reported model-fit statistics show an SRMR of 0.034, while the NFI is 0.899. The study also reports a Q^2predict value of 0.752 for CLS, with RMSE = 0.501 and MAE = 0.361. The positive Q^2predict value indicates out-of-sample predictive relevance for the focal endogenous construct. Because no linear-model benchmark was estimated, RMSE and MAE are presented descriptively rather than used to claim superior predictive performance.

Table 9. Reported model-fit statistics

Index	Saturated model	Estimated model
SRMR	0.034	0.034
d_ULS	0.845	0.845
d_G	0.670	0.670
Chi-square	2470.303	2470.303
NFI	0.899	0.899

Source: Authors' survey data.

Table 10. Predictive statistics for human resource quality

	Q^2predict	RMSE	MAE
CLS	0.752	0.501	0.361

Source: Authors' survey data.

4.3.3. Hypothesis testing

Bootstrapping with 5,000 resamples was used to test the seven direct relationships. Six hypotheses are supported at the 5% significance level. Knowledge has the strongest positive association with human resource quality ($\beta = 0.304$, $p < 0.001$), followed by work attitude and professional conduct ($\beta = 0.179$, $p < 0.001$),

professional skills (β = 0.158, p < 0.001), physical capacity and health status (β = 0.141, p < 0.001), mental and social well-being (β = 0.114, p = 0.002), and behavioral skills (β = 0.103, p = 0.003). Cognitive skills are positively signed but statistically non-significant (β = 0.044, p = 0.189); H4 is therefore not supported.

Table 11. Direct-effect hypothesis tests

Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
CM -> CLS	0.158	0.158	0.035	4.563	<0.001
HV -> CLS	0.103	0.102	0.035	2.958	0.003
KT -> CLS	0.304	0.303	0.041	7.341	<0.001
NT -> CLS	0.044	0.044	0.033	1.312	0.189
PC -> CLS	0.179	0.180	0.032	5.584	<0.001
TC -> CLS	0.141	0.142	0.031	4.482	<0.001
TT -> CLS	0.114	0.115	0.037	3.085	0.002

Source: Authors' survey data.

4.4. Descriptive profile of the antecedent dimensions

As shown in Table 12, the descriptive results indicate, work attitude and professional conduct has the highest average item mean (4.153), followed by mental and social well-being (4.093) and physical capacity and health status (4.090). Behavioral skills has the lowest average item mean, although it remains above 4.00. Within the knowledge construct, awareness of digital financial risks records the lowest item mean (3.96), suggesting a specific development priority even though knowledge is the strongest structural predictor of overall human resource quality.

Table 12. Summary of reported item means by construct

Variables	Items	Mean	SD
Knowledge	KT1. Specialized knowledge	4.13	0.85
	KT2. Computer knowledge	4.11	0.88
	KT3. Knowledge of digital financial products and services	4.13	0.88
	KT4. Knowledge of emerging technologies	4.05	0.87
	KT5. Understanding and awareness of digital financial risks	3.96	0.87
Professional skill	CM1. Data management, analysis, and processing skills	3.92	0.89
	CM2. Skills in performing work effectively and efficiently	4.04	0.85

	CM3. Skills in creating and developing digital content in the work process	4.07	0.87
	CM4. Skills in using emerging technologies confidently and safely	4.08	0.88
Cognitive skills	NT1. Logical thinking	4.06	0.82
	NT2. Creative thinking	4.03	0.84
	NT3. Critical thinking	4.02	0.92
Behavioral skills	HV1. Communication skills	3.97	0.89
	HV2. Communication and collaboration in digital environments, virtual teams	3.96	0.91
	HV3. Decision-making skills	4.03	0.89
	HV4. Customer service skills	3.98	0.85
	HV5. Problem-solving skills	4.07	0.85
Physical capacity and health status	TC1. Ability to undertake assigned tasks	4.03	0.81
	TC2. Ability to work overtime depending on health condition	4.11	0.81
	TC3. Health status	4.11	0.80
	TC4. Chronic illness	4.11	0.83
Mental and social well-being	TT1. Self-confidence	4.13	0.84
	TT2. Calmness in facing stressful challenges in life and work	4.09	0.85
	TT3. Optimism, cheerfulness and positive attitude	4.09	0.86
	TT4. **I**ntegration into the labor community	4.06	0.88
Work attitude and professional conduct	PC1. Organizational discipline and compliance with rules and regulations	4.20	0.83
	PC2. Sense of responsibility at work	4.22	0.85
	PC3. Work motivation	4.18	0.83
	PC4. Autonomy and accountability	4.20	0.82
	PC5. Dynamism, creativity and innovation	4.08	0.86
	PC6. Learning spirit and aspiration for self-improvement	4.16	0.84
	PC7. Job satisfaction	4.03	0.88

Source: Authors' survey data.

5. Discussion

The findings provide a more nuanced understanding of human resource quality for digital transformation in banking. Rather than suggesting that digital banking workforce quality depends only on technology-related knowledge or technical skills, the results show that it is associated with a broader configuration of employee resources. Six of the seven proposed antecedent dimensions are statistically significant, and the model explains 75.9% of the variance in overall human resource quality. This pattern supports the view that workforce quality in digital transformation is a multidimensional capability shaped by intellectual, applied, behavioral, physical, psychological, and attitudinal resources.

From a competency-based perspective, the findings confirm that employee quality depends on the alignment between individual resources and changing job demands. Digital transformation alters the competency requirements of banking work by increasing the importance of digital financial products, data-intensive processes, technology-mediated customer interaction, operational risk awareness, and continuous learning. The significant effects of knowledge, professional skills, behavioral skills, work attitude and professional conduct, physical capacity and health status, and mental and social well-being indicate that digital transformation requires a broad competency configuration rather than a narrow set of technical abilities. In this sense, the study extends the competency-based view by showing how different employee resources contribute unequally to overall workforce quality in a digitally transforming service industry.

Knowledge has the strongest association with human resource quality. This finding is theoretically important because it suggests that knowledge remains a core form of human capital in digital banking. While digital transformation is often discussed in terms of technology adoption, the results indicate that technology creates value only when employees possess the knowledge needed to understand banking operations, digital financial products, emerging technologies, and digital risks. The comparatively lower descriptive mean for digital-risk awareness further suggests that knowledge quality is not only about general banking expertise, but also about the ability to understand and manage new risks created by digitalization. This supports human capital theory by showing that employee knowledge is a strategic productive resource that helps banks convert digital investment into reliable service delivery and operational adaptability.

Work attitude and professional conduct is the second strongest predictor of human resource quality. This finding adds an important theoretical insight to the literature on digital transformation workforce capability. In highly regulated and risk-sensitive sectors such as banking, digital transformation does not reduce the importance of discipline, responsibility, accountability, compliance, and learning orientation. Instead, these attributes become more important because digital systems increase the speed, scale, and potential consequences of employee decisions. The result therefore suggests that professional conduct should not be treated as a peripheral behavioral attribute, but as a central component of workforce quality in digital banking. This extends digital competence research by emphasizing that responsible and compliant use of digital systems is as important as the ability to use those systems technically.

Professional skills also have a significant positive association with human resource quality. This result clarifies the distinction between knowing and doing. Knowledge provides the foundation for understanding digital banking work, but professional skills allow employees to convert that knowledge into effective task performance. Data management, analysis, digital-content creation, and the safe use of emerging technologies represent applied capabilities through which human capital becomes operationally valuable. Theoretically, this finding suggests that digital transformation workforce quality depends not only on the accumulation of knowledge, but also on the practical ability to apply knowledge in concrete banking workflows.

Physical capacity and health status, as well as mental and social well-being, also contribute significantly to human resource quality. This finding broadens the theoretical understanding of digital workforce quality beyond the conventional digital competence framework. Digital banking work can involve prolonged screen exposure, high concentration demands, workload peaks, technological uncertainty, customer pressure, and increased responsibility for data and operational accuracy. Employees who have sufficient physical capacity and psychological resources may be better able to sustain performance, participate in training, cope with change, and maintain service quality. This supports the work ability and well-being perspective, which views performance capacity as the result of a balance between employee resources and work demands. The implication is that health and well-being are not merely welfare-related concerns, but theoretically relevant resources for digital transformation capability.

Behavioral skills have a smaller but still significant association with human resource quality. This suggests that communication, collaboration, decision making, customer service, and problem solving remain important in digital banking, even though their unique contribution is smaller after knowledge, professional conduct, professional skills, health, and well-being are considered. One interpretation is that behavioral skills function as enabling or coordination capabilities. They help employees translate technical and product knowledge into customer-oriented service and support collaboration across business, technology, risk, and customer-facing units. Their smaller coefficient may also indicate that such skills are broadly expected across banking roles and therefore explain less unique variance in overall human resource quality. The non-significant direct effect of cognitive skills provides a useful theoretical refinement. Logical, creative, and critical thinking are theoretically relevant to digital transformation, but they do not show an independent direct association with human resource quality when the other dimensions are included. This should not be interpreted as evidence that cognitive skills are unimportant. Rather, it may suggest that general cognitive ability affects workforce quality indirectly through more applied forms of capability, such as professional skills, problem solving, learning agility, or innovation behavior. Another possible explanation is that the three-item cognitive-skills measure captures general thinking capacity rather than banking-specific analytical judgment. This finding therefore opens a useful direction for future research: cognitive skills may need to be modeled as an indirect, enabling, or role-contingent resource rather than as a simple direct antecedent of overall human resource quality.

Overall, the results support the study's decision to model the seven dimensions as distinct antecedents of human resource quality rather than as interchangeable indicators of a single higher-order construct. The unequal path coefficients show that these resources do not contribute equally to workforce quality. Knowledge and professional conduct appear more salient, while behavioral skills, well-being, and cognitive skills play more specific or indirect roles. This finding is theoretically meaningful because it moves the discussion of human resource quality beyond a checklist of desirable employee attributes. It shows that workforce quality for digital transformation is shaped by the relative salience and configuration of different employee resources. The findings also have contextual implications for the literature on digital transformation in emerging-market banking. In Vietnam, commercial banks are rapidly expanding digital platforms, automated services, and technology-enabled risk controls, but the effectiveness of these investments depends on employee readiness. The study suggests that emerging-market banks need to build workforce quality through a balanced approach that combines digital knowledge, applied professional skills, professional conduct, health, well-being, and behavioral competence. This contributes to a more context-sensitive understanding of digital transformation by showing that employee quality in banking is not only a technological issue, but also a human capital, competency, and work ability issue.

6. Theoretical Contributions

This study makes several theoretical contributions to the literature on human resource quality, workforce capability, and digital transformation in banking.

First, the study reframes human resource quality in banking as a workforce capability for digital transformation. Prior research on digital transformation often emphasizes technology adoption, digital skills, or selected employee competencies. This study broadens that view by conceptualizing human resource quality as an integrated outcome associated with intellectual, applied, behavioral, physical, psychological, and attitudinal resources. This reframing suggests that a high-quality digital banking workforce cannot be understood through technical skills alone. Second, the study contributes to the competency-based view by showing that workforce quality depends on the fit between employee resources and the changing requirements of digital banking work. Digital transformation introduces new demands related to digital financial products, data-intensive processes, technology-mediated customer interaction, risk awareness, compliance, and continuous learning. The findings therefore support a broader competency configuration in which knowledge, applied skills, professional conduct, health, well-being, and behavioral competence jointly shape overall human resource quality. Third, the study extends human capital theory by showing that different forms of employee resources contribute unequally to workforce quality. Knowledge has the strongest association with human resource quality, indicating its central role as a productive resource in digital banking. However, the significance of professional conduct, professional skills, health, well-being, and behavioral skills shows that human capital in digital transformation is not limited to knowledge accumulation. It also includes the capacity to apply knowledge responsibly, sustain performance, and adapt to changing work demands. Fourth, the study extends digital competence research by highlighting the importance of non-technical resources in a highly regulated service industry. In commercial banking, digital workforce capability requires not only information literacy, digital-product knowledge, and technology use, but also compliance orientation, accountability, customer protection, digital-risk awareness, well-being, and behavioral capability. This contribution is important because it links digital competence with responsible, sustainable, and service-oriented performance in banking. Fifth, the study provides a theoretical refinement by distinguishing seven employee-level antecedents from the overall human-resource-quality outcome. Rather than treating these dimensions as interchangeable indicators of one higher-order construct, the model examines them as distinct resources that may vary independently and contribute unequally to overall workforce quality. This specification reveals the relative salience of different employee resources and helps explain why some dimensions, such as cognitive skills, may not show a significant direct effect when more applied and context-specific resources are considered simultaneously. Finally, the study contributes emerging-market evidence to the literature on digital transformation in banking. By analyzing employees from Vietnamese commercial banks, the study extends existing discussions beyond advanced-economy or single-organization settings. The findings suggest that, in emerging banking markets, digital transformation should be understood not only as a technological process, but also as a human capital and workforce-capability challenge.

7. Managerial and Policy Implications

Commercial banks should first develop competency architectures that integrate conventional banking knowledge with digital-product knowledge, emerging-technology awareness, and digital-risk knowledge. The comparatively low mean for digital-risk awareness suggests that this area deserves targeted reinforcement through role-specific, regularly updated learning programs.

Second, recruitment, promotion, and internal mobility should assess applied professional skills rather than relying primarily on qualifications or years of experience. Work-sample tests, data exercises, digital-service simulations, and

scenario-based assessments can provide evidence of whether employees can perform effectively in digitally enabled roles. Third, banks should strengthen professional conduct through clear accountability, compliance-oriented digital workflows, transparent performance criteria, and explicit recognition of learning and responsible innovation. Autonomy is valuable during digital change, but it should be accompanied by accountability for customer protection, data quality, confidentiality, and operational risk.

Fourth, digital-transformation programs should include health and well-being measures. Management can review workload, screen-intensive work patterns, overtime arrangements, ergonomic conditions, psychological support, and team integration during major system or process changes. These measures are not separate from transformation capability; the results suggest that they are associated with overall workforce quality. Fifth, behavioral capability should be embedded in technical training. Employees need to explain digital services to customers, collaborate with technology specialists, make decisions under uncertainty, and solve problems across physical and digital channels. Training designs that combine technical tasks with communication and customer scenarios are therefore likely to be more relevant than stand-alone technical instruction. At the sector level, banking regulators, professional training institutions, universities, and commercial banks can cooperate on occupational standards and digital-competency frameworks. Better alignment among education, recruitment, certification, and continuing professional development would help the banking workforce respond consistently to changing digital requirements.

8. Conclusion

This study examines seven antecedent dimensions of human resource quality in Vietnamese commercial banks during digital transformation. Using survey responses from 603 employees and PLS-SEM, the analysis finds positive and statistically significant relationships for knowledge, professional skills, behavioral skills, work attitude and professional conduct, physical capacity and health status, and mental and social well-being. Cognitive skills do not show a statistically significant direct relationship when the remaining dimensions are modeled simultaneously. The central conclusion is that banks cannot build a high-quality digital workforce through technology training alone. Workforce quality is associated with an integrated combination of knowledge, applied capability, professional conduct, health, psychological resources, and collaborative behavior. Banks that align these elements are better positioned to convert digital investment into reliable service delivery, operational adaptability, and sustainable competitiveness.

9. Limitations and Future Research

Several limitations should be considered. First, the use of convenience sampling limits the representativeness of the sample despite its coverage of 13 banks. Future research should use stratified or probability-based sampling across bank types, regions, and job groups where feasible. Second, the cross-sectional design does not capture changes in employee quality over the course of digital transformation. Longitudinal research could examine how training, technology adoption, and organizational restructuring alter competency profiles over time. Third, the study relies on self-reported perceptions collected from the same respondents, creating potential common-method bias. Future studies should combine employee surveys with supervisor ratings, objective performance indicators, training records, or digital-usage data and should report a formal common-method assessment. Fourth, the non-significant cognitive-skills path warrants additional investigation. Future models could test indirect effects through professional skills, innovation behavior, or learning agility and could refine the scale to capture banking-specific analytical judgment. Finally, comparative studies across countries or between traditional and digital-first banks could identify the contextual conditions under which different dimensions become more or less influential.

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