

The influence of information management quality and process optimization efficiency on the effectiveness of teacher credit recognition systems in vocational colleges in Hebei, China

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Accepted 24 March, 2026

ABSTRACT

Fragmented information management, inefficient operational processes, and concerns over transparency and fairness limit Teacher Credit Recognition System (TCRS) in vocational colleges in Hebei, China from supporting reliable and equitable teacher evaluation. Drawing on the Information Systems Success Model and Business Process Reengineering Theory, this study formulates hypotheses on the direct and interactive effects of Information Management Quality (IMQ) and Operational Process Optimization (OPO) on Teacher Credit Recognition System (TCRS) effectiveness. Hierarchical regression analysis of survey data from 450 staff of five Tangshan vocational colleges verified all hypotheses. IMQ significantly enhances OPO ($\beta = 0.620$); both IMQ ($\beta = 0.670$) and OPO ($\beta = 0.730$) are robust direct predictors of TCRS effectiveness. A significant positive interaction effect was identified ($\beta = 0.220$), meaning high IMQ's positive impacts were markedly amplified by high OPO. The model explains 67.3% of TCRS effectiveness variance. Findings indicate that an efficient, accurate and fair TCRS relies on synergistically advancing IMQ and optimizing operational processes.

Keywords: Information management quality, operational process optimization, teacher credit recognition system, vocational colleges, interaction effect, hierarchical regression.

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INTRODUCTION

Within the rapidly digitizing landscape of China's vocational education system, the Teacher Credit Recognition System (TCRS) has proven instrumental in refining teacher evaluation, performance management, and institutional governance. Designed to promote efficiency, transparency, and fairness in the acknowledgment of teachers' professional accomplishments, the TCRS aligns with digital endeavors that seek to reform educational administration. Conversely, despite significant financial investments in information systems and digital infrastructure, many vocational colleges, particularly those in Tangshan, Hebei Province, still face challenges related to fragmented data management, inefficient approval processes, and issues

of procedural fairness.

These issues underscore a considerable disparity between technological implementation and systemic effectiveness, a phenomenon frequently observed in digital transformation endeavors where system adoption does not automatically translate into improved organizational performance (O'Higgins, 2023). From a theoretical perspective, research on the IS Success Model emphasizes the critical role of information, system, and service quality in influencing system effectiveness and organizational performance.

Recent research indicates that information quality significantly influences user satisfaction, system utilization, and success within digital environments (Vučković et al.,

2023; Alsqour, 2025). Simultaneously, the Business Process Reengineering (BPR) philosophy advocates for the restructuring of corporate workflows to enhance efficiency, responsiveness, and service quality. Consequently, process optimization is essential for translating technological capabilities into operational effectiveness within digitally connected governance.

Therefore, Information Management Quality (IMQ)-encompassing data accuracy, timeliness, accessibility, and integration-and Operational Process Optimization (OPO)-including workflow efficiency, standardization, and transparency-are increasingly acknowledged as interdependent factors influencing information system success.

In the context of educational institutions, information systems have increasingly been adopted to enhance administrative efficiency, transparency, and decision-making processes, particularly in higher and vocational education settings (Al-Shamsi et al., 2023; Li and Wang, 2021; Shannaq and Al-Zeidi, 2024). These studies highlight that digital systems in pedagogical environments not only support operational efficiency but also influence governance quality and institutional trust.

Furthermore, recent studies demonstrate that high-quality information enhances system performance, process integration, coordination, and decision-making, ultimately impacting organizational outcomes (Abdullah et al., 2024).

Existing research has mostly addressed information quality and process-related characteristics as independent indicators of system success, providing little insight into how they combine in complex organizational settings. Information management quality (IMQ) and operational process optimization (OPO) have received insufficient attention, as have their effects on digital system efficacy. This gap ignores the notion that technological and process aspects may work synergistically in a socio-technical environment. To overcome this constraint, this study examines the direct, mediating, and moderating effects of IMQ and OPO on TCRS effectiveness.

In particular, there is limited empirical evidence on how

IMQ influences process optimization, how OPO mediates its effect on system effectiveness, and whether a synergistic relationship between these elements can improve performance. This limitation creates uncertainty for institutional decision-makers regarding the allocation of resources between investments in information system quality and the redesign of operational processes.

This study investigates the direct and mediating influences of Information Management Quality (IMQ) and Operational Process Optimization (OPO) on the efficacy of Teacher Credit Recognition Systems (TCRS), utilizing a comprehensive analytical framework. Hierarchical regression analysis was performed on survey data obtained from vocational college personnel in Tangshan, Hebei Province, informed by the IS Success Model and Business Process Reengineering (BPR) theory.

Consequently, this research enhances our comprehension of the impact of information quality and procedural optimization on the efficacy of digital administrative systems. Furthermore, it offers practical insights for policymakers and institutional leaders seeking to enhance the efficiency, accuracy, and fairness of teacher credit recognition systems in the digital era.

This investigation goes beyond linear models by merging the IS Success Model with BPR theory to capture independent and interaction effects. It adds to the literature by showing that system effectiveness depends on information or process quality, alignment, and mutual reinforcement. The research aims were:

1. To investigate the impact of Information Management Quality (IMQ) and Operational Process Optimization (OPO) on Teacher Credit Recognition System (TCRS) effectiveness.
2. To examine the relationship between Information Management Quality (IMQ) and Operational Process Optimization (OPO).
3. To assess the mediating role of Operational Process Optimization (OPO) in the relationship between IMQ and TCRS effectiveness.

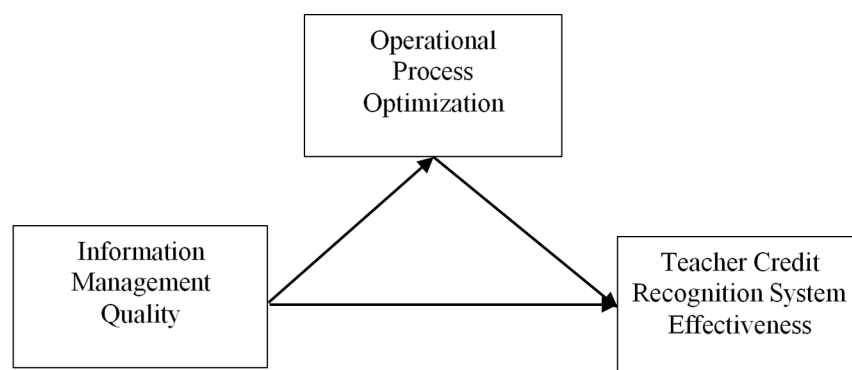


Figure 1. Conceptual framework.

Conceptual framework

Integrating the Information Systems Success Model and Business Process Reengineering theory,

This study proposes a model (Figure 1) where IMQ and OPO jointly determine TCRS effectiveness-IMQ promotes OPO, and both exert a direct positive effect on TCRS effectiveness, with OPO further moderating (strengthening) the IMQ-TCRS relationship.

LITERATURE REVIEW

This study integrates three theories to analyze the effectiveness of TCRS in vocational colleges. The Information Systems Success Model (ISSM) (DeLone and McLean, 2003) underpins the construct of IMQ. Business Process Reengineering (BPR) theory informs the construct of OPO. The concept of organizational justice (Greenberg, 1987; Colquitt, 2001) informs the multi-dimensional assessment of TCRS effectiveness (efficiency, accuracy, fairness). Research confirms that while digitalization enhances administrative efficiency, it can also cause data fragmentation and process disorganization (Sarker et al., 2020; Vial, 2019). For credit systems, poor information management and chaotic workflows undermine outcomes (Li and Wang, 2021). While technology-standardized process integration is a solution (vom Brocke et al., 2021), a critical gap remains: the joint effect of IMQ and OPO on TCRS effectiveness is unclarified. This study addresses this gap.

Hypothesis development

Information management quality (IMQ)

IMO is a key factor in digital operational efficiency, especially in data-intensive administrative systems. Information that is accurate, timely, accessible, and consistent helps organizations streamline workflows, decrease redundancy, and improve decision-making. Due to the complex integration of information flows into operational processes in digital governance frameworks, information quality enhancements should directly aid process optimization.

Digital transformation theory views information as a key driver of process restructuring and organizational progress (Nambisan et al., 2019; Vial, 2019). Digital workflows need structured, reliable, and connected data to coordinate and standardize across organizational units, according to institution and operation studies (Wamba et al., 2020; Hinings et al., 2018). High-quality data reduces ambiguity, errors and enables real-time monitoring and management in Business Process Reengineering (BPR). Recent studies show that data quality and information management abilities improve process efficiency and operational

effectiveness. Enabling automation, consistency, and integration in digital contexts is key (Mikalef et al., 2020).

Teacher Credit Recognition Systems (TCRS) require precise and accessible information to streamline approval workflows, reduce processing time, and improve credit evaluation transparency. Thus, Information Management Quality improvements should boost operational efficiency and effectiveness.

H₁: The impact of IMQ on OPO

OPO and IMQ to TCRS effectiveness

OPO is essential for improving the effectiveness of digital administrative systems by making workflows more efficient, consistent, and transparent. By using well-designed and standardized processes, operational errors are reduced, unnecessary repetitions are avoided, and processing times are shortened, which leads to a more effective system overall (Mendling et al., 2018; OECD, 2021). Moreover, creating clear and transparent procedures helps users see the process as fair, which is crucial for the system's acceptance and overall success (Colquitt et al., 2013; Shapiro et al., 2020).

Within the framework of Teacher Credit Recognition Systems (TCRS), optimized processes facilitate the timely, consistent, and equitable evaluation of teacher credits, thereby bolstering system reliability and user trust.

IMQ constitutes a fundamental foundation for the effective functioning of digital systems. High-quality information, distinguished by its accuracy, consistency, timeliness, and transparency, facilitates dependable decision-making and bolsters user trust in system outputs. The Information Systems Success Model posits that information quality is a crucial determinant of system efficacy and user contentment (DeLone and McLean, 2016; Petter et al., 2013). Moreover, consistent and transparent data records foster perceptions of fairness and equity within decision-making procedures (Colquitt et al., 2013). Within TCRS environments, credible and well-managed information underpins precise credit evaluations, mitigates disputes, and fortifies confidence in the system. Consequently, IMQ is anticipated to exert a direct positive effect on TCRS effectiveness.

H₂: OPO → TCRS Effectiveness

H₃: IMQ → TCRS Effectiveness

Mediating role of operational process optimization (OPO)

IMQ enhances system effectiveness both directly and indirectly by shaping operational processes. Information of high quality, characterized by accuracy, timeliness, and

integration, establishes a dependable basis for the organization and enhancement of workflows. Consequently, when information is consistent and readily available, it fosters improved task coordination, minimizes errors, and streamlines procedural execution. Therefore, advancements in IMQ are anticipated to contribute to the optimization of operational processes.

OPO is crucial for turning information resources into effective system results. Streamlined and standardized procedures enhance efficiency, mitigate delays, and promote consistent application of information in the decision-making process. Within the framework of TCRS, optimized processes contribute to the timely, precise, and transparent execution of teacher credit evaluations.

This indirect mechanism aligns with process-oriented viewpoints, which posit that information resources generate value when integrated into effective organizational processes (Queiroz et al., 2022). Consequently, IMQ augments TCRS effectiveness by initially refining operational processes, which subsequently results in improved system performance.

H₄: OPO mediates IMQ and TCRS effectiveness.

RESEARCH METHODS

A quantitative survey was conducted to test the hypotheses using stratified random sampling; 450 valid responses were obtained from TCRS users across five public vocational colleges in Tangshan, meeting the minimum sample size requirement (Yamane, 1967) for a total population of 1,286 teaching and administrative staff.

The 24-item Likert-scale instrument measured IMQ, OPO, and TCRS effectiveness. The questionnaire was

translated using a back-translation procedure (Herdman et al., 2020; Sánchez-Martínez et al., 2020) to ensure translation validity, and content validity was confirmed by three experts in educational administration and information management.

Prior to analysis, exploratory factor analysis (EFA) and reliability testing confirmed construct validity and internal consistency. Harman's single-factor test indicated that the first factor explained 32.7% of the variance (below the 50% threshold), suggesting no substantial common method bias.

SPSS 26.0 was used for descriptive statistics, Pearson correlation analysis, and hierarchical multiple regression to test the main and interaction effects.

This study relies on perceptual survey data to capture users' evaluations of the TCRS. While appropriate for examining behavioral and attitudinal dimensions, this approach does not incorporate objective system-level metrics (e.g., processing time or activity logs). In addition, institutional constraints associated with digitalization—such as organizational inertia, policy rigidity, and resistance to change (i.e., institutional traps)—were not explicitly modeled. These limitations should be addressed in future research to provide a more comprehensive understanding of system effectiveness.

RESULTS

A total of 450 valid responses were collected from faculty and staff at five vocational colleges in Tangshan. The sample was gender-balanced, with 47.6% male and 52.4% female participants. The majority of respondents were teaching faculty (50.9%), while administrative staff constituted 26.0% of the sample.

Table 1. Demographic profile of respondents (n = 450).

Demographic variable	Category	Frequency (n)	Percentage (%)
Gender	Male	214	47.6
	Female	236	52.4
Professional role	Teaching faculty	229	50.9
	Administrative staff	117	26.0
	IT support staff	61	13.6
	Other	43	9.6
Affiliated institution	Tangshan Labor Technician College	101	22.4
	Hebei Energy College of Vocational and Technology	92	20.4
	Tangshan Industrial Vocational and Technical College	97	21.6
	Tangshan Vocational and Technical College	88	19.6
	Tangshan Vocational College of Science and Technology	72	16.0

The survey respondents demonstrated gender balance, with 52.4% female and 47.6% male. The sample

effectively captured the primary TCRS user groups, with teaching faculty representing the largest proportion

(50.9%), followed by administrative staff (26.0%) and IT personnel (13.6%).

All constructs exhibited excellent psychometric properties: Cronbach's alpha values exceeded 0.89, and

all factor loadings were above 0.79, verifying high reliability and strong convergent validity. The specific items and statistics are presented in Table 2.

Table 2. Reliability and validity of measurement scales.

Construct	Item code	Measurement item	Factor loading	Cronbach's α
Information Management Quality (IMQ)	IMQ1	The TCRS platform is stable and easy to use.	0.845	0.912
	IMQ2	The data related to my teaching credits are accurate and up-to-date.	0.873	
	IMQ3	I can easily access and retrieve my credit records.	0.861	
	IMQ4	Adequate technical support and training for the system are available.	0.828	
	IMQ5	The system integrates well with other institutional platforms.	0.840	
Operational Process Optimization (OPO)	OPO1	The rules for earning and judging teaching credits are clear and applied to everyone the same way.	0.824	0.891
	OPO2	The steps to submit and get credits approved are clear and quick.	0.856	
	OPO3	The process steps and requirements are clearly communicated.	0.811	
	OPO4	The credit recognition process finishes on time.	0.832	
	OPO5	The system delivers clear feedback on the results of credit applications.	0.790	
TCRS Effectiveness	EFF1	The system ensures prompt processing of credit applications and approvals.	0.851	0.902
	EFF2	The system makes faculty's paperwork much easier.	0.836	
	EFF3	The credit assessment results are accurate.	0.820	
	EFF4	The system treats all faculty members fairly.	0.865	
	EFF5	I perceive the credit allocation results fair.	0.848	

All measurement tools in the study showed strong measurement quality. Internal reliability was very high, with Cronbach's alpha values all above 0.89. Convergent validity was also well-established, as all factor loadings surpassed 0.79, exceeding the commonly recommended benchmark of 0.7.

Descriptive statistics

Respondents held consistently favorable attitudes toward all three primary variables. Mean scores were high: IMQ = 4.40 (SD = 0.65), OPO = 4.35 (SD = 0.73), and TCRS Effectiveness = 4.32 (SD = 0.71). The low standard deviations indicate a consensus (Table 3).

Table 3. Descriptive statistics for key constructs.

Construct	Mean	Standard deviation (SD)	Interpretation
Information Management Quality (IMQ)	4.40	0.65	High level
Operational Process Optimization (OPO)	4.35	0.73	High level
TCRS Effectiveness	4.32	0.71	High level

Survey participants held positive views on all three core variables, as reflected in average scores exceeding 4.3 on a 5-point scale. Information Management Quality (IMQ) received the highest rating (Mean = 4.40, SD = 0.65), followed closely by Operational Process Optimization

(OPO; Mean = 4.35, SD = 0.73) and TCRS Effectiveness (Mean = 4.32, SD = 0.71). The low standard deviations (all below 0.75) further suggest a high level of agreement among respondents within the surveyed institutions.

Correlation analysis

All primary variables were positively and significantly correlated ($p < .01$) (Table 4).

As shown in Table 4, all key variables are significantly and positively correlated ($p < .01$). OPO and IMQ are highly correlated ($r = .787$), supporting the link between effective information management and efficient processes. Both OPO ($r = .730$) and IMQ ($r = .670$) also strongly correlate with TCRS effectiveness, confirming

the association of streamlined workflows and reliable information with perceived system performance. These results align with theory and establish a basis for subsequent regression analysis.

Regression analysis

Hierarchical multiple regression analysis fully supported all four hypotheses (Table 5).

Table 4. Correlation matrix.

Variable	1. OPO	2. IMQ	3. TCRS
1. OPO	1		
2. IMQ	.787**	1	
3. TCRS	.730**	.670**	1

Note.** $p < .01$ (two-tailed).

Table 5. Regression results.

Hypothesis	β	p-value	Outcome
H1: IMQ \rightarrow OPO	0.620	< 0.001	Supported
H2: OPO \rightarrow TCRS	0.730	< 0.001	Supported
H3: IMQ \rightarrow TCRS	0.670	< 0.001	Supported
H4: Interaction Effect (IMQ x OPO \rightarrow TCRS)	0.220	< 0.001	Supported

Hierarchical regression analysis: Testing the moderating effect (H_4)

Hierarchical regression confirms that both OPO ($\beta = 0.490/0.440$, $p < 0.001$) and IMQ ($\beta = 0.360/0.380$, $p < 0.001$) are significant positive predictors of TCRS

effectiveness. The positive interaction (IMQ \times OPO: $\beta = 0.220$, $p < 0.05$; $\Delta R^2 = 0.026$, $p < 0.05$) indicates that OPO strengthens the effect of IMQ. The model explains 67.3% of the variance, demonstrating synergy between process optimization and information management.

Table 6. Results of hierarchical regression for the moderating effect.

Model	Predictors	β	t	R ²	ΔR^2
1	OPO	0.730***	20.84	0.533	
2	OPO IMQ	0.490*** 0.360***	11.62 8.54	0.647	0.114***
3	OPO IMQ IMQ x OPO	0.440*** 0.380*** 0.220*	10.42 8.97 5.31	0.673	0.026*

** $p < .001$.

DISCUSSION AND CONCLUSION

This study provides strong empirical evidence for the technology-process interplay in shaping TCRS

effectiveness, confirming IMQ and OPO are critical with distinct and synergistic roles. High-quality information supports efficient, accurate system operation, while optimized processes establish procedural fairness

perceptions-critically, the two interact to amplify overall effectiveness, meaning technology and workflow are interdependent elements of successful administrative systems.

1. The impact of IMQ on OPO

Hypothesis 1 (H1) was strongly supported ($\beta = 0.620$, $p < .001$). Superior IMQ (system reliability, data accuracy, user support) is a foundational enabler for streamlined processes: trustworthy, accessible information reduces friction, clarifies steps and enables coherent workflow design. This reflects the socio-technical principle that information systems actively shape and are shaped by organizational operational routines.

2. The impact of OPO on TCRS effectiveness

Hypothesis 2 (H2) was also confirmed ($\beta = 0.730$, $p < .001$). Well-designed, transparent, consistent procedures directly enhance TCRS effectiveness: clear approval steps reduce errors, accelerate processing and foster fairness perceptions, aligning with process management literature that standardization reduces variability and improves outcomes. In vocational colleges, this translates to less administrative burden, greater transparency and stronger institutional trust.

3. The direct impact of IMQ on TCRS effectiveness

Hypothesis 3 (H3) was supported ($\beta = 0.670$, $p < .001$). IMQ directly contributes to system effectiveness: accurate, up-to-date, retrievable credit information builds credibility, supports sound decision-making and minimizes disputes. This reinforces the Information Systems Success Model's enduring relevance in vocational education digital governance, reminding that digital transformation investments must prioritize underlying information quality, not just technology.

4. The synergistic effect: OPO as a moderator

The most significant finding is strong support for H4 ($\beta = 0.220$, $p < .001$): OPO multiplies IMQ's effect on TCRS effectiveness. High IMQ's positive impact is substantially stronger with optimized processes—practically, a sophisticated digital platform delivers maximum ROI when embedded in a user-centric workflow, while poor processes can stifle even the best technology. This synergy highlights the need for a coordinated, holistic approach to system improvement.

The findings demonstrate that technological and process-

related elements are interdependent in shaping system effectiveness. The discussion provides a rigorous interpretation of the results, underscoring that technological solutions alone are insufficient without concurrent process optimization. This supports a socio-technical perspective, suggesting that sustainable improvements in administrative systems require the alignment of digital infrastructure with well-designed organizational processes.

Implications

Theoretical implications

This study moves beyond isolated analysis of technology or process, demonstrating IMQ-OPO synergy to propose a synthesized digital governance model where system effectiveness stems from the dynamic interplay of data, technology and workflow design—enriching theoretical research on vocational education digital governance.

Practical implications

The findings mandate coordinated improvement for vocational college administrators: isolated platform or workflow upgrades yield limited returns. Success requires a dual, concurrent strategy: (1) systematically enhancing information precision, accessibility and reliability; (2) deliberately streamlining procedures for consistency and transparency. This integrated approach engineers not just efficiency, but the perceived fairness critical for institutional legitimacy and trust.

Limitations and future research

This study has two key limitations: first, data from Tangshan vocational colleges limit generalizability to other institutions/cultural contexts; second, reliance on self-reported perceptual data cannot capture the full organizational reality, despite large-scale reliability and the elimination of serious common method bias.

This study did not explicitly analyze the influence of demographic characteristics on response patterns. Future research may consider examining potential differences across respondent groups (e.g., gender, professional role, and institutional affiliation) to further validate the robustness of the findings.

RECOMMENDATION

Based on IMQ-OPO synergy, three concrete reform recommendations for vocational colleges focus on integrating quality processes and information management:

1. Train for System Integration: Extend training beyond basic software use—faculty/staff must understand how timely, accurate submissions impact system efficiency/fairness, and IT teams need training in administrative realities to ensure technology supports daily work.

2. Build an Integrated, Transparent Platform: Invest in a unified cloud-based platform for the entire credit workflow (application to feedback) to eliminate data silos and manual work. Design for transparency: make approval criteria visible and maintain an immutable audit log to build trust.

3. Foster Collaboration and Benchmarking: Avoid isolated system development—collaborate with peers to standardize data formats/process definitions, and establish a shared framework to benchmark key metrics (processing time, error rates, fairness perceptions) using de-identified data to facilitate improvement across the sector.

Institutions should also gather and use objective system data like processing time, error rates, and activity logs for ongoing performance monitoring and evidence-based improvement.

Future research

This research provides the foundation for multiple studies. First, a longitudinal study should evaluate the associations' durability and long-term impacts. Second, future research should include objective performance indicators such as system processing time, transaction records, and user activity logs to strengthen perceptual survey data and findings. Third, qualitative methods, like in-depth interviews, can reveal the mechanisms that link information management quality (IMQ) with organizational process improvement. Finally, the model should be replicated across multiple institutional contexts to assess generalizability and discover boundary factors like corporate culture and digital maturity.

ACKNOWLEDGEMENTS

The authors would like to extend their heartfelt gratitude to the administrators and staff of the vocational colleges in Tangshan, Hebei Province, for their valuable participation and assistance in data gathering.

Funding

This study received no external support.

Conflicts of interest

The authors state that there are no conflicts of interest

related to the publication of this paper.

Ethical approval

This study was conducted in conformity with ethical research guidelines. Participation was voluntary, and all respondents provided informed consent prior to data collection. All replies were anonymised and used only for academic research reasons.

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Citation: Li, T., Buaduang, R., and Rattanapun, S. (2026). The influence of information management quality and process optimization efficiency on the effectiveness of teacher credit recognition systems in vocational colleges in Hebei, China. *African Educational Research Journal*, 14(2), 345-353.
