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THE IMPACT OF DIGITAL TRANSFORMATION ON ORGANIZATIONAL PERFORMANCE AND OPERATIONAL RISKS IN BANKING SECTOR

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ABSTRACT

This study examines the impact of digital transformation (DT) on organizational performance and operational risks in the banking sector. Internal factors analyzed include communication, comprehension of DT, operational technology readiness, process complexity, risk monitoring, and operational risk training, while external factors encompass regulatory compliance, digital experience, budget constraints, and cyber resilience. Using fuzzy-set qualitative comparative analysis (fsQCA) on survey data from 100 Indonesian banking professionals, the findings highlight the critical role of risk monitoring and operational technology readiness among internal factors, and cyber resilience and budget allocation among external factors. The interplay of these elements, such as combining risk monitoring with cyber resilience, is key to optimizing performance and mitigating risks. This study provides actionable insights for practitioners, policymakers, and scholars, emphasizing the alignment of internal capabilities with external demands. It highlights the importance of streamlined processes, cybersecurity frameworks, and supportive regulations for sustainable DT. While limited by sample size and subjective data, the research identifies opportunities for future studies, including cross-sectoral analyses and the use of objective performance metrics

Introduction

Digital transformation (DT) has become a critical driver of business performance, particularly in the banking sector (Porfírio et al., 2024). The adoption of technology in banking is unavoidable, reshaping socio-economic landscapes and contributing to advancements within the context of the Fourth and Fifth Industrial Revolutions (Dąbrowska et al., 2022).

Existing research on DT predominantly focuses on macro-level analyses at the firm or industry level, exploring topics such as internationalization (Feliciano-Cestero et al., 2023), higher education (Wang et al., 2023), (Ata et al., 2022;) (Liu et al., 2023) (Peng & Tao, 2022), sustainability and digital disruption (Nyagadza, 2022), labor share (Chen et al., 2022), the

dynamic processes of DT in asset-intensive organizations (Buck et al., 2023), and ESG performance (Y. Li et al., 2024). Despite this extensive coverage, research on the perceptions of DT's impact in the banking sector remains limited (Joel et al., 2024), particularly concerning the factors influencing organizational performance and their implications for operational risk.

Technological advancements inherent to DT also heighten operational risks in banking, introducing vulnerabilities such as system failures, process inefficiencies, and security threats (Uddin et al., 2023). Overinvestment in cyber technology, or "excess digitalization," can destabilize banks by increasing operational risks (Uddin et al., 2020). While digitalization drives faster processes and business growth, it also raises the likelihood of disruptions, incurring economic costs for both banks and consumers. Technology's inherent vulnerabilities, including exposure to cybercrime and software failures, render even a single risk event potentially catastrophic (Uddin et al., 2023).

Existing studies largely overlook industry-specific, micro-level analyses of DT in banking. This study seeks to bridge this gap by examining the interplay between internal and external factors shaping DT outcomes in the Indonesian banking sector, focusing on their influence on organizational performance and operational risk.

This research focuses on addressing the following question: How do internal and external factors in banking intersect to impact the outcomes of digital transformation, particularly in enhancing organizational performance and mitigating operational risk?

The study aims to examine and identify the internal factors in banking institutions that predominantly influence DT outcomes and to explore the external factors that significantly affect DT outcomes in the banking sector.

Literature Review

Digitization and Digital Transformation

The term "digitization" refers to the translation of analogue or physical information into digital formats, whereas "digitalisation" refers to the change of industries, business models, and procedures (Diener & Špaček, 2021). Digitization has prompted both direct and indirect changes in the banking industry in recent decades (Rezaei et al., 2024) ; Shcherbatykh et al., 2021). Individuals and organizations must face and adapt to the huge process of change that digital transformation represents (Vey et al., 2017).

This technique requires the use of digital technology to create new business processes, corporate cultures, operational techniques, consumer experiences, and offerings, or change old ones to react to changing company and market demands (Hess et al., 2016; Nadkarni & Prügl, 2021; Parviainen et al., 2017). A comprehensive analysis of the impact of digitalization in the banking sector revealed its influence on customers, financial institutions, and external service providers.

In the banking sector, digital transformation represents a pervasive problem (Diener & Špaček, 2021). Following the digitization phase, which involved an integration of traditional IT hardware and software into their operations banks began to develop what is known as internet finance (Zuo et al., 2021). However, Banks are integrating and incorporating digital transformation into their everyday operations in a big way because of the recent rise of Fintechs, which have revolutionized initial coin offers, crowdfunding, and loans (Bollaert et al., 2021). it

has shown to have a significant influence on how banks are integrating and incorporating digital transformation into their daily operations (Breidbach et al., 2020; (Diener & Špaček, 2021); Tantri, 2021).

Digital transformation pertains to the alterations that digital technology effectuates in a company's business model, culture, goods, procedures, and organizational structures (de Miguel et al., 2022; Hess et al., 2016; Khan & Mujitaba, 2023; Mergel et al., 2019; Nadkarni & Prügl, 2021; Chen et al., 2022; Ogunrinde, 2022; Troilo, 2023). To achieve successful outcomes, it necessitates the active involvement of skilled employees and executives, combined with effective utilization of technological resources (Nadkarni & Prügl, 2021). DT frequently brings about substantial changes to fundamental business operations (Karimi & Walter, 2015) and requires a comprehensive adjustment of organizational resources and capabilities to align with shifting strategic objectives (Cha et al., 2015; Yeow et al., 2018).

The part on literature review consists of research that examines; a) Internal factors of digital transformation; b) external factors of digital transformations; and c) internal and external factors associated with outcomes.

Internal Organizational Factors of Digital Transformation

Understanding DT is a critical internal factor for successful implementation. Research indicates that employees often have limited comprehension of DT, leading to resistance or reluctance during initial phases of transformation (Diener & Špaček, 2021). Enhanced process transparency associated with DT can also create employee apprehensions, particularly regarding its implications for job security.

Challenges in communication between IT personnel and non-IT staff have also been identified as barriers to DT. Rodrigues et al. (2023) highlight issues such as ambiguous business objectives, inadequate conversations, and limited articulation of organizational needs, which hinder effective collaboration. (Joel et al., 2024) suggest that specific variable configurations, such as robust communication strategies and operational readiness, enable banks to navigate these challenges effectively.

Operational technology readiness is another pivotal factor in DT implementation. Poorly integrated systems or outdated technology increase risks, including system failures and cybersecurity threats, emphasizing the need for strategic alignment between technology infrastructure and organizational goals (Zuo et al., 2021). Additionally, process complexity and legacy system integration exacerbate risks, necessitating simplified workflows and seamless technological transitions to optimize outcomes (Baskerville et al., 2010; Zuo et al., 2021).

Risk monitoring and operational risk training are crucial to managing potential disruptions. Studies have shown that effective monitoring and targeted training enhance resilience against digital threats and improve organizational performance (Khattak et al., 2023; Bahl et al., 2022). For instance, operational risk training equips employees with specialized skills, enabling them to minimize losses and adapt to evolving challenges.

Based on these principles, the first proposition is formulated as follows:

P1: Internal factors such as communication, understanding of DT, operational technology readiness, process complexity, risk monitoring, and operational risk training significantly influence the perceived impacts of DT in banking.

External Factors of Digital Transformation

Regulatory compliance significantly influences DT in the banking sector. Stringent regulations can slow digitalization efforts, while variations in customer trust and digital adoption complicate technology integration (Diener & Špaček, 2021). Customer expectations also play a critical role. Research by Filotto et al. (2021) found that economic benefits, user-friendliness, and structural assurance mechanisms such as transparent security policies drive customer loyalty to digital platforms.

The dynamic role of customers in DT is further underscored by Lähteenmäki et al. (2022), who emphasize the shift toward customer-driven ecosystems. Modern consumers demand seamless, efficient digital services, compelling banks to integrate traditional assets with digital capabilities to meet these expectations (Pousttchi & Dehnert, 2018).

Budgetary constraints present another challenge in DT. Effective resource management, combined with robust communication and employee understanding, mitigates the risks associated with limited financial resources (Rodrigues et al., 2023). Cyber resilience, as highlighted by Zuo et al. (2021), is essential for maintaining operational continuity amid disruptions, underscoring the need for robust cybersecurity frameworks.

Building on these concepts, the second proposition is presented as follows:

P2: External factors, including regulations and compliance, people's digital experience, budget, and cyber resilience, shape the perceived outcomes of DT in banking.

DT significantly reshapes organizational operations, enhancing efficiency, fostering innovation, and improving overall performance. Emerging technologies, such as artificial intelligence (AI), machine learning (ML), and cloud computing, enhance operational efficiency, minimize costs, and facilitate swift decision-making (Niemand et al., 2021; Bharadwaj et al., 2013). However, DT also introduces operational risks, such as cybersecurity breaches and system failures, particularly during the integration of legacy systems with modern technologies (Huang et al., 2017).

Khattak et al. (2023) emphasize the importance of proactive and flexible risk management strategies, including real-time monitoring systems and disaster recovery plans, to mitigate these risks. Comprehensive risk management frameworks combining technological and governance strategies further enhance the success of DT initiatives (Deloitte, 2021).

Research Methods

Building on the research model proposed by (Joel et al., 2024), this research explores the critical factors influencing digital transformation (DT) within the Indonesian banking sector, emphasizing its effects on organizational performance and operational risk. The study employs a comprehensive framework that integrates both internal and external factors to analyze the outcomes of DT.

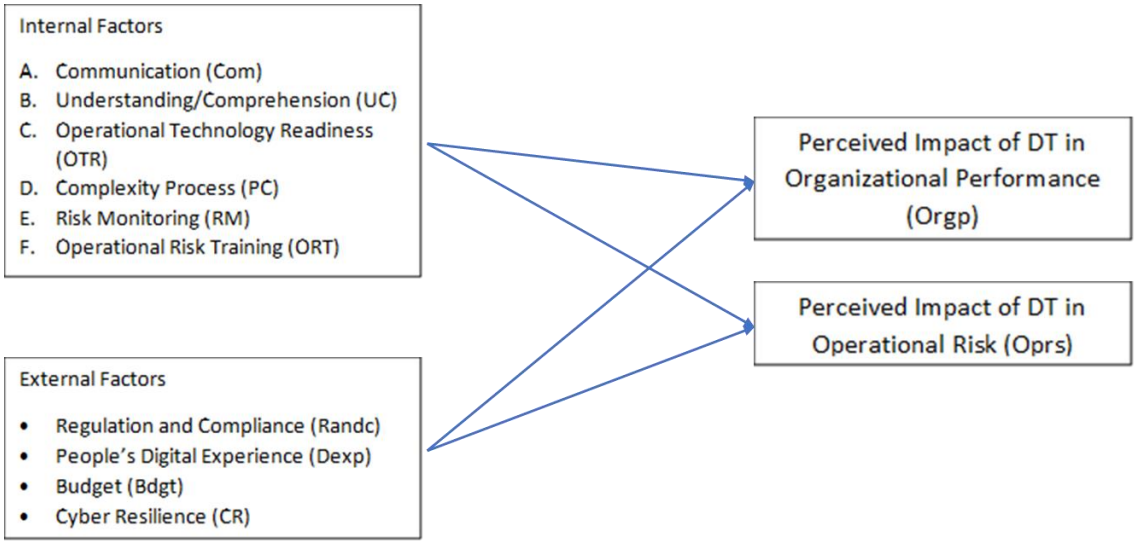

Figure 1 Research Model (António Porfírio et al., 2024)

Database and Methodology

The survey was conducted among banking employees, both current and former, with a total of 100 respondents who possess sufficient tenure, knowledge, and experience in implementing digital transformation (DT) within the banking sector. In terms of tenure, 82% of respondents have over five years of work experience in the banking industry, while 18% have between 1 and 5 years of experience. From the perspective of job positions, 63% of respondents hold executive and senior management roles, 23% are in middle management, and 11% occupy entry-level positions. Regarding work divisions, 48% of respondents are from retail, branch operations, finance and accounting, and credit management divisions, which are directly impacted by banking operations. Additionally, 32% work in risk management and compliance, 12% in information technology (IT), and 8% in marketing and people development.

Data was collected through completed questionnaires, with 30 questions distributed to each participant. Despite a small number of unanswered responses, these were accounted for using the mode to ensure validity. All responses received were deemed acceptable after validation.

A structured questionnaire was designed to evaluate the proposed internal and external factors. Key aspects of the questionnaire include:

Internal Factors: Questions addressing communication levels, employee understanding and comprehension, operational technology readiness, complexity of processes, risk monitoring, and operational risk training.

External Factors: Questions related to regulation and compliance, people's digital experience, budgetary considerations, and cyber resilience.

Analytical Method

This research employed Fuzzy-Set Qualitative Comparative Analysis (fsQCA) to identify and evaluate the typologies of internal and external elements influencing DT outcomes. fsQCA was utilized to determine the consolidated configurations of these factors, providing insights into their impact on organizational performance and operational risk.

Result and Discussion

This study utilized fuzzy-set qualitative comparative analysis (fsQCA) to examine data obtained from a survey of banking staff in Indonesia. The initial data collection used ordinal Likert scales to capture qualitative insights for each variable contributing to the dependent constructs. Each variable was represented by multiple survey items, requiring additional steps to prepare the data for analysis. This approach aligns with best practices in fsQCA to extract meaningful qualitative patterns (Dus, 2023; Ragin, 2008).

To transform the data from ordinal to interval scales, descriptive statistical methods were applied. Specifically, the mean value of responses for each variable was calculated, consolidating the individual survey items into a single composite measure. This transformation facilitated the calibration of data into fuzzy-set membership values, enabling the identification of qualitative patterns and configurations within the dataset (Dus, 2023). Calibration is critical in fsQCA to define thresholds for "fully in," "fully out," and "maximum ambiguity" based on the data distribution (Schneider & Wagemann, 2012).

The calibration process adopted thresholds to represent set membership accurately, with the intermediate threshold for "maximum ambiguity" assigned as either 2.5 or 3.5, depending on whether the data distribution indicated bias toward non-membership or membership (Dus, 2023). This process ensures consistency in membership allocation, which is vital for meaningful fsQCA results.

This systematic approach bridges qualitative and quantitative methodologies, enabling the evaluation of how internal and external factors influence digital transformation outcomes in the banking sector. The synthesized data and corresponding calibrations are presented in Table 1.1, providing a comprehensive framework for understanding the interdependencies among variables.

Table 1 Constructs and variables

Independent Variables			
Aggregate	Conditions	Scale/Value	Calibration
Internal Factors	fs_Com	1 – 5 mean value = 4.01	1 = fully out 3.5 = maximum ambiguity 5 = fully in
	fs_UC	1 – 5 mean value = 4.1	1 = fully out 3.5 = maximum ambiguity 5 = fully in
	fs_OTR	1 – 5 mean value = 3.975	1 = fully out 3.5 = maximum ambiguity 5 = fully in
	fs_PC	1 – 5 mean value = 2.75	1 = fully out 2.5 = maximum ambiguity 5 = fully in
	fs_RM	1 – 5 mean value = 4.02	1 = fully out 3.5 = maximum ambiguity 5 = fully in
	fs_ORT	1 – 5 mean value = 4.12	1 = fully out 3.5 = maximum ambiguity

			5 = fully in
External Factors	fs_Randc	1 – 5	1 = fully out
		mean value = 2.75	2.5 = maximum ambiguity
			5 = fully in
	fs_Dexp	1 – 5	1 = fully out
		mean value = 2.75	2.5 = maximum ambiguity
			5 = fully in
	fs_Bdgt	1 – 5	1 = fully out
		mean value = 4.02	3.5 = maximum ambiguity
			5 = fully in
	fs_CR	1 – 5	1 = fully out
		mean value = 3.41	3.5 = maximum ambiguity
			5 = fully in
Dependent Variables			
Organizational Performance	fs_Orgp	1 – 5	1 = fully out
		mean value = 3.285	3.5 = maximum ambiguity
			5 = fully in
Operational Risk	fs_Oprs	1 – 5	1 = fully out
		mean value = 3.495	3.5 = maximum ambiguity
			5 = fully in

Likert scales were used to capture survey responses to statements such as "strongly agree," "neither agree nor disagree," and "strongly disagree." These responses were calibrated into fuzzy-set membership categories, where "strongly agree" represented "fully in", "neither agree nor disagree" corresponded to "maximum ambiguity", and "strongly disagree" indicated "fully out" (Dus, 2023).

To refine the calibration process, the threshold for maximum ambiguity was assigned as either 2.5 or 3.5, depending on the data distribution. This adjustment addressed biases observed in the dataset, such as tendencies toward non-membership at lower values or membership at higher values (Dus, 2023). This approach ensures that the calibration aligns with the underlying patterns in the responses, facilitating a robust fuzzy-set qualitative comparative analysis (fsQCA).

We consider creating two sub-sets of each dependent variable based on the model, the first outcome is Organizational Performance, and the second outcome is Operational Risk. Then, each outcome variable will be tested by Internal Factors and External Factor, sequentially.

The model considered were the following:

Model 1: Internal Factor.

Model 1a: fsOrgp = f(fsCom, fsUC, fsOTR, fsPC, fsRM, fsORT).

Model 1b: fsOprs = f(fsCom, fsUC, fsOTR, fsPC, fsRM, fsORT).

The internal factors reflect critical elements of organizational readiness, encompassing communication effectiveness, employee comprehension of digital transformation, technological preparedness, operational complexity, risk monitoring practices, and training programs for risk management. These variables align with prior research emphasizing the importance of internal dynamics in digital transformation success (Porfírio et al., 2024; (Diener & Špaček, 2021); Schneider & Wagemann, 2012).

Model 2: External Factor.

Model 2a: fsOrgp = f(fsRandc, fsDexp, fsBdgt, fsCR).
Model 2b: fsOprs = f(fsRandc, fsDexp, fsBdgt, fsCR).

External factors reflect external pressures and resources critical to digital transformation. These include regulatory frameworks, customer digital experience, budget limitations, and the organization's resilience against cyber threats. These variables are supported by existing literature that highlights the external environment's significant role in shaping digital transformation outcomes (Buck et al., 2023; (Uddin et al., 2023); Ragin, 2008).

For each model, fsQCA was conducted to derive intermediate solutions, producing the results and configurations presented in Table 2 – Table 5. These solutions reveal the pathways and combinations of internal and external factors that contribute to Organizational Performance and Operational Risk.

The methodological rigor of fsQCA allows for the identification of multiple equifinal configurations, where different combinations of factors can lead to similar outcomes. This approach is particularly valuable in understanding complex phenomena, such as digital transformation, where causal relationships are often interdependent and nonlinear (Ragin, 2008; Schneider & Wagemann, 2012).

Table 2 Model 1a Fsorgp = f(fsCom, fsUC, fsOTR, fsPC, fsRM, fsORT)

	Config 1	Config 2	Config 3	Config 4	Config 5
fs_Com	◦	◦	◦	●	●
fs_UC	◦	◦	◦	●	●
fs_OTR		◦	◦	●	●
fs_PC	◦			◦	◦
fs_RM	●	●	◦		●
fs_ORT	◦	◦	●	◦	
Raw Coverage	0.42	0.43	0.41	0.38	0.36
Unique Coverage	0.01	0.02	0.05	0.05	0.03
Consistency	0.96	0.95	0.97	0.96	0.98
Solution Coverage	0.60				
Solution Consistency	0.94				

Note: ● = presence of a condition, ○ = absence of a condition, ● = presence of a core condition, and ○ absence of a core condition.

Configuration 1: Risk monitoring is present significantly in this configuration so that results (outcome) can be achieved as the impact of digital transformation. Meanwhile, communication, understanding/comprehension, complexity process, and operational risk training are not a barrier to achieving organizational performance.

Configuration 2: Similar with previous configuration, risk monitoring as the transformation of digital in firm makes a significant contribution to outcomes. In addition, the absence of operational technology readiness is not become a problem to the organizational performance as long risk monitoring is present significantly.
Configuration 3: When communication, understanding/comprehension, operational technology readiness and risk monitoring is absent as the variables of digital transformation, the significant presence of operational risk training can produce outcomes of the organizational performance.
Configuration 4: The combination of effective communication, understanding/comprehension, and operational technology readiness will have a positive impact on organizational performance. This combination tends to produce adequate organizational performance as the impact of digital transformation, without the condition of complex process and the training regarding risk management.
Configuration 5: As with previous combination and risk management as the variables for digital transformation, these variables promote decent organizational performance when the complexity process is not an issue to achieve satisfactory organizational performance.

Table 3 Model 1b Fsoprs = f(fsCom, fsUC, fsOTR, fsPC, fsRM, fsORT)

	Config 1	Config 2	Config 3	Config 4	Config 5	Config 6	Config 7
fs_Com	◦	◦	◦	●	◦	◦	◦
fs_UC	◦	◦	◦	●	◦	◦	◦
fs_OTR		◦	◦	●	◦	◦	◦
fs_PC	◦			◦	◦	◦	◦
fs_RM	●	●	◦		●		◦
fs_ORT	◦	◦	●	◦		◦	
Raw Coverage	0.48	0.49	0.45	0.41	0.41	0.66	0.68
Unique Coverage	0.01	0.01	-	0.01	0.04	0.00	-
Consistency	0.99	0.96	0.97	0.94	0.98	0.82	0.83
Solution Coverage	0.79						
Solution Consistency	0.81						

Note: ● = presence of a condition, ○ = absence of a condition, ● = presence of a core condition, and ○ absence of a core condition.

Configuration 1: Risk monitoring is present significantly in this configuration so that results (outcome) can be achieved. Meanwhile, communication, understanding/comprehension, complexity process and operational risk training is not become a problem to reach the impact to digital transformation to operational risk.

Configuration 2: Similar with previous configuration, risk monitoring as the transformation of digital in firm makes a significant contribution to outcomes. In addition, the absence of operational technology readiness is not become a problem to the operational risk as long risk monitoring is present significantly.
Configuration 3: When communication, understanding/comprehension, operational technology readiness and risk monitoring is absence as the variables of digital transformation, the significant presence of operational risk training can produce outcomes of operational risk.
Configuration 4: The combination of adequate communication, understanding/comprehension, operational technology readiness will impact the decent operational risk. This combination tends to produce adequate operational risk as the impact of digital transformation, without the condition of complex process and the training regarding risk management.
Configuration 5: As with previous combination and complexity process as for digital transformation, these variables tend not to promote decent operational risk when the risk monitoring is become significant issue to achieve satisfactory operational risk management.
Configuration 6: The absence of proper communication, understanding/comprehension of digital transformation, operational technology readiness, complex process for firm and operational risk training might not an issue to achieve decent operational risk management.
Configuration 7: Similar with configuration 6, the absence of proper communication, understanding/comprehension of digital transformation, operational technology readiness, complex process for firm and risk monitoring might not an issue to achieve decent operational risk management.

Table 4 Model 1a Fsorgp = f(fsRandc, fsDexp, fsBdgt, fsCR)

	Config 1	Config 2
fs_Randc	◦	●
fs_Dexp	◦	●
fs_Bdgt		
fs_CR	●	●
Raw Coverage	0.73	0.59
Unique Coverage	0.28	0.15
Consistency	0.97	0.97
Solution Coverage	0.88	
Solution Consistency	0.97	

Note: ● = presence of a condition, ○ = absence of a condition, ● = presence of a core condition, and ○ absence of a core condition.

Configuration 1: Decent cyber resilience in organizations that undergo digital transformation to reduce cyber risk is a challenge in achieving desired organizational performance. Meanwhile, this significant impact of Cyber Resilience may dissemble the impact of regulation and compliance regarding digital transformation and digital experience that is already inherent as a part of digital transformation.
Configuration 2: Combination of external factors such as Regulation Compliance, Digital Experience and Cyber Resilience also have significant impact to digital transformation for promoting the organizational performance.

Table 5 Model 1a Fsoprs = f(fsRandc, fsDexp, fsBdgt, fsCR)

	Config 1	Config 2	Config 3
fs_Randc	◦	◦	●
fs_Dexp	◦	◦	●
fs_Bdgt	◦		
fs_CR		●	●
Raw Coverage	0.74	0.76	0.58
Unique Coverage	0.08	0.10	0.09
Consistency	0.79	0.91	0.85
Solution Coverage	0.93		
Solution Consistency	0.75		

Note: ● = presence of a condition, ○ = absence of a condition, ● = presence of a core condition, and ○ absence of a core condition.

Configuration 1: When a firm's budget is not viewed as a barrier to digital transformation, regulation and compliance, as well as digital experience, are not obstacles to achieving the appropriate operational risk level.
Configuration 2: Decent Cyber Resilience in firms which become a part digital transformation to prevent cyber risk tend to be an issue to promote decent operational risk. Meanwhile, this significant impact of Cyber Resilience may trigger the impact of regulation and compliance regarding digital transformation and digital experience to not tend to be an issue for operational risk.
Configuration 3: Combination of external factors such as Regulation Compliance, Digital Experience and Cyber Resilience also have significant impact to decent operational risk.

Risk monitoring (fs_RM) emerges as a crucial variable across configurations for both organizational performance (fs_Orgp) and operational risk (fs_Oprs). This aligns with findings from Khattak et al. (2023), which emphasize rigorous monitoring and risk management training as essential for mitigating digital transformation (DT) risks and improving operational resilience by having decent operational risk.

Configurations where fs_RM is combined with communication or operational technology readiness showcase pathways for achieving performance, reflecting Zuo et al. (2021)'s assertion on technology readiness and its foundational role.

Models demonstrate that process simplicity contributes positively to outcomes, corroborating Zuo et al. (2021)'s observations on process complexity being a barrier to DT efficiency. The results underscore the need for streamlined workflows during DT implementation.

While communication and understanding were not always essential in certain configurations, their significance in others aligns with findings by (Diener & Špaček, 2021), which stress clear communication strategies in ensuring employees comprehend and support DT objectives.

Cyber resilience frequently dominates as a critical factor for both performance and operational risk outcomes. This finding supports Rodrigues et al. (2023) and (Uddin et al., 2023), who highlight cybersecurity's role in safeguarding systems against operational disruptions and cyber threats. The configurations illustrate that cyber resilience sometimes compensates for weaker regulatory compliance or digital experience, reflecting the interplay between these external factors.

Adequate budget allocation appears vital in configurations for operational risk, aligning with Bharadwaj et al. (2013), which emphasizes financial investment in digital tools as a driver for organizational adaptability and risk mitigation.

Configurations with a combination of internal fs_RM and fs_OTR and external fs_CR factors achieving high consistency levels reflect Niemand et al. (2021)'s proposition that strategic alignment between organizational resources and external challenges ensures DT success.

Variability in solution coverage indicates that no singular factor ensures success; instead, a balance and strategic pairing of variables (cyber resilience with risk monitoring) are essential.

Conclusion

The study highlights the essential interplay between internal and external factors for the successful implementation of digital transformation (DT). The findings reveal that DT success requires a strategic combination of both internal and external elements rather than reliance on a single factor.

Among internal factors, Risk Monitoring (fs_RM) and Operational Technology Readiness (fs_OTR) are identified as key contributors to DT success, with Operational Risk Training (fs_ORT) playing a supportive role in mitigating operational risks. Externally, Cyber Resilience (fs_CR) is the most critical factor for safeguarding digital systems, while Budget (fs_Bdgt) enables investments in technological infrastructure and training.

The optimal pathways for enhancing organizational performance involve combining internal factors, such as risk monitoring, with external factors, such as cyber resilience, or pairing technology readiness with adequate budget allocations.

This research provides actionable insights for scholars, practitioners, and policymakers. It underscores the symbiotic relationship between internal factors (e.g., risk monitoring,

technology readiness) and external factors (e.g., cyber resilience, regulation), integrating perspectives from risk management and DT literature. Additionally, the study advocates for clear, supportive regulations to reduce barriers to DT, incentivize cybersecurity investments, and ensure compliance. Finally, it emphasizes the need for government-industry collaboration to develop a robust digital ecosystem with advanced infrastructure and workforce training.

Limitations and Future Research

The findings of this study are derived from a limited, non-randomized sample of Indonesian banking employees, which restricts the extent to which the results can be generalized. The restricted sample size and data availability may not capture the diverse scenarios and complexities of digital transformation (DT) across various organizational contexts.

Organizational performance, a key outcome variable, remains challenging to define and measure, with inherent ambiguities despite efforts to refine its metrics. Future research should develop more precise and applicable performance indicators.

The study excludes critical variables such as leadership, organizational culture, and market competition, which are likely to influence DT outcomes. Including these factors could provide a more comprehensive analysis of DT's impact.

Reliance on employee perceptions introduces subjectivity, potentially affecting result robustness. Future studies should incorporate objective performance data from operational activities to reduce bias.

Lastly, expanding research to other industries and conducting cross-sectoral comparisons could reveal both universal and sector-specific factors, offering broader insights into the dynamics of successful digital transformation.

Bibliography

António Porfírio, J., Augusto Felício, J., & Carrilho, T. (2024). Factors affecting digital transformation in banking. Journal of Business Research, 171. https://doi.org/10.1016/j.jbusres.2023.114393

António Porfírio, J., Carrilho, T., Fernandes, G., & José, E. (2024). The impact of digital transformation on business performance in the banking sector. Journal of Business Research, 158, 113562.

Ata, S., Arslan, H. M., Baydaş, A., & Pazvant, E. (2022). The effect of social media influencers' credibility on consumer's purchase intentions through attitude toward advertisement. ESIC Market, 53(1), e280. https://doi.org/10.7200/esicm.53.280

Bahl, S., et al. (2022). Specialized training in operational risk and its impact on banking performance. Journal of Risk Management, 18(3), 240–258.

Baskerville, R., et al. (2010). Managing IT complexity in organizational alignment. MIS Quarterly Executive, 9(1), 20–35.

Bharadwaj, A., et al. (2013). Digital business strategies: Toward a next-generation framework. MIS Quarterly, 37(2), 471–482.

Bollaert, H., et al. (2021). FinTech and banking integration in digital transformation. Financial Services Review, 48, 230–247.

Breidbach, C. F., et al. (2020). Digital disruption in financial services. Journal of Service Research, 23(3), 220–240.

Buck, C., Clarke, J., Torres de Oliveira, R., Desouza, K. C., & Maroufkhani, P. (2023). Digital transformation in asset-intensive organisations: The light and the dark side. Journal of Innovation and Knowledge, 8(2). https://doi.org/10.1016/j.jik.2023.100335

Cha, J., et al. (2015). Managing IT complexity for competitive advantage. Information Systems Journal, 25(3), 227–263.

Chen, N., Sun, D., & Chen, J. (2022). Digital transformation, labour share, and industrial heterogeneity. Journal of Innovation and Knowledge, 7(2). https://doi.org/10.1016/j.jik.2022.100173

Dąbrowska, J., Almpanopoulou, A., Brem, A., Chesbrough, H., Cucino, V., Di Minin, A., Giones, F., Hakala, H., Marullo, C., Mention, A. L., Mortara, L., Nørskov, S., Nylund, P. A., Oddo, C. M., Radziwon, A., & Ritala, P. (2022). Digital transformation, for better or worse: a critical multi-level research agenda. R and D Management, 52(5), 930–954. https://doi.org/10.1111/radm.12531

de Miguel, M., et al. (2022). Understanding digital transformation in organizational processes. Information Systems Journal, 32(3), 412–431.

Deloitte. (2021). Navigating operational risks in digital transformation: Strategies for success. Deloitte Insights.

Diener, F., & Špaček, M. (2021). Digital transformation in banking: A managerial perspective on barriers to change. Sustainability (Switzerland), 13(4), 1–26. https://doi.org/10.3390/su13042032

Dus, A. (2023). Calibration and fuzzy-set qualitative comparative analysis

Filotto, U., et al. (2021). Drivers of customer loyalty in digital banking. International Journal of Bank Marketing, 39(4), 523–540.

Feliciano-Cestero, M. M., Ameen, N., Kotabe, M., Paul, J., & Signoret, M. (2023). Is digital transformation threatened? A systematic literature review of the factors influencing firms' digital transformation and internationalization. Journal of Business Research, 157. https://doi.org/10.1016/j.jbusres.2022.113546

Hanafizadeh, P., & Amin, M. (2023). Digitalization in banking: Opportunities, challenges, and lessons learned. International Journal of Bank Marketing, 41(2), 294–314. https://doi.org/10.1108/IJBM-11-2022-0459

Hess, T., Matt, C., Benlian, A., & Wiesböck, F. (2016). Options for formulating a digital transformation strategy. MIS Quarterly Executive, 15(2), 123–139.

Huang, J., et al. (2017). Digital risk management in the era of cloud computing. Journal of Risk Management, 34(5), 315–333.

Karimi, J., & Walter, Z. (2015). The role of dynamic capabilities in responding to digital disruption. MIS Quarterly, 39(1), 115–142.

Khan, S., & Mujitaba, G. (2023). Cultural adaptation and digital transformation in emerging economies. Journal of Global Information Technology Management, 26(1), 34–50.

Khattak, M. A., Ali, M., Azmi, W., & Rizvi, S. A. R. (2023). Digital transformation, diversification and stability: What do we know about banks? Economic Analysis and Policy, 78, 122–132. https://doi.org/10.1016/j.eap.2023.03.004

Li, S., Gao, L., Han, C., Gupta, B., Alhalabi, W., & Almakdi, S. (2023). Exploring the effect of digital transformation on Firms' innovation performance. Journal of Innovation and Knowledge, 8(1). https://doi.org/10.1016/j.jik.2023.100317

Li, Y., Zheng, Y., Li, X., & Mu, Z. (2024). The impact of digital transformation on ESG performance. International Review of Economics & Finance, 96, 103686. https://doi.org/10.1016/j.iref.2024.103686

Liu, M., Li, C., Wang, S., & Li, Q. (2023). Digital transformation, risk-taking, and innovation: Evidence from data on listed enterprises in China. Journal of Innovation and Knowledge, 8(1). https://doi.org/10.1016/j.jik.2023.100332

Mergel, I., et al. (2019). Digital transformation in public administration. Public Administration Review, 79(5), 715–725.

Nadkarni, S., & Prügl, R. (2021). Digital transformation: A resource-based perspective. Journal of Business Research, 124, 10–20.

Niemand, T., et al. (2021). Strategic vision and entrepreneurial orientation in DT. European Management Journal, 39(2), 270–285.

Nyagadza, B. (2022). Sustainable digital transformation for ambidextrous digital firms: systematic literature review, meta-analysis and agenda for future research directions. Sustainable Technology and Entrepreneurship, 1(3). https://doi.org/10.1016/j.stae.2022.100020

Ogunrinde, O. (2022). Exploring the link between digitalization and organizational agility. Strategic Change, 31(6), 529–543.

Parviainen, P., Tihinen, M., Kääriäinen, J., & Teppola, S. (2017). Tackling the digitalization challenge: How to benefit from digitalization in practice. International Journal of Information Systems and Project Management, 5(1), 63–77. https://doi.org/10.12821/ijispm050104

Peng, Y., & Tao, C. (2022). Can digital transformation promote enterprise performance? — From the perspective of public policy and innovation. Journal of Innovation and Knowledge, 7(3). https://doi.org/10.1016/j.jik.2022.100198

Porfírio, J. A., Felício, J. A., & Carrilho, T. (2024). Factors affecting digital transformation in banking. Journal of Business Research, 171. https://doi.org/10.1016/j.jbusres.2023.114393

Pousttchi, K., & Dehnert, M. (2018). Customer-driven ecosystems in digital banking. Electronic Markets, 28(3), 215–228.

Ragin, C. C. (2008). Redesigning Social Inquiry: Fuzzy Sets and Beyond. University of Chicago Press.

Rodrigues, L. F., et al. (2023). Budgetary constraints and communication in DT. Journal of Financial Technology, 14(2), 101–115.

Schneider, C. Q., & Wagemann, C. (2012). Set-Theoretic Methods for the Social Sciences: A Guide to Qualitative Comparative Analysis (QCA). Cambridge University Press.

Troilo, M. (2023). Leveraging technology for sustainable organizational performance. Technology & Innovation, 25(1), 52–68.

Uddin, M. H., Mollah, S., & Ali, M. H. (2020). Does cyber tech spending matter for bank stability? International Review of Financial Analysis, 72. https://doi.org/10.1016/j.irfa.2020.101587

Uddin, M. H., Mollah, S., Islam, N., & Ali, M. H. (2023). Does digital transformation matter for operational risk exposure? Technological Forecasting and Social Change, 197. https://doi.org/10.1016/j.techfore.2023.122919

Vey, K., Fandel-Meyer, T., Zipp, J. S., & Schneider, C. (2017). Learning & Development in Times of Digital Transformation: Facilitating a Culture of Change and Innovation. International Journal of Advanced Corporate Learning (IJAC), 10(1), 22. https://doi.org/10.3991/ijac.v10i1.6334

Wang, K., Li, B., Tian, T., Zakuan, N., & Rani, P. (2023). Evaluate the drivers for digital transformation in higher education institutions in the era of industry 4.0 based on decision-making method. Journal of Innovation and Knowledge, 8(3). https://doi.org/10.1016/j.jik.2023.100364

Westerman, G., et al. (2014). Leading digital: Turning technology into business transformation. Harvard Business Review Press.

Yeow, A., Soh, C., & Hansen, R. (2018). Aligning with digital transformation strategies. MIS Quarterly Executive, 17(1), 1–17.

Zuo, L., Strauss, J., & Zuo, L. (2021). The digitalization transformation of commercial banks and its impact on sustainable efficiency improvements through investment in science and technology. Sustainability (Switzerland), 13(19). https://doi.org/10.3390/su131911028