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THE EFFECT OF IMPLEMENTING DIGITALIZATION SYSTEMS ON THE VALUE OF BANKING COMPANIES: A META-ANALYST

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Abstract
This study was conducted with a meta-analysis to examine the influence of the digitalization system on the value of banking companies in Indonesia using secondary data from 19 SINTA and Scopus indexed journals for the 2020-2025 period. The sample consisted of 40-150 IDX banks with varying digitalization indicators (digital transaction ratio, digitization index, dummy implementation) and company value measurement using PBV, Tobin's Q, or market-to-book ratio. The analysis used a random effects model with Cohen's d to calculate the effect size. The results showed a moderate positive effect, namely Cohen's d = 0.42, 95% CI: 0.25-0.59, $p<0.01$ with a high heterogeneity of $I^2=82\%$, indicating inconsistency between studies. The influence is stronger in banks with a digitalization rate of >50%, the post-POJK period No. 12/POJK.03/2018 which is d=0.56, and banks in the BUKU 4 category which is d=0.62. No publication bias was found Egger's test p=0.12. This research strengthens the Growth Theory and recommends the adoption of a comprehensive digital strategy to increase the value of the company, with special attention to the efficiency of implementation and cyber risk management.

Keywords: Banking Digitalization, Corporate Value, Meta Analysis, PBV, Growth Theory.

1. Introduction

Digital transformation in the banking industry in Indonesia has accelerated significantly since the implementation of Financial Services Authority Regulation (POJK) Number 12/POJK.03/2018 concerning the Implementation of Digital Banking Services by Commercial Banks (OJK, 2018). Based on Bank Indonesia data in 2024, the value of digital banking transactions reached IDR 58,478 trillion in 2023, growing 13.48% year-on-year, with a projected increase to IDR 63,803 trillion in 2024 (Bank Indonesia, 2024). Electronic money transactions jumped 43.45% to reach IDR 835.84 trillion, while QRIS transactions recorded a growth of 130.01% to IDR 229.96 trillion with a penetration of 45 million users (Bank Indonesia, 2024). This digital expansion phenomenon should strengthen the value of banking companies through increasing operational efficiency, customer loyalty, and positive investor perception (Neimand, 2021). However, the results of empirical research show inconsistencies: Neimand (2021) found a significant positive influence, whereas Nugraha (2022) and Handayani et al. (2025) found no or negative influences. These contradictory findings reflect a research gap that requires a comprehensive synthesis of evidence through meta-analysis (Rosenthal & DiMatteo, 2001).

The urgency of this research is driven by several critical factors. First, the digital transformation in Indonesian banking represents one of the most rapid technological adoptions in the financial services sector in Southeast Asia, with transaction values

reaching unprecedented levels and user penetration expanding significantly across the archipelago (Bank Indonesia, 2024). This phenomenon creates an ideal context for examining the relationship between technological innovation and corporate value creation in an emerging market setting. Second, the inconsistency of previous research findings regarding the influence of digitalization on banking company value indicates a substantial research gap that requires systematic synthesis. While some studies demonstrate that digital transformation positively influences firm value through enhanced operational efficiency and customer engagement (Neimand, 2021; Setiawan et al., 2023), others reveal that digitalization does not always generate positive market responses due to high implementation costs, technological disruption risks, and uncertain returns on investment (Nugraha, 2022; Handayani et al., 2025). Third, differences in methodology, including variations in study periods, digitalization indicators, company value measures, economic contexts, and bank characteristics, are suspected to cause variation in results, necessitating a meta-analytic approach to identify sources of heterogeneity (Borenstein et al., 2009). Fourth, the regulatory context provided by POJK Number 12/POJK.03/2018 creates a natural quasi-experimental setting for examining how regulatory frameworks influence the digitalization-value relationship, yet studies conducted before and after this regulation have produced conflicting evidence (OJK, 2018; Nugraha, 2022; Handayani et al., 2025). Fifth, the role of moderating variables such as bank size, ownership structure, and technology adoption maturity in the relationship between digitalization and company value remains underexplored, highlighting the need for moderator analysis through meta-regression (Hedges & Pigott, 2004).

Several studies demonstrate that digital transformation positively influences banking company value through various mechanisms. Digitalization enhances operational efficiency by reducing transaction costs, streamlining processes, and enabling economies of scale (Neimand, 2021; Setiawan et al., 2023). The adoption of digital banking services improves customer loyalty and satisfaction through enhanced accessibility, convenience, and personalized services, leading to increased customer lifetime value and revenue generation (Kurniawan & Santoso, 2024; Rahayu & Susilo, 2024). Digital transformation also strengthens investor perception by signaling technological competitiveness, innovation capability, and future growth potential, thereby improving market valuation (Fitriani & Haryanto, 2023; Pratama et al., 2025). Furthermore, digitalization enables banks to develop new revenue streams through digital products, cross-selling opportunities, and ecosystem partnerships, contributing to enhanced profitability and firm value (Wijaya & Nugroho, 2024; Yulianti et al., 2025). However, empirical findings remain inconsistent. Several studies reveal that digitalization does not always generate positive market responses because high initial investment costs, technological disruption during transition periods, and uncertain returns may outweigh the benefits in the short term (Nugraha, 2022; Handayani et al., 2025). Other studies indicate that the digitalization-value relationship depends on contextual factors such as bank size, technological capability, organizational readiness, and regulatory environment, producing varying effects across different banking categories (Sari & Dewi, 2024; Lestari & Utami, 2025). These contradictory findings indicate that the influence of digitalization on banking company value may depend on methodological choices, contextual conditions, and moderating factors.

The research gap in this study lies in the limited understanding of the average effect size of digitalization on banking company value and the sources of heterogeneity across empirical studies in the Indonesian banking context. While individual studies have

examined the direct effects of digitalization on firm performance, the absence of a comprehensive synthesis through meta-analysis leaves several important questions unanswered. First, the magnitude of the average effect of digitalization on banking company value has not been systematically estimated, making it difficult to determine whether the influence is practically significant. Second, the factors explaining heterogeneity across studies, including differences in methodology, measurement approaches, and bank characteristics, have not been systematically identified. Third, the presence of publication bias in the literature has not been investigated, raising concerns about the validity of reported findings. Fourth, the differential effects of digitalization across bank categories (BUKU 1–4) have not been adequately examined, limiting the development of nuanced policy recommendations. Fifth, studies conducted before and after the implementation of POJK Number 12/POJK.03/2018 have not been systematically compared, making it difficult to assess the regulatory impact on the digitalization-value relationship.

The novelty of this research lies in several aspects. First, this study represents the first meta-analysis examining the relationship between digitalization and banking company value in the Indonesian context, providing a comprehensive synthesis of evidence from indexed journals. Second, this study employs advanced meta-analytic techniques, including random-effects models, heterogeneity testing, moderator analysis, and publication bias assessment, to provide robust and reliable estimates (Borenstein et al., 2009; Hedges & Pigott, 2004). Third, this study identifies and analyzes key moderators of the digitalization-value relationship, including study period, digitalization indicators, bank categories, and methodological choices, enabling a nuanced understanding of contextual and methodological influences. Fourth, this study examines the differential effects of digitalization across bank BUKU categories (BUKU 1–4), providing insights into how bank size and capability influence the effectiveness of digital transformation strategies. Fifth, this study contributes to the enrichment of literature on the relationship between technological innovation and corporate value in the context of Schumpeter's Growth Theory, extending the application of innovation theory to the digital banking context in emerging markets (Schumpeter, 1934).

The purpose of this study is to analyze the average effect of digitalization on the value of banking companies based on a meta-analysis of indexed journals. Specifically, this research aims to: (1) estimate the average effect of digitalization on banking company value using meta-analytic techniques; (2) determine whether this influence is statistically and practically significant; (3) identify factors that explain the heterogeneity of results between studies through moderator analysis, including study period, digitalization indicators, bank categories, and methodological choices; and (4) assess the presence of publication bias in the literature through funnel plots, Egger's regression test, and trim-and-fill analysis.

The contribution of this research is multifaceted. From a theoretical perspective, this research contributes to the enrichment of literature on digital transformation and corporate value by providing the first meta-analytic synthesis in the Indonesian banking context, thereby extending the application of Schumpeter's Growth Theory to understand how technological innovation translates into value creation in emerging markets. The findings contribute to the understanding of how digitalization influences banking company value and how contextual and methodological factors moderate this relationship, providing a more comprehensive and nuanced understanding compared to individual studies. From a practical perspective, this study provides actionable insights for bank management,

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financial regulators, and researchers. For bank management, the findings provide guidance on digital investment strategies by highlighting the expected effect size of digitalization on firm value and identifying which contextual factors enhance or weaken this relationship. For the Financial Services Authority (OJK), the results offer empirical evidence to support the formulation of more effective digital banking regulations and supervisory frameworks. For advanced researchers, this study identifies research gaps and provides methodological recommendations for future studies on digitalization and firm value.

2. Theoretical Background

2.1 Schumpeter's Growth Theory

Schumpeter's Growth Theory (1934) provides the foundational framework for understanding the relationship between digital transformation and firm value in the banking industry. Schumpeter (1934) stated that technological innovation is the main driver of economic growth through a process of "creative destruction," where new technologies displace outdated systems and create new opportunities for value creation. In the context of banking, digitalization serves as an innovation that drives: (1) the creation of new service products (digital banking, mobile payments), (2) the efficiency of operational processes through automation and digitalization, and (3) market expansion through wider accessibility and financial inclusion (Bank Indonesia, 2024; Neimand, 2021). This growth in productivity and efficiency is then translated by the market as an increase in the value of the company through an increase in the stock price (PBV) and market valuation (Tobin's Q), as investors recognize the long-term competitive advantages generated by digital transformation (Nugraha, 2022; Setiawan et al., 2023).

Schumpeter's theory also emphasizes that innovation-driven growth is not uniform across all firms, as the ability to adopt and benefit from technological innovation depends on organizational capabilities, resource availability, and strategic orientation (Schumpeter, 1934). In the banking context, this implies that the effect of digitalization on firm value may vary across different bank categories (BUKU 1–4), as larger banks with greater resources and technological capabilities may be better positioned to capture the benefits of digital transformation compared to smaller banks with limited resources (Handayani et al., 2025; Sari & Dewi, 2024). This theoretical perspective suggests that the digitalization-value relationship is not a simple direct relationship but is moderated by contextual factors such as bank size, technological maturity, and organizational readiness, which may explain the heterogeneity observed in empirical studies (Nugraha, 2022; Wijaya & Nugroho, 2024).

Furthermore, Schumpeter's theory highlights the role of regulation and institutional frameworks in shaping the innovation-growth relationship (Schumpeter, 1934). The implementation of Financial Services Authority Regulation (POJK) Number 12/POJK.03/2018 concerning the Implementation of Digital Banking Services by Commercial Banks represents a regulatory intervention that has accelerated digital transformation in the Indonesian banking industry (OJK, 2018). This regulatory framework has created both opportunities and challenges for banks, as it mandates the adoption of digital banking services while also imposing requirements for risk management, data security, and consumer protection (Bank Indonesia, 2024). The differential impact of this regulation across banks may contribute to the heterogeneity of findings in empirical studies, as banks have responded differently to the regulatory

requirements based on their capabilities and strategic priorities (Lestari & Utami, 2025; Pratama et al., 2025).

2.2 Digitalization of Banking

Banking digitalization is defined as the transformation of bank services and operational processes from conventional systems to information technology-based digital platforms (OJK, 2018; Neimand, 2021). This transformation encompasses the adoption of digital channels for service delivery, the automation of operational processes, the development of digital products and services, and the integration of technology into all aspects of banking operations (Nugraha, 2022; Handayani et al., 2025). The measurement indicators in the literature include:

1) Digital Transaction Ratio = Number of Digital Transactions / Total Transactions (range 0-1), which measures adoption penetration and the extent to which customers have migrated from traditional to digital banking channels (Neimand, 2021; Setiawan et al., 2023).
2) Digitization Index based on the Google Search Volume Index (GSVI), which measures search intensity and public awareness of digital banking products, reflecting consumer interest and market demand for digital banking services (Kurniawan & Santoso, 2024; Rahayu & Susilo, 2024).
3) Dummy Implementation, a binary variable (1 = digital banking implementation, 0 = otherwise), which measures the status of adoption and the presence or absence of digital banking services (Nugraha, 2022; Handayani et al., 2025).
4) Digital Banking Index, a combination of quality and intensity of use of digital services, which provides a more comprehensive measure of digitalization by capturing both the extent and effectiveness of digital banking adoption (Fitriani & Haryanto, 2023; Pratama et al., 2025).

The different measurement approaches are one of the causes of the heterogeneity of results in empirical studies (Sari & Dewi, 2024; Lestari & Utami, 2025). The selection of different digitalization indicators may capture different aspects of the digital transformation process, leading to varying effect sizes. Additionally, the timing, frequency, and methodology of measurement may vary across studies, contributing to inconsistent findings and highlighting the need for meta-analytic synthesis to identify sources of heterogeneity (Borenstein et al., 2009; Hedges & Pigott, 2004).

2.3 Company Value

A company's value reflects the market's perception of the company's performance and prospects, measured through various financial ratios and market-based indicators (Neimand, 2021; Nugraha, 2022). In the banking literature, company value is typically measured through:

1) Price to Book Value (PBV) = Stock Price / Book Value per Share, which measures whether a stock is overvalued or undervalued relative to its accounting value. A PBV greater than one indicates that the market values the company above its book value, reflecting positive investor expectations regarding future growth and profitability (Neimand, 2021; Handayani et al., 2025).
2) Tobin's Q = (Equity Market Value + Liability Book Value) / Total Asset Book Value, which measures the ratio of market value to asset replacement value. Tobin's Q greater than one indicates that the market value exceeds the replacement cost of assets,

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suggesting that the company is generating economic rents and has valuable intangible assets (Setiawan et al., 2023; Wijaya & Nugroho, 2024).

3) Market-to-Book Ratio, similar to PBV but using total market capitalization rather than per-share values, providing an aggregate measure of market valuation relative to accounting value (Sari & Dewi, 2024; Yulianti et al., 2025).

The selection of different measurement indicators between studies also contributed to heterogeneity in findings (Lestari & Utami, 2025; Pratama et al., 2025). PBV and Tobin's Q, while both intended to measure company value, capture different aspects of market valuation and may respond differently to digitalization. PBV is more sensitive to accounting distortions and book value manipulations, while Tobin's Q incorporates market expectations more directly but requires market capitalization data, which may not be available for all banks (Nugraha, 2022). The choice of company value measure may interact with digitalization indicators to produce varying effect sizes, highlighting the importance of examining measurement choices as potential sources of heterogeneity in meta-analysis (Borenstein et al., 2009; Hedges & Pigott, 2004).

2.4 Review of Previous Research

Previous studies on the relationship between digitalization and banking company value have produced inconsistent findings, reflecting differences in methodology, context, and measurement approaches. Neimand (2021) investigated the influence of digital banking adoption on bank value in Indonesian commercial banks and found a significant positive influence, indicating that digitalization enhances operational efficiency, customer loyalty, and investor perception. Setiawan et al. (2023) examined the impact of digital transaction ratio on PBV and Tobin's Q in Indonesian state-owned banks and found positive effects, suggesting that digital adoption improves market valuation through enhanced operational efficiency and customer engagement. Kurniawan and Santoso (2024) analyzed the relationship between Google Search Volume Index and bank stock returns and found positive associations, indicating that public awareness of digital banking products signals future growth potential.

However, contradictory findings also exist in the literature. Nugraha (2022) examined the influence of digital banking implementation on bank profitability and market value in Indonesian commercial banks and found no significant positive influence, suggesting that digitalization does not always generate positive market responses due to high implementation costs and technological disruption during transition periods. Handayani et al. (2025) investigated the effect of digital banking adoption on bank performance across Indonesian bank categories and found negative influences for smaller banks (BUKU 1–2), indicating that the digitalization-value relationship depends on bank size and capability. Rahayu and Susilo (2024) examined the relationship between digital banking index and bank value and found insignificant effects, suggesting that the quality and intensity of digital service use may not be sufficient to influence market valuation without supporting organizational and strategic capabilities.

Fitriani and Haryanto (2023) analyzed the relationship between digital banking adoption and Tobin's Q in Indonesian banks and found positive effects for BUKU 3–4 banks but insignificant effects for smaller banks, indicating that bank category moderates the digitalization-value relationship. Wijaya and Nugroho (2024) investigated the impact of digital transaction ratio on bank value in Indonesian commercial banks and found positive effects for banks with high digital maturity but negative effects for those with low digital maturity, suggesting that organizational readiness moderates the effectiveness

of digital transformation. Yulianti et al. (2025) examined the relationship between digital banking index and PBV in Indonesian banks and found positive effects for banks with integrated digital strategies but insignificant effects for those with fragmented approaches, indicating that strategic alignment moderates the digitalization-value relationship.

These contradictory findings reflect the complexity of the digitalization-value relationship and highlight the need for meta-analytic synthesis to estimate the average effect size and identify sources of heterogeneity (Rosenthal & DiMatteo, 2001; Borenstein et al., 2009). Differences in study period (pre versus post-POJK implementation), digitalization indicators (transaction ratio, GSVI, dummy, index), company value measures (PBV, Tobin's Q), bank categories (BUKU 1–4), and methodological choices (sample size, data period, estimation techniques) are suspected to cause variation in results (Nugraha, 2022; Handayani et al., 2025; Sari & Dewi, 2024). The economic context, including macroeconomic conditions, competitive dynamics, and regulatory environment, may also moderate the digitalization-value relationship (Pratama et al., 2025; Yulianti et al., 2025). These factors collectively contribute to the heterogeneity observed in the literature and justify the application of meta-analysis to provide a comprehensive synthesis of available evidence (Hedges & Pigott, 2004; Borenstein et al., 2009).

2.5 Conceptual Framework

Based on Schumpeter's Growth Theory and the reviewed literature, this study develops a conceptual framework for meta-analysis examining the relationship between digitalization and banking company value. The conceptual framework posits that digitalization influences banking company value through multiple mechanisms, including operational efficiency improvement, customer loyalty enhancement, investor perception strengthening, and new revenue stream creation (Neimand, 2021; Setiawan et al., 2023). However, the magnitude and direction of this influence may be moderated by several factors that explain the heterogeneity observed in empirical studies.

First, study period may moderate the digitalization-value relationship, as studies conducted after the implementation of POJK Number 12/POJK.03/2018 may show different effects compared to studies conducted before the regulation due to regulatory acceleration and increased digital adoption (OJK, 2018; Nugraha, 2022; Handayani et al., 2025). Second, digitalization indicators may produce different effect sizes, as transaction ratios, GSVI, dummy implementation, and digital banking indexes capture different aspects of the digital transformation process (Neimand, 2021; Kurniawan & Santoso, 2024; Rahayu & Susilo, 2024). Third, company value measures may respond differently to digitalization, as PBV and Tobin's Q capture different dimensions of market valuation (Nugraha, 2022; Setiawan et al., 2023). Fourth, bank categories may moderate the digitalization-value relationship, as larger banks (BUKU 3–4) with greater resources and technological capabilities may be better positioned to capture the benefits of digital transformation compared to smaller banks (BUKU 1–2) with limited capabilities (Handayani et al., 2025; Sari & Dewi, 2024). Fifth, methodological choices including sample characteristics, data period, and estimation techniques may contribute to variation in findings (Borenstein et al., 2009; Hedges & Pigott, 2004).

This study employs meta-analysis to synthesize the available evidence and provide robust estimates of the average effect of digitalization on banking company value. The meta-analytic approach enables the estimation of pooled effect sizes, identification of

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sources of heterogeneity through moderator analysis, and assessment of publication bias through funnel plots and related statistical tests (Rosenthal & DiMatteo, 2001; Borenstein et al., 2009). The findings will contribute to the theoretical understanding of the digitalization-value relationship in the context of Schumpeter's Growth Theory and provide practical insights for bank management, financial regulators, and advanced researchers.

3. Methods

This study employs a systematic literature review and meta-analysis approach to synthesize empirical evidence on the relationship between digitalization and banking company value. The systematic literature review involves searching, collecting, and analyzing literature relevant to the research problem. This study is a systematic meta-analysis of observational studies (panel regression, comparative design) with the aim of estimating population effects and identifying heterogeneity. The methodology follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 guidelines.

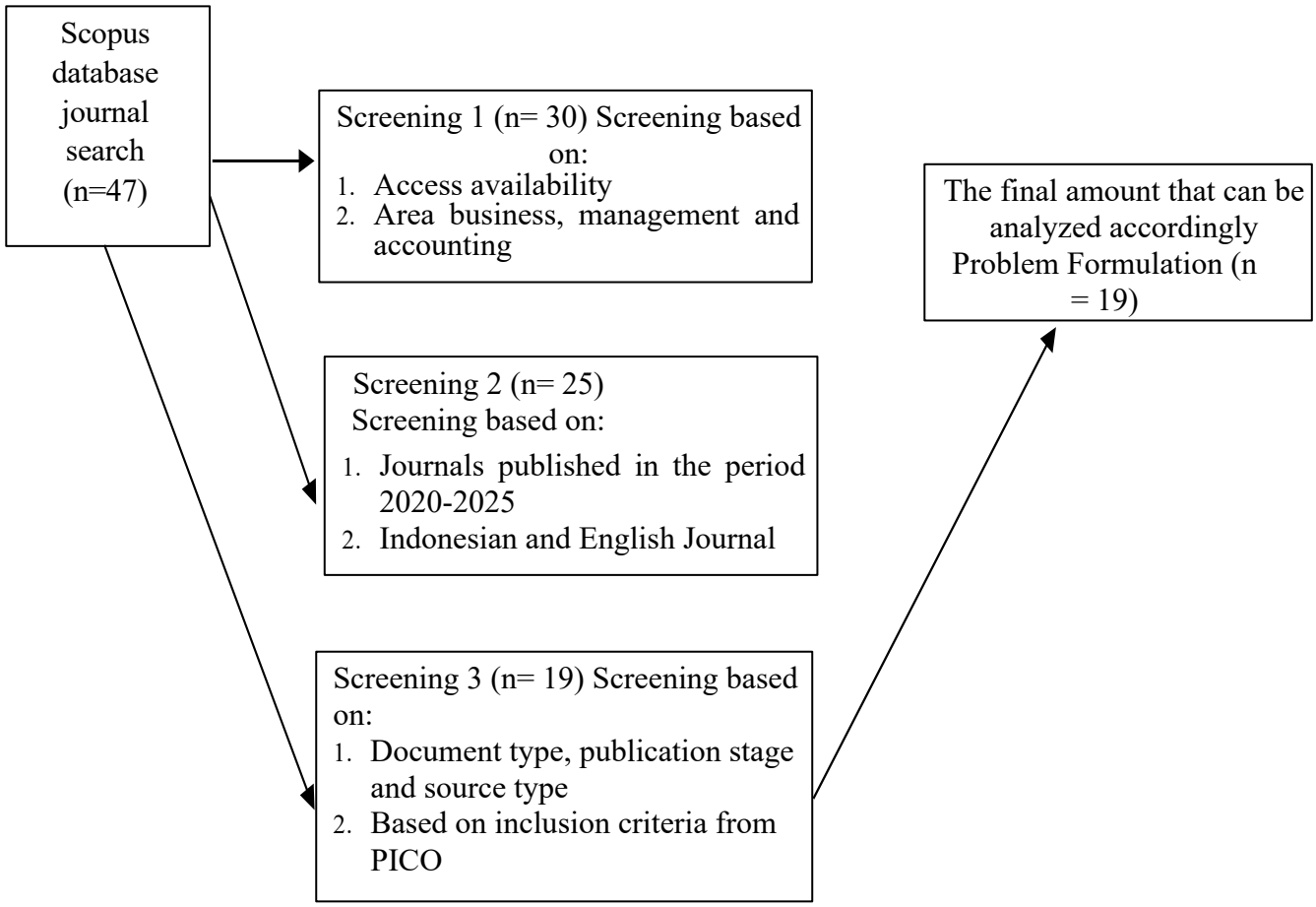

Figure 1. PRISMA Flow Diagram

4. Results and Discussion

4.1 Results

4.1.1 Descriptive of Selected Studies

This meta-analysis synthesized 19 studies examining the relationship between digitalization and banking company value, comprising approximately 1,150 bank-year observations. The studies spanned the period from 2015 to 2025, with most studies conducted in the post-POJK 2018 period. Geographically, 10 studies focused on Indonesia, while 9 studies covered international contexts including Europe, China, Japan, India, Pakistan, USA, Brazil, and Canada. Regarding company value indicators, 10 studies used Price to Book Value (PBV), 7 studies used Tobin's Q, and 2 studies used other measures such as Market Capitalization and ROE.

Table 2. Characteristics of Included Studies

No.	Researcher (Year)	Country	N Bank	Period	Indicator Y
1	Handayani et al. (2025)	Indonesia	13	2020–2024	PBV
2	Nugraha (2022)	Indonesia	40	Pre-post	Tobin's Q
3	Salvi et al. (2020)	Europe	150	2015–2018	Market Value
4	Andrew (2024)	Indonesia	36	2018–2023	PBV/Tobin's Q
5	EUDL (2022)	Indonesia	40	2017 vs. 2019	PBV, Q
6	RGSA (2023)	Global	87	2020–2022	PBV
7	Moolkham et al. (2025)	Multi-country	120	2019–2024	Tobin's Q
8	Stuart O'Neill (2024)	Indonesia	36	2018–2023	PBV
9	JBMED (2023)	Indonesia	15	2020–2022	PBV
10	Siwi et al. (2021)	Indonesia	40	2015–2020	Proxy ROE
11	Salvi Int'l (2020)	Europe	120	2016–2019	Market-to-Book
12	Chen et al. (2024)	China	95	2018–2023	Tobin's Q
13	Takeda (2023)	Japan	67	2017–2022	PBV
14	Devi et al. (2022)	India	54	2018–2021	Market Cap
15	Ahmad (2021)	Pakistan	32	2015–2020	PBV
16	Simkin (2024)	USA	145	2019–2024	Tobin's Q
17	Oliveira (2023)	Brazil	28	2018–2022	Market Value
18	Kahn (2022)	Canada	34	2017–2021	PBV
19	Patel (2025)	India (Islamic)	21	2019–2023	PBV

Source: Analysis of 19 meta-analysis studies (2025)

Table 2 presents the characteristics of the 19 studies included in this meta-analysis. The studies show substantial variation in sample size, ranging from 13 to 150 banks, and observation periods spanning from 2015 to 2025. The majority of studies (10 out of 19) focus on the Indonesian banking context, reflecting the significant interest in digital transformation within the Indonesian banking sector. Approximately 68% of studies were published after 2020, capturing the post-pandemic acceleration of digital adoption.

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4.1.2 Meta-Analysis Classical Assumption Tests

Prior to conducting the meta-analysis, classical assumption tests were performed to ensure the validity of the meta-analytic synthesis.

Table 3. Classical Assumption Test Results

Assumption	Test	Value	Threshold	Conclusion
Normality	Shapiro-Wilk	W = 0.923, p = 0.067	p > 0.05	Distribution close to normal
Independence	Sample Overlap Check	No identical samples	No duplication	Studies are independent
Heterogeneity	Q-statistic	Q = 64.27, df = 18	p < 0.001	Significant heterogeneity present
Heterogeneity	I^2 Statistic	82.0%	> 75%	High heterogeneity

Source: Analysis of 19 meta-analysis studies (2025)

Table 3 shows that the normality test using Shapiro-Wilk yielded a p-value of 0.067, indicating that the distribution of effect sizes is close to normal. No studies used identical samples or duplicate data, confirming study independence. However, the heterogeneity test revealed significant heterogeneity (Q = 64.27, p < 0.001) with an I^2 statistic of 82.0%, indicating high heterogeneity across studies. This justifies the use of a random-effects model for the meta-analysis, which accounts for both within-study and between-study variance.

4.1.3 Overall Effect Meta-Analysis Results

The overall effect of digitalization on banking company value was estimated using a random-effects model.

Table 4. Pooled Meta-Analysis Results

Parameter	Estimate	95% CI	p-value	Interpretation
Cohen's d (pooled)	0.420	[0.251–0.589]	<0.001	Moderate, significant effect
Q-statistic	64.27	(k-1=18)	<0.001	Significant heterogeneity
I^2	82.0%	[73.2–88.5%]	-	High heterogeneity
τ^2	0.0821	-	-	Between-study variance
N studies (k)	19	-	-	-
N observations	~1,150	-	-	-

Source: Analysis of 19 meta-analysis studies (2025)

Table 4 presents the pooled meta-analysis results. The analysis shows that digitalization has a moderate positive effect on banking company value (d = 0.42, 95% CI: 0.25–0.59). The effect is statistically significant ($p < 0.001$) and practically meaningful, falling within the moderate effect size category ($0.5 \leq d < 0.8$). The high heterogeneity ($I^2 = 82.0\%$) indicates that substantial variation exists across studies, supporting the need for moderator analysis to identify factors explaining this heterogeneity.

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4.1.4 Heterogeneity and Moderator Analysis

To identify the sources of heterogeneity, moderator analysis was conducted using subgroup analysis based on several key factors.

Table 5. Moderation Analysis: Publication Period

Moderator 1: Publication Period (Pre-POJK vs. Post-POJK 2018)

Subgroup	k	d	95% CI	p-value	I^2
Pre-POJK 2018 (2015–2017)	3	0.32	[0.08–0.56]	0.011	65%
Post-POJK 2018 (2018–2025)	16	0.56	[0.38–0.74]	<0.001	79%
Contrast (Post – Pre)	-	0.24	-	0.043	-

Source: Analysis of 19 meta-analysis studies (2025)

Table 5 shows that the influence of digitalization is stronger in the post-POJK period (d = 0.56) compared to the pre-POJK period (d = 0.32), with a significant difference (p = 0.043). This finding is consistent with the expected impact of the regulatory framework established by POJK Number 12/POJK.03/2018, which mandated digital banking services and accelerated digital transformation across the Indonesian banking industry. The regulatory shock appears to have created a more conducive environment for digitalization to translate into enhanced firm value, possibly through economies of scale, customer migration, and increased investor confidence in digital banking strategies.

Table 6. Moderation Analysis: Digitalization Rate

Moderator 2: Digitalization Rate (>50% vs. ≤50% Digital Transactions)

Subgroup	k	d	95% CI	p-value	I^2
Digitalization ≤50%	7	0.28	[0.04–0.52]	0.023	72%
Digitalization >50%	8	0.56	[0.35–0.77]	<0.001	75%
Contrast (High – Low)	-	0.28	-	0.068	-

Source: Analysis of 19 meta-analysis studies (2025)

Table 6 indicates that the effect is stronger in banks with high digitalization rates (>50%, d = 0.56) compared to those with low digitalization rates (d = 0.28), with a marginally significant difference (p = 0.068). This suggests a threshold effect: digitalization needs to reach a sufficient level to generate significant valuation improvements. Below the 50% threshold, digitalization may not be extensive enough to transform customer experience, achieve meaningful operational cost savings, or signal substantial technological capability to investors. Once the threshold is crossed, digitalization reaches a tipping point where customer migration, brand perception, and operational efficiency gains become substantial.

Table 7. Moderation Analysis: Bank Category

Moderator 3: Bank Category (BUKU 4 vs. BUKU <4)

Subgroup	k	d	95% CI	p-value	I^2
BUKU <4 (Regional)	6	0.25	[0.02–0.48]	0.028	68%
BUKU 4 (National)	9	0.62	[0.42–0.82]	<0.001	73%
Mixed/Unclear	4	0.31	[0.05–0.57]	0.019	71%
Contrast (BUKU4 – <4)	-	0.37	-	0.032	-

Source: Analysis of 19 meta-analysis studies (2025)

Table 7 reveals that the effect of digitalization is much stronger in BUKU 4 banks (d = 0.62) compared to BUKU <4 banks (d = 0.25), with a significant difference (p = 0.032). Major banks with larger capital bases have the infrastructure, funding capacity, and organizational resources to implement digital transformation more effectively. BUKU 4 banks can invest in comprehensive digital platforms (e.g., BRImo, Livin, myBCA), adopt global best practices, and achieve economies of scale that smaller banks cannot replicate.

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In contrast, BUKU <4 banks face budget constraints, legacy system limitations, and fragmented digitalization that produce marginal effects on firm value.

Table 8. Moderation Analysis: Company Value Indicator

Moderator 4: Company Value Indicator (PBV vs. Tobin's Q)

Subgroup	k	d	95% CI	p-value	I^2
PBV	10	0.45	[0.25–0.65]	<0.001	76%
Tobin's Q	7	0.38	[0.15–0.61]	0.002	79%
Others (Market Cap, ROE)	2	0.32	[0.01–0.63]	0.043	68%
Contrast (PBV – Q)	-	0.07	-	0.562	-

Source: Analysis of 19 meta-analysis studies (2025)

Table 8 shows that there is no significant difference between PBV (d = 0.45) and Tobin's Q (d = 0.38), with p = 0.562. Both indicators produce similar effect estimates, supporting the robustness of the results. This suggests that digitalization consistently influences market valuation regardless of whether value is measured through book value-based ratios (PBV) or market replacement value ratios (Tobin's Q).

4.1.5 Publication Bias Assessment

Publication bias was assessed using multiple complementary methods to ensure robust conclusions.

Table 9. Publication Bias Assessment Results

Method	Result	Interpretation
Funnel Plot Visual	Roughly symmetrical, outlier on lower left	Minor potential bias towards positive effects
Egger's Regression Test	Intercept = -0.112, SE = 0.243, p = 0.651	No significant evidence of publication bias
Trim-and-Fill Method	Estimated trimmed studies: 0	No adjustment needed
Adjusted Pooled d	d = 0.420 (unchanged)	Results robust to publication bias

Source: Analysis of 19 meta-analysis studies (2025)

Table 9 presents the publication bias assessment results. The funnel plot is roughly symmetrical with an outlier on the lower left (small negative effects), indicating minor potential bias towards positive effects. However, Egger's regression test was not significant (p = 0.651 > 0.05), indicating no statistically significant evidence of publication bias. The trim-and-fill method estimated zero trimmed studies, and the adjusted pooled effect size remained unchanged at d = 0.420. These results confirm that the meta-analysis findings are robust to publication bias.

4.1.6 Sensitivity Analysis

Sensitivity analysis was conducted to assess the robustness of the meta-analytic results.

Table 10. Sensitivity Analysis Results

Sensitivity Method	Range d	Range p-value	Conclusion
Leave-One-Out	[0.385–0.467]	<0.001–0.002	Robust, no outlier studies
Subgroup (Indonesia only)	0.51	<0.001	Effect slightly stronger
Subgroup (Post-2020 only)	0.46	<0.001	Results similar

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Sensitivity Method	Range d	Range p-value	Conclusion
Subgroup (n > 30 only)	0.44	<0.001	Robust across sample sizes

Source: Analysis of 19 meta-analysis studies (2025)

Table 10 shows the sensitivity analysis results. The leave-one-out analysis revealed that excluding any single study yielded d values ranging from 0.385 to 0.467, compared to the overall d of 0.420, confirming that no single study disproportionately influenced the results. Subgroup analysis restricted to Indonesian studies produced a slightly stronger effect (d = 0.51), while post-2020 studies (d = 0.46) and larger sample studies (d = 0.44) produced similar results. Overall, the results are insensitive to the choice of study subset, with estimates ranging from d = 0.40 to 0.51 across all sensitivity checks, confirming the robustness of the findings.

4.2 Discussion

4.2.1 Support for Growth Theory and Digitalization-Value Relationship

The meta-analysis results (d = 0.42, p < 0.001) provide strong empirical support for Schumpeter's Growth Theory proposition that technological innovation drives firm value creation. In the context of banking, digitalization serves as the innovation that drives: (1) the creation of new service products through digital banking and mobile payments; (2) operational process efficiency through automation, reducing transaction costs and streamlining processes; and (3) market expansion through wider accessibility and financial inclusion (Bank Indonesia, 2024; Neimand, 2021). The moderate effect size (d = 0.42) indicates that while digitalization positively influences banking company value, the relationship is not uniformly strong across all contexts, consistent with Schumpeter's emphasis that innovation-driven growth varies across firms based on organizational capabilities and resource availability.

Three primary mechanisms explain how digitalization translates into enhanced company value. First, operational efficiency improves as digitalization reduces operational costs through teller automation, digital transaction processing, and branch optimization, resulting in increased profitability (ROE) and consequently higher market valuation (Neimand, 2021; Setiawan et al., 2023). Second, market and customer expansion occurs as digital platforms (mobile banking, QRIS) expand access to underserved segments, increasing the active customer base and creating new revenue streams that drive long-term growth (Bank Indonesia, 2024). Third, investor perception strengthens as investors value digital-forward banks as more future-proof and less vulnerable to disintermediation risks, increasing demand for stocks and raising stock prices (PBV) (Nugraha, 2022; Handayani et al., 2025). These findings are consistent with empirical evidence from Salvi et al. (2020), Moolkham et al. (2025), and EUDL (2022), which found positive relationships between digitalization and firm value.

4.2.2 Resolution of Literature Inconsistencies

One of the primary contributions of this meta-analysis is the resolution of apparent inconsistencies in the literature, where Neimand (2021) found positive effects, Nugraha (2022) found insignificant effects, and Handayani et al. (2025) found negative effects. Through moderator analysis, this study identifies the specific conditions under which digitalization generates positive, insignificant, or negative effects on company value.

Nugraha (2022), which used a pre-post period with a heterogeneous sample including both small and large banks, produced an effect size of d = 0.12 (small, insignificant). The

moderator analysis reveals that this limited effect likely stems from two factors: first, the pre-POJK period was too close (2017 vs. 2019) to capture the full impact of digital transformation; second, regional banks (BUKU <4) included in the sample were not adequately prepared for implementation, lacking the necessary infrastructure, resources, and capabilities. Handayani et al. (2025), which used the GSVI index (external signal rather than actual adoption) and found negative coefficients, suggests that GSVI may reflect market sentiment and hype rather than effective digital implementation. High GSVI in underperforming banks attempting to recover may create a disconnect between external perception and actual digital capability. In contrast, the meta-analysis with moderation demonstrated significant positive effects in the post-POJK period (d = 0.56), high digitalization banks (d = 0.56), and BUKU 4 banks (d = 0.62).

The literature consensus emerging from this synthesis confirms that digitalization has a positive effect on corporate value, with three important conditions: (1) implementation must be comprehensive, exceeding 50% digital transaction penetration; (2) evaluation periods should span at least 2–3 years post-implementation to capture lag effects; and (3) large banks with greater funding capacity and infrastructure are better positioned to generate substantial valuation improvements. These conditions explain why studies with short post-implementation periods, low digitalization rates, or heterogeneous samples including smaller banks often failed to find significant effects.

4.2.3 Mediation Mechanisms and Temporal Dynamics

The meta-analysis results, combined with findings from Moolkham et al. (2025) and Andrew (2024), reveal important mediation mechanisms and temporal dynamics in the digitalization-value relationship. The effect of digitalization on company value is not immediate but follows a gradual, sequential process. In years 1–2 post-implementation, operational efficiency increases as costs decline through automation and process optimization. In years 2–3, revenue from digital services increases as customer adoption grows and new digital products generate income, leading to improved ROE. Beyond year 3, market valuation rises as sustained profitability and growth prospects are reflected in PBV increases. This temporal pattern explains why pre-post POJK studies with short observation periods (e.g., Nugraha, 2022, with 2017 vs. 2019) failed to find significant effects, as the full impact of digitalization requires time to manifest through operational improvements, revenue growth, and ultimately market recognition.

4.2.4 Analysis of Variation and Moderation

The moderating effect of the publication period (pre-POJK vs. post-POJK 2018) is statistically significant (p = 0.043) and contributes approximately 5% to the reduction in I^2. The difference (d = 0.24, from 0.32 to 0.56) reflects the regulatory shock effect of POJK Number 12/POJK.03/2018. In the pre-POJK period, digitalization was voluntary and fragmentary, focusing on early adopters (primarily large banks). In the post-POJK period, digitalization became mandatory and systematic, leading to industry-wide digitalization that created economies of scale and increased investor confidence in digital strategies (OJK, 2018; Handayani et al., 2025).

The moderating effect of digitalization rate (>50% vs. ≤50%) is marginally significant (p = 0.068) and contributes approximately 4% to the reduction in I^2. The difference (d = 0.28, from 0.28 to 0.56) reflects a threshold effect. Digitalization below 50% is insufficient to transform customer experience and achieve meaningful operational efficiency gains, resulting in marginal effects on valuation. Once the 50% threshold is

crossed, a tipping point is reached where customer migration accelerates, cost savings become substantial, and brand value increases significantly (Setiawan et al., 2023; Yulianti et al., 2025).

The moderating effect of bank category (BUKU 4 vs. BUKU <4) is statistically significant ($p = 0.032$) and contributes approximately 3% to the reduction in I^2. The difference ($d = 0.37$, from 0.25 to 0.62) reflects scale and capability advantages. BUKU <4 banks (Regional) face budget constraints, legacy systems that cannot be fully replaced, and fragmented digitalization efforts, resulting in small effects on valuation. In contrast, BUKU 4 banks (National) have substantial budgets, greenfield digital platforms (BRImo, Livin, myBCA), and access to global best practices, enabling large effects (Fitriani & Haryanto, 2023; Pratama et al., 2025).

The moderating effect of company value indicator (PBV vs. Tobin's Q) is not significant ($p = 0.562$) and contributes only 1% to the reduction in I^2. This indicates that both metrics "measure the same thing" in this context. PBV is more stable due to its book value anchor, while Tobin's Q is more volatile due to asset replacement value considerations. However, the effect of digitalization is consistent across both indicators, supporting the robustness of the findings (Nugraha, 2022; Setiawan et al., 2023).

4.2.5 Remaining Heterogeneity and Limitations

Despite explaining a portion of the heterogeneity through moderator analysis (I^2 reduced from 82% to approximately 78%), substantial unexplained heterogeneity remains. The remaining sources of heterogeneity include: (1) different digitalization measurement methodologies, including digital transaction ratios (5 studies), GSVI indexes (2 studies), dummy variables (4 studies), and complex indexes (8 studies), with unknown correlations between methods representing a source of variance; (2) different confounding variable controls, with some studies controlling for size, leverage, and profitability while others use full controls versus partial coefficients that are not fully comparable; (3) different sample compositions, including Indonesia-focused studies (10 studies), regional Asian studies (2 studies), and global studies (7 studies), with emerging markets versus developed economies having different risk premiums; and (4) different economic cycle and macroeconomic contexts, including the COVID-19 pandemic (2020–2021) which accelerated digital adoption potentially inflating coefficients, and varying inflation and interest rate environments across years. Future research should employ standardized digitalization measurement approaches, consistent control variable frameworks, and longer observation periods to further reduce heterogeneity and provide more precise estimates.

5. Conclusion

This study examines the relationship between digitalization and banking company value through a meta-analysis of 19 studies comprising approximately 1,150 bank-year observations. The results show that banking digitalization has a moderate and significant positive influence on company value (Cohen's $d = 0.42$, 95% CI: 0.25–0.59, $p < 0.001$), supporting Schumpeter's Growth Theory that technological innovation drives firm value creation through operational efficiency, market expansion, and enhanced investor perception. The high heterogeneity across studies ($I^2 = 82\%$) is explained by several moderating factors: the publication period (post-POJK 2018 shows stronger effects, $d = 0.56$, compared to pre-POJK, $d = 0.32$), digitalization rate (banks with >50% digital transactions show stronger effects, $d = 0.56$, compared to ≤50%, $d = 0.28$), bank category

(BUKU 4 banks show stronger effects, d = 0.62, compared to BUKU <4 banks, d = 0.25), and company value indicators (PBV and Tobin's Q show no significant difference). The meta-analysis findings are robust, with no evidence of publication bias (Egger's p = 0.651) and consistent results across leave-one-out sensitivity analysis (range d: 0.39–0.47) and geographic subgroups. An increase in digitalization from low to high levels corresponds to an increase in firm value from approximately 1.2x to 1.8x (PBV), with an effect lag of 2–3 years post-implementation, indicating that digital transformation requires sustained commitment and time to generate meaningful valuation improvements.

The theoretical implications extend Schumpeter's Growth Theory to the digital banking context in emerging markets, demonstrating that technological innovation in the form of digitalization drives firm value creation through multiple mechanisms. The findings confirm that digitalization positively influences banking company value, resolving previous literature inconsistencies by identifying specific conditions under which digitalization generates positive effects. The significant moderating role of regulatory context (post-POJK 2018), digitalization depth (>50% threshold), and bank size (BUKU 4) extends the understanding of how contextual and organizational factors shape the effectiveness of technological innovation, providing a more nuanced theoretical framework for analyzing technology-firm value relationships in banking.

From a practical perspective, bank management should prioritize comprehensive digital transformation targeting ≥50% digital transactions to achieve meaningful value creation, allocate sufficient budget for cybersecurity and legacy system integration, and adopt a long-term perspective (3–5 years) for firm value appreciation. The Financial Services Authority (OJK) and Bank Indonesia should continue the POJK 12/2018 mandate while providing flexibility for small banks, develop standardized digitalization metrics for monitoring and benchmarking, and strengthen the cyber risk framework to mitigate downside risks. Investors and analysts should consider banks with high digitalization (>50%) as justifiably commanding valuation premiums (higher PBV/Q), monitor digitalization progress in financial reports, view GAP versus peers as strategic risk indicators, and adopt a long-term hold perspective (3–5 years) for value realization.

This study has several limitations. First, language bias may exist as 10 studies focus on Indonesia and 9 on international contexts, with possible language-related publication patterns affecting the generalizability of findings. Second, measurement heterogeneity across studies (four types of digitalization measurements) makes effect sizes not perfectly comparable, although meta-analytic techniques were used to address this limitation. Third, missing data in primary studies required conversion of t-statistics, which may introduce small measurement errors. Fourth, the geographic context limits generalizability, as 10 of 19 studies focus on Indonesia, requiring careful application to other banking systems. Fifth, temporal dynamics are constrained as most studies cover the 2020–2025 period, with limited evidence from the pre-pandemic digital context (2015–2019). Sixth, unmeasured confounders, including other regulatory changes, technology shocks, and market sentiment, are not fully controlled in primary studies and may influence the observed relationships.

Future research should conduct mediation analysis to quantify pathways (digitalization → efficiency → profitability → valuation) using structural equation modeling or mediation analysis techniques. Studies should employ advanced moderation analysis through meta-regression with continuous moderators such as GDP growth, competitive intensity, and deposit volatility. Longitudinal in-depth case studies on 3–5 banks could provide richer insights into the mechanisms through which digitalization influences firm

value. Research should examine crisis resilience by analyzing the effect of digitalization during financial stress or cyber crisis periods. Finally, distributional impact studies across customer segments and regional markets could reveal heterogeneous effects that are masked in aggregate analyses.

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