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Digital Transformation, Governance Risk, and Firm Value: Evidence from Indonesian Manufacturing Firms

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ABSTRACT

Digital transformation has become a central strategic agenda for firms, yet its impact on firm value remains inconclusive, particularly in emerging-market manufacturing where governance quality varies widely. This study examines the effect of digital transformation on firm value and the moderating role of governance risk, measured by board independence and audit committee effectiveness. Using an unbalanced panel of 310 manufacturing firms listed on the Indonesia Stock Exchange over 2020–2024 (1,240 firm-year observations), digital transformation is measured through TF-IDF text mining of annual reports and firm value through Tobin's Q. The data are analysed using fixed-effects panel regression with firm-clustered standard errors. The results show that digital transformation has a positive and significant effect on firm value ($\beta = 0.312$, $p < 0.001$), whereas governance risk significantly weakens this effect ($\beta = -0.187$, $p < 0.001$). These findings confirm that the increase in firm value from digital transformation depends heavily on the strength of board and audit committee oversight.

INTRODUCTION

Indonesia's manufacturing sector is entering the digital era at an uneven pace. Under the *Making Indonesia 4.0* roadmap, a growing number of manufacturers listed on the Indonesia Stock Exchange (IDX) disclose investments in artificial intelligence, big data analytics, cloud computing, robotics, and the Internet of Things in their annual reports. The market, however, does not reward these firms equally. Some firms with extensive digital initiatives trade at a substantial premium over the book value of their assets, while others with similar digital narratives see almost no change in Tobin's Q. This divergence raises an important question for investors and boards alike: under what conditions does digital transformation actually translate into higher firm value?

Firm value reflects investors' assessment of a firm's expected future cash flows relative to the replacement value of its assets, so a Tobin's Q above one indicates that the market recognises intangible sources of value that are not recorded on the balance sheet. Digital

transformation is one of these sources. It goes beyond adopting technology and fundamentally changes business processes, business models, and organisational structures (Hanelt et al., 2021; Verhoef et al., 2021). From the Resource-Based View, digital capabilities that are rare and difficult to imitate become a source of sustained competitive advantage (Barney, 1991), because they enable data-driven decisions, reduce operational inefficiency, and open new revenue streams (Kraus et al., 2022). Evidence from MSMEs in Malang likewise shows that accounting practices and e-commerce improve the quality of managerial decisions (Yanto & Rahmawati, 2024). At the capital-market level, digital transformation has been shown to improve firm performance (Zhai et al., 2022), increase operating flexibility and access to financing (Tian et al., 2022), and be followed by higher market valuations for firms that move toward digital business models (Chen & Srinivasan, 2024). Digital transformation disclosures therefore serve as credible signals of future competitive advantage, which leads to the first hypothesis (H1): digital transformation has a positive and significant effect on firm value.

Nevertheless, the relationship between digital transformation and firm value is not always positive. Guo et al. (2023) show that the benefits of digitalisation can be held back by the digitalisation paradox and managerial myopia, while Faridah et al. (2026) find that, among non-financial firms on the IDX, digital transformation actually increases financial distress because of high early adoption costs. These mixed results are consistent with contingency theory, which holds that the effectiveness of a strategy depends on the conditions surrounding it (Lawrence & Lorsch, 1967). Governance risk is one such condition. Within the agency theory framework, governance quality determines how closely managerial decisions are aligned with shareholder interests (Jensen & Meckling, 1976). When governance risk is high, information asymmetry widens and investors tend to discount managers' signals about large, long-horizon investments such as digital transformation.

Board independence and audit committee effectiveness are the two governance mechanisms most directly involved in this process. Independent commissioners bring an external perspective, curb managerial opportunism, and demand more rigorous evaluation of large capital commitments. Indonesian evidence shows that the board of commissioners has a positive effect on firm value (Rahmawati et al., 2021). Active audit committees, reflected in the frequency of their meetings, strengthen oversight of financial reporting, and audit committee characteristics have been shown to determine the financial performance of Indonesian firms (Lisbeth & Edastami, 2024). In the telecommunications sector, corporate governance even strengthens the relationship between digital transformation and Tobin's Q (Supadmini & Subaweh, 2026). Conversely, when boards lack independence and audit committees rarely meet, the market is likely to apply a governance discount to digital transformation signals, which leads to the second hypothesis (H2): governance risk weakens the positive effect of digital transformation on firm value.

Most empirical evidence on digital transformation and firm value comes from China (Guo et al., 2023; Tian et al., 2022; Zhai et al., 2022) and the United States (Chen & Srinivasan, 2024), while evidence from Southeast Asia remains limited. Comparative work on the

implementation of the ASEAN Corporate Governance Scorecard in Singapore, Thailand, and Indonesia shows that governance practices in the region extend beyond formal harmonisation and differ in how they are applied (Rahmawati et al., 2024). Indonesia's manufacturing sector, which combines rapid digital investment with wide variation in governance quality across firms, therefore provides a suitable setting to test whether governance risk shapes the effect of digital transformation on firm value. This study aims to examine the effect of digital transformation on firm value and the moderating role of governance risk, measured through board independence and audit committee effectiveness, among manufacturing firms listed on the IDX over 2020–2024. Theoretically, it integrates the Resource-Based View, agency theory, and contingency theory into a governance-conditioned valuation framework; empirically, it provides new evidence from an ASEAN market.

The research model developed from both hypotheses is presented in Figure 1.

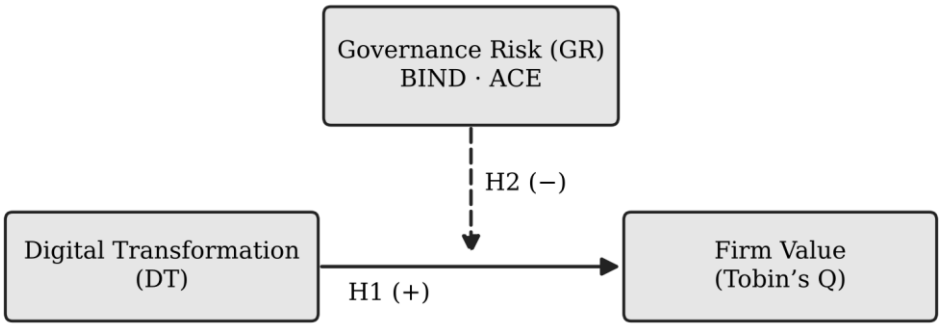


Figure 1. Research model

METHOD

This is a quantitative study using an unbalanced panel. The population comprises manufacturing firms listed on the IDX over 2020–2024, namely firms in the consumer and industrial manufacturing sector classifications that are the primary target of the *Making Indonesia 4.0* agenda. The sample is selected using specific criteria: firms with incomplete governance disclosures and firms listed for fewer than two years are excluded, and observations outside the 1st–99th percentile range are removed to limit the influence of outliers. Data are obtained from annual reports and audited financial statements published on the IDX. The final sample consists of 310 firms and 1,240 firm-year observations.

Digital transformation (DT). DT is measured using text mining with the Term Frequency–Inverse Document Frequency (TF-IDF) method applied to the management discussion and analysis section of annual reports, in line with text-based measurement in digital transformation research (Chen & Srinivasan, 2024). A dictionary of 62 digital keywords, covering artificial intelligence, cloud computing, big data, the Internet of Things, blockchain,

automation, and robotics, is applied to each report, and the TF-IDF scores are summed into a firm-year DT index.

Firm value (Tobin's Q). Firm value is measured using Tobin's Q, a forward-looking market-based indicator commonly used in digital transformation research (Chen & Srinivasan, 2024; Supadmini & Subaweh, 2026). Tobin's Q is calculated as follows:

$$Tobin's\ Q = (Market\ Capitalisation + Total\ Debt) / Total\ Assets \quad (1)$$

Governance risk (GR). Governance risk is measured through two dimensions. Board independence ratio (BIND) is the proportion of independent commissioners to the total board of commissioners, and audit committee effectiveness (ACE) is the number of audit committee meetings held per year. Both indicators are reverse-scored, standardised, and averaged into a composite score, so that higher values reflect weaker governance.

Control variables. The study controls for firm size (natural logarithm of total assets) and firm age (number of years since listing on the IDX). Year fixed effects capture macroeconomic variation, including the COVID-19 shock of 2020–2021 and the post-pandemic digital acceleration of 2022–2024.

The operational definitions of all variables are summarised in Table 1.

Table 1. Variable operationalisation

Variable	Symbol	Measurement	Reference
Firm value	TQ	(Market capitalisation + total debt) / total assets	Chen & Srinivasan (2024)
Digital transformation	DT	Sum of TF-IDF scores of 62 digital keywords in the MD&A section of annual reports	Chen & Srinivasan (2024)
Governance risk	GR	Average of reverse-scored, standardised BIND and ACE; higher values indicate weaker governance	Rahmawati et al. (2021); Lisbeth & Edastami (2024)
Board independence	BIND	Independent commissioners / total board of commissioners	Rahmawati et al. (2021)
Audit committee effectiveness	ACE	Number of audit committee meetings per year	Lisbeth & Edastami (2024)
Firm size	SIZE	Natural logarithm of total assets	–
Firm age	AGE	Number of years since listing on the IDX	–

Hypotheses are tested using fixed-effects (FE) panel regression in Stata 17, with cluster-robust standard errors at the firm level to address within-firm serial correlation. The moderating role of governance risk is tested through an interaction term, as specified in the following model:

$$TQ_{it} = \beta_0 + \beta_1 DT_{it} + \beta_2 GR_{it} + \beta_3 (DT \times GR)_{it} + \beta_4 SIZE_{it} + \beta_5 AGE_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

H1 is supported if β_1 is positive and significant, and H2 is supported if β_3 is negative and significant. To address the potential endogeneity of DT, instrumental variable (IV) estimation is conducted using the lagged regional-industry mean DT score and city-level internet penetration as instruments; first-stage F-statistics above 20 indicate that the instruments are relevant. Robustness is tested by replacing Tobin's Q with the price-to-book ratio (PBR) and by sub-group analyses across manufacturing sub-sectors.

RESULTS AND DISCUSSION

The mean Tobin's Q of the sample is 1.34 (SD = 0.72), consistent with prior studies of manufacturing firms on the IDX. The mean DT index is 0.18 (SD = 0.09), indicating moderate but varied digital disclosure intensity across firms. Board independence averages 0.41, close to the minimum requirement of the Financial Services Authority (*Otoritas Jasa Keuangan*, OJK) that at least one-third of the board of commissioners be independent. Audit committees meet on average 6.2 times per year (SD = 3.1), reflecting considerable differences in oversight intensity across firms.

Diagnostic tests support the use of the FE model. The Hausman test ($\chi^2 = 34.72$, $p < 0.001$) indicates that fixed effects are more appropriate than random effects. All variance inflation factors (VIF) are below 5, indicating no multicollinearity problem, and cluster-robust standard errors address heteroscedasticity. The within R^2 of 0.387 shows that the model explains about 38.7% of within-firm variation in Tobin's Q, which is adequate for a firm-level valuation model.

The fixed-effects regression results are presented in Table 2. Both hypotheses are supported at the 0.001 significance level.

Table 2. Fixed-effects regression results

Path / Hypothesis	Std. β	t-value	p-value	Decision
H1: DT → Firm value (direct effect)	0.312	7.61	< 0.001***	Supported
H2: DT × GR → Firm value (moderation)	−0.187	4.92	< 0.001***	Supported

Note: ***p < 0.001. Cluster-robust standard errors at the firm level; year and sub-sector fixed effects included.

When Tobin's Q is replaced with the PBR, the results for both hypotheses remain consistent, so the findings do not depend on the choice of valuation measure. Sub-group analysis further shows that the moderating effect of governance risk is stronger in capital-intensive sub-sectors, namely basic materials and heavy industry, than among consumer goods firms. In sub-sectors where digital investments are larger and payback periods longer, investors pay closer attention to governance quality when valuing firms.

The support for H1 shows that digital transformation has a positive and significant effect on firm value ($\beta = 0.312$, $t = 7.61$, $p < 0.001$). This result is in line with the Resource-Based View: digital capabilities are rare and difficult to imitate, so investors reward firms that develop them as a signal of future competitive advantage and cash flows (Barney, 1991). The finding is consistent with evidence that digital transformation improves firm performance (Zhai et al., 2022), enhances operating flexibility and access to financing (Tian et al., 2022), and is followed by higher market valuations (Chen & Srinivasan, 2024). For Indonesian manufacturers, the result indicates that the market reads digital transformation disclosures in annual reports as substantive, forward-looking information rather than mere rhetoric.

The support for H2 shows that governance risk significantly weakens the relationship between digital transformation and Tobin's Q ($\beta = -0.187$, $t = 4.92$, $p < 0.001$). Firms with less independent boards and infrequently meeting audit committees capture considerably less market value from their digital investments than well-governed firms. Consistent with agency

theory (Jensen & Meckling, 1976), a lack of independent commissioners weakens oversight of digital investment decisions, while inactive audit committees reduce transparency over information technology spending. The resulting information asymmetry leads investors to discount digital transformation signals from poorly governed firms. This finding is in line with Supadmini and Subaweh (2026), who find that governance strengthens the link between digital transformation and Tobin's Q, with Rahmawati et al. (2021), who show the role of the board of commissioners in firm value, and with Lisbeth and Edastami (2024) on the role of audit committee characteristics.

The stronger moderating effect in capital-intensive sub-sectors deepens these findings. When digital investments are large and long-horizon, investors become more sensitive to governance signals when judging the credibility of a firm's digital commitments. This also helps explain why some studies find that the benefits of digital transformation are held back (Guo et al., 2023) or that financial pressure even increases in the early stages of adoption (Faridah et al., 2026). Overall, digital transformation creates value on average, but the size of that value depends on the governance environment in which digital investments are decided and disclosed.

CONCLUSION

This study concludes that digital transformation has a positive and significant effect on the firm value of manufacturing firms listed on the Indonesia Stock Exchange over 2020–2024, and this result remains consistent under an alternative valuation measure and across sub-group analyses. However, governance risk, measured through board independence and audit committee effectiveness, significantly weakens this effect, so that firms with weak oversight structures obtain a much smaller increase in firm value from digital transformation. This moderating effect is strongest in capital-intensive sub-sectors, where the value of each digital investment is greatest.

Theoretically, this study integrates the Resource-Based View (digital transformation as a strategic resource), contingency theory (governance as a boundary condition), and agency theory (governance mechanisms as regulators of information quality) into a framework in which governance conditions the effect of digital transformation on firm value. The composite governance risk construct, which combines board independence and audit committee effectiveness, offers a parsimonious measure for emerging-market research and extends a digital transformation literature that has so far been dominated by China and developed economies.

Practically, board independence and audit committee activity should be regarded as drivers of value creation rather than mere compliance obligations. Firms seeking to obtain the full increase in firm value from digital investment should ensure that independent commissioners are actively involved in technology-related decisions and that audit committees meet often enough to maintain transparency over information technology spending. For management, digital transformation announcements will not consistently raise Tobin's Q unless

investors trust the surrounding governance environment, so investment in governance quality should go hand in hand with investment in technology. For regulators, the findings support strengthening board composition standards and audit committee activity requirements as part of digital economy governance.

This study has two limitations. First, measuring digital transformation through TF-IDF text mining of annual reports does not fully capture the depth and quality of actual technology deployment. Second, differences in governance practices across IDX sub-sectors may introduce measurement bias into the composite governance risk construct. Future research is suggested to examine digital-specific governance mechanisms, such as technology committees or the appointment of a chief digital officer (CDO), and to extend the analysis to other ASEAN countries such as Malaysia, Thailand, and Vietnam to enable cross-country institutional comparisons.

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