



DIGITAL TRANSFORMATION AS A MODERATOR: EXAMINING ENVIRONMENTAL DISCLOSURE, INNOVATION CULTURE, AND TAX AVOIDANCE IN INDONESIA



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Abstract

Corporate tax avoidance remains difficult to measure accurately, and the roles of environmental disclosure, innovation culture, and digital transformation in influencing such behavior remain inconclusive. The study aims at developing a more robust proxy for tax avoidance by decomposing book-tax differences and to examine the moderating role of digital transformation. Using Moderated Regression Analysis (MRA), the study analyzes 620 observations from 310 non-financial and non-service firms listed on the Indonesia Stock Exchange during 2023–2024. The findings show that the proposed measure is more robust than prior proxies. Environmental disclosure significantly reduces tax avoidance, while innovation culture has no significant effect. Digital transformation weakens the negative impact of environmental disclosure but does not moderate the role of innovation culture. These results highlight the importance of aligning digital transformation with transparent environmental practices as a governance mechanism to curb tax avoidance.

INTRODUCTION

Tax avoidance is a significant concern for regulators, investors, and the general public as it directly impacts fiscal equity and economic sustainability. Conceptually, tax avoidance involves a

company’s efforts to minimize its tax burden legally through strategic tax planning. However, this practice is frequently associated with agency conflicts. In such scenarios, management, possessing superior information, may exploit regulatory loopholes for private gain, thereby reducing transparency, undermining compliance, and potentially damaging the firm’s corporate reputation (Hanlon & Heitzman, 2010; Desai & Dharmapala, 2006).

In the Indonesian context, tax avoidance remains a critical issue that erodes potential state revenue. Estimates suggest that Indonesia loses approximately USD 2.995 billion in corporate income tax annually due to profit shifting to low-tax jurisdictions. In response, the Indonesian government has implemented a 15% global minimum tax policy for multinational companies, as stipulated in PMK 136/2024. This policy encompasses mechanisms such as the Qualified Domestic Minimum Top-up Tax (QDMTT) and the Subject to Tax Rule (STTR) mechanisms (Faradina, 2025). Despite these challenges, tax revenue performance has shown a positive trend; as of 31 December 2024, tax realization reached 100.5% of the target. This underscores the ongoing urgency for robust policies to close remaining tax avoidance loopholes (Budiyanti, 2024; Kementrian Keuangan, 2025).

A critical shortcoming in prior empirical research is the heavy reliance on aggregated tax avoidance proxies that conflate structurally different sources of book–tax differences, thereby limiting the ability to distinguish between opportunistic tax planning and accounting-driven timing effects. This limitation creates a substantive research gap, particularly in evaluating firms’ behavioral responses to increasingly stringent tax regulation. Accordingly, this study advances the literature by introducing a refined measurement approach that enhances the behavioral interpretability of tax avoidance indicators.

The primary methodological contribution or novelty of this study lies in refining the measurement of tax avoidance by extending the framework developed by Badertscher et al., (2019). While the original model employed aggregate Book–Tax Difference (BTD) as a composite indicator of discretionary tax avoidance, this approach implicitly assumed that all components of BTD were homogeneous in nature. However, prior literature has emphasized that BTD consists of heterogeneous elements that arise from fundamentally different sources, including accounting standards, tax regulations, and managerial discretion (Hanlon & Heitzman, 2010). Treating total BTD as a single construct may therefore introduce measurement bias and potentially overstate the extent of discretionary tax avoidance. Prior research employed aggregate Book–Tax Difference (BTD) as a proxy for discretionary tax avoidance, which is expressed as follows:

$$\text{TAXESPAID_TO ASSETS}_{it} = \beta_0 + \beta_1\text{BTD}_{it} + \beta_2\text{NEG}_{it} + \beta_3\text{BTD}_{it} \times \text{NEG}_{it} + \beta_4\text{NOL}_{it} + \beta_5\Delta\text{NOL}_{it} + \varepsilon_{it} \dots\dots\dots(1)$$

While this study decomposed BTD into three components: permanent differences (PermDiff), depreciation-related temporary differences (DeprDiff), and other discretionary temporary differences (TempDiff non-depr)—the new model is expressed as follows:

$$\text{TAXESPAID_TO ASSETS}_{it} = \beta_0 + \beta_1\text{PermDiff}_{it} + \beta_2\text{TempDiffnonDepr}_{it} + \beta_3\text{DeprDiff}_{it} + \beta_4\text{NEG}_{it} + \beta_5\text{PermDiff}_{it} * \text{NEG}_{it} + \beta_6\text{TempDiffnonDepr}_{it} * \text{NEG}_{it} + \beta_7\text{DeprDiff}_{it} * \text{NEG}_{it} + \beta_8\text{NOL}_{it} + \beta_9\Delta\text{NOL}_{it} + \varepsilon_{it} \dots\dots\dots(2)$$

The present study decomposes BTD into three distinct components: permanent differences (PermDiff), depreciation-related temporary differences (DeprDiff), and other temporary differences not related to depreciation (TempDiff non-depr). This decomposition is particularly relevant in the Indonesian institutional context, where tax regulations and accounting standards explicitly distinguish between permanent and temporary differences (IAI, 2023). PSAK 212 (IAI, 2023) defines temporary differences as timing discrepancies between accounting profit and taxable profit that reverse in future periods, while permanent differences arise from items recognized in accounting income but are never taxable.

The refinement addressed a core limitation of the original model, which treated total BTD as homogeneous despite its heterogeneous nature (Hanlon & Heitzman, 2010; Sutrisno et al., 2023).

Depreciation-related differences, in particular, were largely mechanical and arose from regulatory discrepancies between financial accounting depreciation and tax depreciation schedules. As such, these differences were driven primarily by statutory rules rather than strategic managerial behavior. By isolating these mechanically driven differences, the proposed model minimized the risk of misclassifying regulatory timing differences as intentional tax avoidance. Furthermore, distinguishing temporary differences unrelated to depreciation from permanent differences allowed the model to better capture managerial discretion embedded in accrual choices and tax planning activities. Permanent differences represented items that permanently reduced taxable income without future reversal, whereas temporary differences typically reflected timing adjustments associated with accrual accounting. By separating these components, the refined specification enabled a clearer identification of tax avoidance behavior that reflected strategic corporate decision making rather than structural accounting–tax mismatches. Extant literature suggested that variations in tax avoidance were largely driven by temporary differences; while permanent differences might elevate tax risk, temporary differences appeared to have no significant impact on such risk (Gaertner et al., 2016; Guedrib & Bougacha, 2024; Kobbi-Fakhfakh & Bougacha, 2023). By aligning the empirical specification with both theoretical insights from the tax avoidance literature and the institutional framework of Indonesian accounting and tax regulations, the proposed refinement enhanced the accuracy of tax avoidance measurement and provided a more robust foundation for examining the influence of digital transformation and innovation culture on corporate tax behavior.

Another important contribution of this refinement is that the residual derived from the regression model captures the portion of tax avoidance that cannot be explained by observable book–tax differences or loss carryforward mechanisms. In this context, the residual represents abnormal tax payments that remained unexplained after controlling for permanent differences, temporary differences, depreciation-related timing effects, and accumulated net operating losses. Consequently, this residual provides a more precise proxy for discretionary tax avoidance that is not mechanically driven by accounting rules or tax regulations. This approach improves construct validity by isolating managerial tax behavior that is not detectable through conventional BTM measures.

Legitimacy theory suggests that corporate sustainability is highly dependent on the support of the community and broader stakeholder groups. To secure and maintain social legitimacy, companies must ensure that their operations align with publicly accepted social values and norms. To demonstrate compliance with societal expectations, companies may adopt both symbolic and substantive actions, such as the disclosure of environmental information. A primary source of legitimacy pressure arises when the public criticizes companies that generate substantial profits while simultaneously engaging in tax avoidance practices perceived as unethical (Dowling & Pfeffer, 1975). In addition, agency theory helps explain the role of innovation culture and digital transformation in shaping corporate tax behavior. Firms that promote an innovation culture often encourage experimentation, flexibility, and risk-taking in managerial decision-making. While such characteristics may enhance organizational competitiveness, they may also increase managerial discretion in financial and tax-related decisions. Similarly, digital transformation enhances firms' information-processing capabilities and access to complex financial data.

Environmental disclosure (ED) has emerged as a vital dimension of modern corporate reporting. It is defined as the reporting of a company's environmental impact, a concept further reinforced by the Paris Agreement framework, which emphasizes financial, technical, and capacity-building pillars. The Global Reporting Initiative (GRI) 300 series standards provide specific guidance for the implementation of environmental disclosure (Baalouch et al., 2019; Global Reporting Initiative, 2024; Polizzi & Scannella, 2023). Companies committed to sustainability tend to exhibit higher levels of transparency and compliance, including in their tax affairs. While some empirical evidence has suggested that environmental disclosure helped mitigate tax avoidance (Gu & Wang, 2023; Kuralbayeva, 2019; Rudyanto, 2024), other studies have found that ED has no significant effect on tax outcomes (Rini et al., 2024).

Furthermore, a culture of innovation has become increasingly important to modern corporate strategy. Innovation not only generates value but also strengthens competitive advantage. Companies

that foster an innovation culture are often more adept at developing sophisticated financial strategies, including tax management (Jiang & Yu, 2025). Research by Hasan et al., (2024) and Xiang et al., (2025) suggested that while a highly creative culture might increase the likelihood of tax avoidance through complex structures, a strong capacity for innovation could also reduce tax avoidance by aligning with long-term value creation (Uyar et al., 2021). However, an alternative perspective suggests that the defining characteristics of an innovative company, namely flexibility and “out-of-the-box” thinking, may also be applied to aggressive tax planning. Hasan et al., (2024) identified a significant positive relationship between a corporate culture of innovation and tax avoidance. The findings suggest that an innovation-oriented culture fosters a higher propensity for exploiting regulatory loopholes, thereby facilitating more aggressive tax avoidance activities.

Digital transformation (DT) fundamentally alters corporate information architecture, financial integration systems, and tax management practices (X. Chen & Lloyd, 2024; Tiantian et al., 2023). While prior literature has frequently associated digitalization with enhanced transparency and compliance, this study advances a different theoretical positioning by conceptualizing DT as a facilitator of tax avoidance. Specifically, DT enhances firms’ analytical capacity, data integration, automation, and strategic coordination, thereby increasing the efficiency and sophistication of tax planning activities (Zhou et al., 2022).

From a capability-based perspective, digital transformation strengthens a firm’s ability to process large-scale financial data, conduct scenario-based tax simulations, and optimize inter-temporal and cross-jurisdictional tax positions. Advanced digital systems reduce informational asymmetry within organizations, lower transaction and coordination costs, and enable real-time fiscal planning. Consequently, DT may reduce fiscal rigidity and provide firms with greater flexibility to design complex, yet legally compliant, tax minimization strategies (M. Chen et al., 2024; W. Chen & Meng, 2024; Tiantian et al., 2023).

Within this framework, digital transformation conditions the effectiveness of environmental disclosure (ED). Although ED is generally associated with higher transparency and reputational concerns that discourage tax avoidance, firms with sophisticated digital infrastructures may simultaneously maintain credible sustainability reporting while implementing technologically supported tax optimization strategies. The separation between external disclosure systems and internal tax analytics allows firms to preserve legitimacy without necessarily constraining aggressive tax planning. Accordingly, higher levels of DT are expected to weaken the negative relationship between environmental disclosure and tax avoidance (Gu & Wang, 2023; Rini et al., 2024).

Similarly, firms characterized by a strong innovation culture possess greater creativity, strategic flexibility, and problem-solving capacity, which may extend to financial and tax-related decision making (Hasan et al., 2024). When supported by advanced digital capabilities, innovative orientations become more operationally effective, as digital tools translate creative tax ideas into executable optimization models. Thus, DT is expected to amplify the positive relationship between innovation culture and tax avoidance.

Based on this reasoning, the study hypothesizes that: (1) environmental disclosure negatively affects tax avoidance; (2) innovation culture positively affects tax avoidance; (3) digital transformation weakens the negative association between environmental disclosure and tax avoidance; and (4) digital transformation strengthens the positive association between innovation culture and tax avoidance.

This research contributes to the literature on three levels: scientific, practical, and policy-oriented. From a scientific perspective, it enriches the literature by integrating environmental disclosure, innovation culture, and digital transformation into a unified framework. It highlights the role of digital transformation as a governance mechanism that moderates the impact of environmental transparency on tax aggressiveness. From a practical perspective, the findings provide a foundation for management to design sustainability and digitalization strategies that enhance efficiency while strengthening tax compliance and mitigating reputational risks. Finally, for regulators, these results provide empirical evidence to support risk-based tax oversight by linking the quality of environmental reporting and the level of digitalization to a company’s tax avoidance profile.

METHOD

This study is a quantitative, causal study that employs panel data regression with moderation (Moderated Regression Analysis, MRA). MRA is used to examine the effects of environmental disclosure and innovation culture on tax avoidance, with digital transformation serving as a moderating variable and company size, leverage, profitability, and capital intensity as control variables. The regression equation used in this study is as follows:

$$TA_{it} = \beta_0 + \beta_1 ED_{it} + \beta_2 INOV_{it} + \beta_3 ED_{it} * DT_{it} + \beta_4 INOV_{it} * DT_{it} + \beta_5 SIZE_{it} + \beta_6 LEV_{it} + \beta_7 ROA_{it} + \beta_8 CI_{it} + \epsilon_{it} \dots \dots \dots (3)$$

Description: TA=tax avoidance, ED=Environmental disclosure, INOV=culture of innovation, DT=digital transformation, SIZE=company size, LEV=leverage, ROA=profitability, CI=capital intensity.

This study investigates the effects of environmental disclosure and innovation culture on tax avoidance, with digital transformation serving as a moderating variable. All variable measurements are shown in Table 1. Each item of environmental disclosure and digital transformation measurement is assessed on a scale from 0 to 3 (0 indicates that the item is not disclosed, 1 indicates qualitative disclosure, 2 indicates detailed disclosure supported by numerical information, and 3 indicates full disclosure both qualitatively and quantitatively) (Papoutsi & Sodhi, 2020).

Table 1. Variable measurement

Variable name	Measurement	References
Tax avoidance (TA)	$TAXESPAID_TO\ ASSETS_{it} = \beta_0 + \beta_1 PermDiff_{it} + \beta_2 TempDiff_{nonDepr_{it}} + \beta_3 DeprDiff_{it} + \beta_4 NEG_{it} + \beta_5 PermDiff_{it} * NEG_{it} + \beta_6 TempDiff_{nonDepr} * NEG_{it} + \beta_7 DeprDiff * NEG_{it} + \beta_8 NOL_{it} + \beta_9 \Delta NOL_{it} + \epsilon_{it}$ The regression residual value (ϵ_{it}) is recognized as the tax avoidance value.	(Badertscher et al., 2019) dimodifikasi
Environment disclosure (ED)	$ED = \frac{ED\ disclosure\ based\ on\ GRI}{Maximum\ value\ of\ disclosure}$ Environmental disclosure is measured using an environmental disclosure index based on the GRI 300 standards, which includes 32 items in the environmental category.	(Alipour et al., 2019; Yan, 2024; Pereira et al., 2023)
Cultural Innovation (INOV)	$INOV = \ln(\text{the emergence of the word about the culture of innovation})$	(Likitapiwat et al., 2024)
Digital Transformation (DT)	$DT = \frac{DT\ disclose}{maximum\ value\ of\ disclosure}$ Include terms such as big data analytics, artificial intelligence, cloud computing, blockchain, and the Internet of Things.	(Zhou et al., 2022)
Size (SIZE)	$SIZE = \ln(\text{Total Assets})$	(Hossain et al., 2024; Dharma & Afrilia, 2024; Mahdiana & Amen, 2020; Rachmawati et al., 2024)
Leverage (LEV)	$LEV = \frac{total\ liabilities}{Total\ assets}$	(Ahnan & Murwaningsari, 2019; Alipour et al., 2019; Zhang et al., 2023)
Profitability (PROF)	$ROA = \frac{Net\ income}{Total\ Assets}$	(Hossain et al., 2024; Ahnan & Murwaningsari, 2019; Dhariwal et al., 2024; Rachmawati et al., 2024)
Capital Intensity (CI)	$CI = \frac{Net\ fixed\ assets}{Total\ Assets}$	(Matitaputty & Ramadan, 2023; Aprilians & Hidayati, 2023; Dharma & Afrilia, 2024)

Innovation culture is measured by counting the occurrence of words related to innovation in the company’s annual reports, including terms such as creativity, innovative, innovate, innovation, excellence, passion, world-class, technology, operational excellence, product innovation, capability, customer experience, thought leadership, expertise, agility, efficiency, competency, know-how, cutting-edge, agile, creatively, customer-centric, enable, value proposition, reinvent, focus, and innovation capability. The total frequency of these words is then transformed using the natural logarithm (ln) (Likitapiwat et al., 2024).

Digital transformation is measured using an index based on company disclosures regarding their use of digital technologies, specifically: (1) big data analytics, (2) artificial intelligence, (3) cloud computing, (4) blockchain, and (5) the Internet of Things (Zhou et al., 2022). Each indicator is scored on a scale from 0 to 3: a score of 0 is assigned if the company does not disclose the dimension, 1 if the disclosure is narrative only, 2 if the disclosure includes both narrative and numerical information, and 3 if the disclosure is comprehensive for each dimension (Papoutsi & Sodhi, 2020).

This study uses four control variables. Company size is measured by the natural logarithm (ln) of total assets (Hossain et al., 2024); Leverage is measured by the ratio of total debt to total assets. Profitability is measured by return on assets (ROA) (Ahnani & Murwaningsari, 2019; Alipour et al., 2019; Darma & Afrilia, 2024; Dhariwal et al., 2024; Mahdiana & Amin, 2020; Zhang et al., 2023). Capital intensity is measured by the ratio of fixed assets to total assets (Apriliani & Hidayati, 2023; Darma & Afrilia, 2024; Matitaputty & Ramadhan, 2023).

This study utilized financial statements, annual reports, and sustainability reports of companies listed on the Indonesia Stock Exchange (IDX) for the period 2023–2024. The sample selection used a purposive sampling method based on the following criteria: (i) companies not included in the financial and service sectors, (ii) companies not delisted during the research period, (iii) companies not experiencing fiscal losses, and (iv) companies not subject to final taxation. Non-financial companies were selected because the financial and service sectors are subject to special regulations, have different revenue structures, and receive distinct tax treatment, making them less comparable to the production sector and potentially introducing comparability bias. Additionally, companies subject to final taxes were excluded, as their rates are predetermined by the government, preventing meaningful observation of variations in tax avoidance strategies. The final sample included 310 firms, resulting in 620 firm-year observations over the two-year study period.

Table 2. Selection of research samples

No.	Remarks	Quantity
1.	Companies listed on the IDX for the 2023-2024 period, other than the Financial Sector	762
2.	Service companies listed on the IDX for the 2023-2024 period	(285)
3.	Companies that are delisted and suspended during the 2023-2024 period	(22)
3.	Companies that have suffered fiscal losses	(75)
4.	Companies subject to final tax	(70)
	Sample firm	310
	Number of Research Years	2
	Total Observation Data (310 × 2)	620

RESULTS

Table 3 presents the descriptive statistics. Based on 620 observations (310 companies over a two-year period), the average tax avoidance (TA) value of -0.000062 is close to zero with minimal variation, suggesting that most companies do not engage in aggressive tax avoidance. The average environmental disclosure (ED) is 0.1885, meaning that the average level of environmental transparency based on the GRI is only 18.85% and remains relatively low, with considerable variation. The culture of innovation (INO) is at a moderate level, with an average of 114 words, falling between the minimum and maximum values. The data are relatively homogeneous, as indicated by a standard deviation lower than

the mean. The average digital transformation value of 0.2238 (22.38%) indicates that most sample companies are still in the early stages of adopting and integrating digital technologies, exhibiting similar digitalization patterns and not yet reaching maturity in digital transformation. The standard deviation suggests that the level of digital transformation is relatively homogeneous across the sample.

Table 3. Statistic Descriptives

Variabel	Obs.	Mean	Std. dev.	Min	Max
TA	620	-0.0000622	0.0376	-0.0630	0.3382
ED	620	0.1885	0.1215	0.0104	0.8333
INOV	620	114.00	100.00	4.0000	780.00
DT	620	0.2238	0.1323	0.0067	0.7333
Size	620	12.379 trillion	35.691 trillion	37.917 million	472.925 trillion
LEV	620	0.6040	2.4332	0.0001	45.747
ROA	620	0.0394	0.1406	-1.770	0.4030
CI	620	0.3154	0.2136	0.0001	0.9125

Description: TA: Tax avoidance, ED: environmental disclosure, INOV: Corporate innovation culture, DT: Digital Transformation, SIZE: Company size, LEV: leverage, ROA: Probability, CI: Capital Intensity.

Sources: output Stata v.15, 2025

The control variable for company size exhibits substantial variation, ranging from relatively small firms to large conglomerates. Leverage also varies widely, with some companies carrying very high levels of debt. The average profitability of 3.9%, combined with a broad range, reflects a heterogeneous sample of companies. The capital intensity variable has an average of 31.54%, indicating that most companies in the sample possess substantial fixed assets, although the distribution of this variable is fairly wide.

Table 4. Pairwise correlation

Variable	TA	ED	INOV	DT	EDxDT	INOVxDT	SIZE	LEV	ROA	CI
TA	1.000									
ED	0.0588	1.000								
INOV	0.0053	0.1342 (***)	1.000							
DT	0.0402	0.0821	0.2979 (***)	1.000						
EDxDT	-0.098 (**)	-0.742 (***)	-0.297 (***)	-0.51 (***)	1.000					
INOVxDT	0.0296	0.0918	0.5000 (***)	0.965 (***)	-0.507 (***)	1.000				
SIZE	0.1038 (**)	0.0375	0.2257 (***)	0.137 (***)	-0.066	0.1788 (***)	1.000			
LEV	0.0099	-0.028	-0.001	0.003	-0.0152	-0.0002	-0.08	1.000		
ROA	0.2515 (***)	0.0951	0.0379	0.011	0.0815	0.0161	0.182	-0.59	1.000	
CI	-0.166 (***)	0.0556	0.0050	-0.09	-0.0026	-0.0758	-0.02	-0.04	-0.06	1.000
VIF		4.22	4.29	1.67	7.44	6.49	1.11	1.57	1.63	1.04

N=620 data observation, *** p<0.01, ** p<0.05, * p<0.1

Description: TA: Tax avoidance, ED: environmental disclosure, INOV: Corporate innovation culture, DT: Digital Transformation, SIZE: Company size, LEV: leverage, ROA: Probability, CI: Capital Intensity. VIF: variance inflation factors.

Sources: output Stata v.15, 2025

Table 4 presents the correlations between the study variables. The correlation matrix indicates that the relationships between tax avoidance and the main variables are generally weak, although some show significant patterns. Specifically, tax avoidance has weak and insignificant correlations with

environmental disclosure ($r = 0.0588$), digital transformation ($r = 0.0053$), and innovation culture ($r = 0.0053$), suggesting that there is no strong bivariate relationship between these variables and tax avoidance. In contrast, the interaction variable reveals a more pronounced relationship: tax avoidance is negatively and significantly associated with the interaction of environmental disclosure and digital transformation ($ED \times DT$, $r = -0.098$, $p < 0.05$), suggesting that the combination of environmental disclosure and digital transformation is linked to lower tax avoidance at the level of simple correlations. Additionally, tax avoidance is positively and significantly correlated with company size ($SIZE$, $r = 0.104$, $p < 0.05$) and profitability (ROA , $r = 0.252$, $p < 0.01$), but negatively and significantly correlated with capital intensity (CI , $r = -0.166$, $p < 0.01$). This indicates that larger and more profitable companies are more likely to engage in tax avoidance, whereas companies with higher capital intensity tend to exhibit lower tax avoidance. The multicollinearity test results indicate that there is no serious issue, as all VIF values are below 10. Although the interaction terms ($ED \times DT = 7.44$, $INOV \times DT = 6.49$) reflect the structural multicollinearity commonly found in moderation models, they remain within acceptable tolerance limits.

The regression results, as shown in Table 5, indicate that the overall model is significant ($Prob F = 0.000$) with moderate explanatory power. The adjusted R^2 value of 0.1226 indicates that approximately 12.26% of the variation in tax avoidance is explained by the model, while the remaining proportion is attributable to other firm-specific, institutional, or macroeconomic factors not captured in this study. Although the explanatory power appears modest, this magnitude is consistent with prior empirical tax avoidance research, where corporate tax behavior is influenced by complex, multidimensional, and often unobservable determinants. The adjusted R^2 should not be interpreted as evidence of weak model validity, but rather as reflective of the multifaceted nature of tax planning behavior.

Partially, environmental disclosure (ED) had a negative and significant effect on tax avoidance (coef. = -1.81 , $p = 0.035$), supporting the first hypothesis (H_1) and indicating that higher environmental disclosure is associated with a lower tendency for companies to engage in tax avoidance. Innovation culture ($INOV$) does not significantly affect tax avoidance (coef. = -0.39 , $p = 0.350$); thus, the second hypothesis (H_2) is not supported.

Table 5. Hypothesis test results

$TA_{it} = \beta_0 + \beta_1 ED_{it} + \beta_2 INOV_{it} + \beta_3 DT_{it} + \beta_4 ED_{it} * DT_{it} + \beta_5 INOV_{it} * DT_{it} + \beta_6 SIZE + \beta_7 LEV + \beta_8 ROA + \beta_9 CI + e$					
Variabel	Direction prediction	Coefficient	p-value	Explanation	
konstanta		-0.018			
ED	-	-1.81	0.035**	H_1 accepted	
INOV	+	-0.39	0.350	H_2 is unacceptable	
DT		0.31	0.378		
ED*DT	+	2.23	0.013**	H_3 accepted, DT as pure moderator.	
INOV*DT	+	-0.58	0.280	H_4 is unacceptable, DT as a homologous moderator.	
SIZE		1.82	0.035**		
LEV		2.64	0.004***		
ROA		5.12	0.000***		
CI		-2.59	0.050***		
Total observations			620		
Adjusted R-squared			0.1226		
Prob F Statistic			0.000		

*Significance 10%, **significance 5%, ***significance 1%

Description: TA: Tax avoidance, ED: environmental disclosure, INOV: Corporate innovation culture, DT: Digital Transformation, SIZE: Company size, LEV: leverage, ROA: Probability, CI: fixed asset intensity

Sources: output Stata v.15, 2025

The results presented in Table 5 indicate that digital transformation has no direct effect on tax avoidance (coef. = 0.31 ; $p = 0.378$). However, it acts as a moderator that weakens the relationship between environmental disclosure and tax avoidance (coef. = 2.23 ; $p = 0.0013$), suggesting that higher levels of digital transformation decrease the ability of environmental disclosure to reduce tax avoidance.

It can be inferred that the third hypothesis (H3) is supported. According to (Sharma et al., 1981), digital transformation is classified as a pure moderator, meaning that it only weakens the relationship between environmental disclosure and tax avoidance without having a direct effect on tax avoidance.

In contrast, the interaction between innovation culture and digital transformation is not significant (coef. = -0.58, p = 0.280); thus, the fourth hypothesis (H4) is not supported, indicating that digital transformation neither strengthens nor weakens the relationship between innovation culture and tax avoidance. This suggests that digital transformation acts as a homologous moderator, meaning that it possesses the potential to moderate the relationship but has not actively functioned as a moderating variable in this context (Sharma et al., 1981).

The robustness test was conducted to ensure that the study's main findings were not merely artifacts of how tax avoidance was measured, given that BTD-based proxies are highly sensitive to normal accounting components and can conflate tax avoidance behavior with legitimate reporting differences. In this study, the primary tax avoidance measure is a modified approach that decomposes BTD to more clearly separate discretionary components from routine accounting variations. Specifically, BTD is divided into (i) temporary differences related to depreciation, (ii) temporary differences excluding depreciation, and (iii) permanent differences. This decomposition is intended to isolate the variation in BTD that better reflects discretionary tax policy while minimizing contamination from normal temporary differences due to depreciation methods and structural permanent differences. Consequently, a robustness test was conducted to confirm that the modified tax avoidance measures are reliable (Badertscher et al., 2019).

Table 6. Robustness test results

TAit = $\beta_0 + \beta_1 ED_{it} + \beta_2 INOV_{it} + \beta_3 DT_{it} + \beta_4 ED_{it} * DT_{it} + \beta_5 INOV_{it} * DT_{it} + \beta_6 SIZE + \beta_7 LEV + \beta_8 ROA + \beta_9 CI + e$								
Variabel	Development Tax Avoidance				Model Tax Avoidance Badertscher et al., (2019)			
	Predict ion	Coef.	P-value	Remarks	Predict ion	Coef.	Pvalue	Remarks
konstanta		-0.018				0.14		
ED	-	-1.81	0.035**	Accepted	-	-0.51	0.305	Rejected
INOV	+	-0.39	0.350	Rejected	+	1.17	0.122	Rejected
DT		0.31	0.378			1.32	0.091	
ED*DT	+	2.23	0.013**	Accepted	+	1.47	0.071*	Accepted
INOV*DT	+	-0.58	0.280	Rejected	+	-1.80	0.036**	Rejected
SIZE		1.82	0.035**			1.57	0.058	
LEV		2.64	0.004***			3.42	0.001	
ROA		5.12	0.000***			6.20	0.000***	
CI		-2.59	0.050***			-3.96	0.000***	
<i>Adjusted R Squared</i>				0.2748				0.1024
<i>Prob F statistic</i>				0,0000				0,0000
Number of observations				620				620

*Significance 10%, **significance 5%, ***significance 1%

Description: TA: Tax avoidance, ED: environmental disclosure, INOV: Corporate innovation culture, DT: Digital Transformation, SIZE: Company size, LEV: leverage, ROA: Probability, CI: Capital intensity.

Source: output Stata v.15, 2025

In the model using the modified tax avoidance measure, environmental disclosure had a negative and significant effect on tax avoidance (coef. = -1.81; p = 0.035), while in the model of Badertscher et al., 2019) the direct effect of environmental disclosure became insignificant (coef. = -0.51; p = 0.305). This difference suggests that the direct effect of environmental disclosure on tax avoidance is sensitive to how tax avoidance is measured, particularly when the BTD components are not fully separated from normal accounting differences. These results support the view that decomposing BTD allows for capturing the more discretionary and behaviorally relevant aspects of tax avoidance, in contrast to broader, more aggregated measures (Badertscher et al., 2019).

DISCUSSION

Environmental disclosure negatively affects tax avoidance (H1 is supported), indicating that the higher the quality and scope of a company's environmental reporting, the lower its tendency to engage in tax avoidance. Substantively, these findings suggest that enhancing environmental disclosures in accordance with GRI 300 is associated with a reduction in the portion of tax avoidance not explained by standard accounting factors, reflecting a decrease in riskier tax behaviors. Companies weigh the short-term cash savings from tax avoidance against the expected marginal costs, including sanction risks, reputational damage, and potentially higher capital costs. Stronger environmental disclosures increase visibility and amplify reputational costs when there are discrepancies between environmental responsibility narratives and actual fiscal behavior. In this context, taxes are no longer viewed solely as a legal obligation but as a form of social contribution aligned with claims of environmental responsibility. Theoretically, these findings support legitimacy theory, which underscores the importance of aligning corporate actions with social norms and stakeholder expectations. Environmental disclosure signals a commitment to public value, and pairing it with aggressive tax strategies generates reputationally costly legitimacy dissonance (Rini et al., 2024; Toumi & Jouini, 2025). The reduction in tax avoidance associated with increased environmental disclosures likely reflects a decline in the discretionary and high-risk components of tax policy, rather than merely the mechanical effects of accounting. Implicitly, companies with mature environmental disclosures tend to shift from aggressive tax avoidance to compliant tax planning, thereby lowering their tax burden without increasing unexplained tax avoidance.

The findings of this study are in line with previous evidence by Rini et al. (2024), which showed that high environmental disclosure was associated with a decline in tax avoidance practices. Thus, this study highlights that environmental disclosure is not merely a symbol of social responsibility but can function as a governance mechanism that promotes more ethical fiscal behavior, demonstrating the link between sustainability (non-financial) performance and tax compliance (financial) (Rudyanto, 2024).

In contrast, innovation culture (INOV) had no significant effect on tax avoidance (coef. -0.39 , $p = 0.350$), so the second hypothesis (H2) is not supported. This suggests that a company's innovation culture is unrelated to tax avoidance and that an innovative orientation does not directly translate into tax-saving strategies. Descriptive statistics further indicate that most companies in the sample do not engage in aggressive tax avoidance, as reflected in the low average values. This limited variation in tax avoidance reduces the explanatory power of non-financial variables, such as innovation narratives, meaning that changes in innovation culture are not necessarily reflected in tax avoidance behavior. Moreover, the variation in innovation culture in this study is relatively modest, suggesting that differences between companies are not pronounced enough to drive significant changes in tax outcomes. This is particularly relevant because an innovation culture is measured by the presence of innovation-related words or terminology, capturing narrative intensity rather than actual innovation activities that could influence tax planning.

Innovation can create opportunities for tax avoidance, as it complicates comparisons and audits for tax authorities, thereby expanding the scope for profit shifting. As explained by Okoshi, (2021), product differentiation or uniqueness can increase audit difficulty and expand tax avoidance opportunities. On the other hand, the literature highlights that tax avoidance can generate agency costs, diverting managerial attention and resources away from innovation activities and reducing the quality of innovation investment decisions. Studies have found that tax avoidance can hinder a firm's innovative capacity, supporting agency theory, and that stronger governance can mitigate these negative effects. Moreover, the relationship between tax avoidance and innovation performance can vary depending on the company's life-cycle stage: during the growth phase, tax avoidance may help fund innovation, whereas in the maturity or decline phase, it tends to be detrimental due to increasing agency problems and organizational complexity (Jianhua, 2017; Zhang, 2023).

Digital transformation does not necessarily strengthen the disciplining role of environmental disclosure in reducing tax avoidance; instead, it may significantly weaken this negative relationship. Although environmental disclosure is expected to enhance transparency and legitimacy, thereby

discouraging opportunistic behaviors such as aggressive tax avoidance, the integration of digital technologies alters how such disclosure is produced, communicated, and perceived. Digital transformation increases the complexity of corporate operations and data structures, which may obscure the link between environmental performance and financial behavior. Stakeholders often face difficulties in processing large volumes of digital information, reducing their ability to critically assess whether environmental disclosure aligns with actual corporate conduct, including tax practices. This weakens external monitoring pressure that would otherwise discourage tax avoidance.

In contrast, the interaction between innovation culture and digital transformation indicates that digital transformation neither strengthens nor weakens the relationship between innovation culture and tax avoidance (H4 is not supported). This suggests that digital transformation acts as a homologous moderator, meaning that it possesses the potential or characteristics to moderate the relationship but has not functioned actively as a moderating variable in this context (Sharma et al., 1981).

Substantively, these results align with the nature of measuring innovation culture through the presence of innovation-related terms, which capture “innovation talk” rather than actual innovation output. Thus, although digital transformation enhances data-processing capabilities and managerial efficiency, it does not automatically translate the innovation narrative into a tangible channel for tax planning. In other words, digital transformation functions as a lever for enhancing tax management capabilities through the flexibility of digital and intangible transactions, whereas text-based measures of innovation culture are largely symbolic and communicative. Therefore, it is unsurprising that the interaction between innovation culture and digital transformation does not produce a strong effect on tax avoidance.

However, the most consistent and robust results appeared in the interaction variable. The interaction of environmental disclosure and digital transformation remained positive and significant in both models ($p = 0.013$ in the modified model; $p = 0.071$ in the unmodified model). This consistency reinforces the conclusion that corporate digitalization systematically shapes how environmental disclosure translates into fiscal behavior. Similarly, the interaction between innovation culture and digital transformation, which is insignificant in the modified model, becomes significant and negative in the unmodified model. This suggests that the effect of the innovation–digital transformation interaction on tax avoidance is more detectable when tax avoidance measurements are not fully filtered for the non-discretionary BTM components. Overall, these findings indicate that the influence of innovation culture on tax behavior primarily operates through digitalization channels, although its effect is highly sensitive to the method used to measure tax avoidance (Badertscher et al., 2019).

Overall, the robustness tests indicate that although the significance of the direct effects of environmental disclosure and innovation culture may vary depending on the specific tax measurement used, the key findings regarding the role of interaction terms and control variables remain consistent. This suggests that the conclusions about the relationships between sustainability, digitalization, and tax avoidance are not artifacts of proxy selection but reflect a relatively stable empirical relationship, particularly in terms of interaction effects and firms’ fundamental economic characteristics.

CONCLUSION

This study examines the effects of environmental disclosure and innovation culture on tax avoidance, taking into account the role of digital transformation and validating the tax avoidance measurement using a modified approach (Badertscher et al., 2019). Using a sample of non-financial companies listed on the Indonesia Stock Exchange during 2023–2024, the main findings indicate that environmental disclosure has a significant negative effect on tax avoidance, whereas innovation culture does not have a significant impact. The moderation results indicate that digital transformation serves as a boundary condition, altering the effectiveness of environmental disclosure in curbing tax avoidance, although the interaction between innovation culture and digital transformation shows inconsistencies across specification tests. Robustness checks further reveal that decomposing BTM-based tax avoidance proxies into temporary differences by depreciation, temporary differences excluding depreciation, and fixed differences provides greater explanatory power than more aggregated models. Importantly, the

study's core findings, particularly regarding the role of interaction effects and fundamental economic determinants, remain consistent across specifications.

The theoretical implications of this study underscore the relevance of legitimacy theory and governance perspectives in explaining corporate tax behavior. More credible environmental disclosures enhance visibility and reputational pressure, thereby reducing tendencies toward tax avoidance, while digital capabilities can influence these relationships by expanding the scope of data-driven tax management. Practically, this implies that corporate management should integrate sustainability reporting and tax governance into a unified ESG–tax governance framework that includes strengthening internal tax controls, implementing responsible tax policies, and ensuring the accuracy of non-financial information to prevent inconsistencies between sustainability narratives and fiscal behavior. From a policy perspective, these findings highlight the need for more targeted, risk-based supervision of companies based on specific characteristic combinations, alongside enhanced synergy between sustainability reporting policies and digital tax administration. This approach ensures that non-financial transparency goes beyond formal compliance and promotes more accountable fiscal behavior.

This study has several limitations. First, the distribution of tax avoidance in the sample is generally low and clustered around zero, resulting in limited variation in aggressive tax avoidance behavior and potentially reducing the ability to detect the effects of certain non-financial variables. Second, the measurement of innovation culture relies on the presence of innovation-related terms in company documents, which reflects the intensity of narratives and communication signals rather than the actual output of observed innovations. Based on these limitations, future research is recommended to extend the time horizon to capture longer periods, allowing for a more robust analysis of long-term dynamics and lag effects. Additionally, subsequent studies should integrate text-based measures of innovation with output-based indicators.

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