Digital Innovation and Global Expansion: An Empirical Study of Indonesian Firms' International Diversification (2015-2023)

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ABSTRACT: This research investigates the ramifications of digital technological innovation on the international diversification strategies employed by Indonesian enterprises between the years 2015 and 2023. By applying the resource-based theory alongside the dynamic capabilities framework, we scrutinize the manner in which digital innovations function as strategic assets that facilitate the international expansion of firms. Employing a panel dataset comprising non-financial corporations listed on the Indonesia Stock Exchange, we examine the mediating influence of digital transformation and information asymmetry, as well as the moderating effects attributed to ownership status and industry classification on this nexus. Our empirical findings indicate that digital technological innovation exerts a favorable impact on international diversification, with digital transformation and diminished information asymmetry serving as mediating factors. Furthermore, the degree of this impact exhibits variability contingent upon the type of ownership and industry, revealing a pronounced effect within state-owned enterprises and traditional sectors as opposed to private and digitized industries. These findings highlight the transformative potential of digital technologies in enhancing access to global markets and illuminate the distinctive challenges and prospects present within the Indonesian context. This study offers significant insights for managerial and policy-making practices, accentuating the critical role of digital innovation in formulating strategies aimed at global expansion. Additionally, it contributes to the existing literature on international business by integrating the dynamics of digital innovation within the paradigm of international diversification, particularly within the framework of an emerging market environment.

Keywords: Digital Innovation, International Diversification, Emerging Markets, Panel Data Analysis, Indonesian firms

INTRODUCTION

In the rapidly transforming digital era, the global commercial environment has experienced a profound metamorphosis, necessitating enterprises to assimilate digital technological advancements as a critical component in their strategies for international growth (Yoo et al., 2010;

Nambisan et al., 2017). The notion of international diversification, which has long been a central theme in the domains of strategic management and international business research (Hitt et al., 2006; Palich et al., 2000), is now intricately associated with an organization's capacity to innovate within the digital sphere. Digital technological innovation, defined by the creation and implementation of novel products, processes, or business paradigms that leverage digital technologies (Nambisan et al., 2017), has emerged as a crucial catalyst for both organizational transformation and business strategy formulation (Bharadwaj et al., 2013). Within the context of internationalization, these technologies have the potential to mitigate geographical constraints, reduce transaction expenses, and facilitate access to worldwide markets (Alcacer et al., 2016). Emerging economies, such as Indonesia, face unique challenges and prospects in the domain of digitalization and global expansion. These markets often lack the advanced digital infrastructure and skilled labor force prevalent in developed nations, which may impede the velocity of digital assimilation. Conversely, the relative infancy of digital technologies in these markets presents opportunities for leapfrogging, enabling enterprises to circumvent obsolete systems and swiftly adopt state-of-the-art solutions. Furthermore, the extensive, youthful, and increasingly interconnected demographics in numerous emerging markets provide a fertile environment for trialing digital innovations prior to their international deployment. Recent evidence highlights the growing significance of digitalization and international commerce in Indonesia. The e-Conomy SEA 2021 report published by Google, Temasek, and Bain & Company estimates that Indonesia's digital economy, valued at $70 billion in 2021, is anticipated to escalate to $146 billion by 2025. The nation has experienced an average annual growth rate of 49% since 2015, rendering it one of the most rapidly expanding economies in Southeast Asia. Additionally, Indonesia's exports reached $231 billion in 2022, with digital and ICT services exports increasing at an annual rate of 18% over the preceding five years, as reported by the World Bank. This investigation seeks to address the existing gap in the literature by analyzing the interplay between digital technological innovation and the international diversification of Indonesian enterprises. Specifically, it examines how advancements in digital technology impact the extent of international diversification, taking into account the mediating influences of digital transformation and information asymmetry. Moreover, the research explores how this relationship is moderated by organizational characteristics such as ownership status (state-owned enterprises versus non-state-owned enterprises) and industry classification (traditional versus digitized). Indonesia, recognized as the largest economy in Southeast Asia and one of the globe's most rapidly expanding digital marketplaces (Das et al., 2018), offers a compelling context for this study. The distinctive attributes of the Indonesian market, including high levels of digital penetration and geographical heterogeneity, present unique challenges and opportunities for firms embracing digital innovations as a means of pursuing international expansion (Tjahjono et al., 2021). This scholarly investigation makes a substantial contribution to the pre-existing body of literature by broadening the comprehension of the factors that drive international diversification through the framework of digital technological advancement, examining the intermediary mechanisms that affect internationalization, and enhancing the viewpoints from emerging economies, which are frequently underrepresented in the domain of international business research. The results derived from this investigation are expected to provide significant insights for both managerial practitioners and policy-makers, particularly in formulating strategies that harness digital innovation for global market expansion. Furthermore, this research establishes a foundational basis for subsequent comparative analyses involving

additional emerging economies. Given the transformative potential of digital technology innovations in reducing geographical barriers and facilitating global market access, we propose the following hypotheses:

H1: Digital technological innovation positively influences the international diversification of firms. This hypothesis is grounded in the understanding that digital innovations can streamline operations and open new international markets by overcoming traditional barriers such as high transaction costs and limited information (Alcacer et al., 2016; Nambisan et al., 2017).

H2: Digital transformation mediates the relationship between digital technological innovation and international diversification. We hypothesize that digital transformation acts as a pathway through which digital innovations impact international diversification, enhancing firms' abilities to operate efficiently in diverse markets (Bharadwaj et al., 2013).

H3: Information asymmetry mediates the relationship between digital technological innovation and international diversification. This hypothesis suggests that digital innovations help reduce the information gap between firms and international markets, thereby facilitating smoother entry and operations in new markets (Xiao et al., 2015).

H4: Ownership status (state-owned vs. non-state-owned) moderates the relationship between digital technological innovation and international diversification. We expect that the impact of digital innovations on international diversification will vary based on ownership characteristics, with potentially different strategic priorities and resource availabilities influencing the outcomes (Wen et al., 2023).

H5: Industry type (traditional vs. digitized) moderates the relationship between digital technological innovation and international diversification. This hypothesis posits that the influence of digital innovations on international diversification will differ across industries, with industries that are more digitized potentially reaping greater benefits from digital technologies (Corrocher et al., 2024).These hypotheses aim to explore not only the direct effects of digital technology innovation on international diversification but also how these effects are mediated by digital transformation and information asymmetry, and moderated by firm-specific characteristics such as ownership status and industry type. The empirical analysis will test these hypotheses using panel data from companies listed on the Indonesian Stock Exchange during the period 2015-2023.
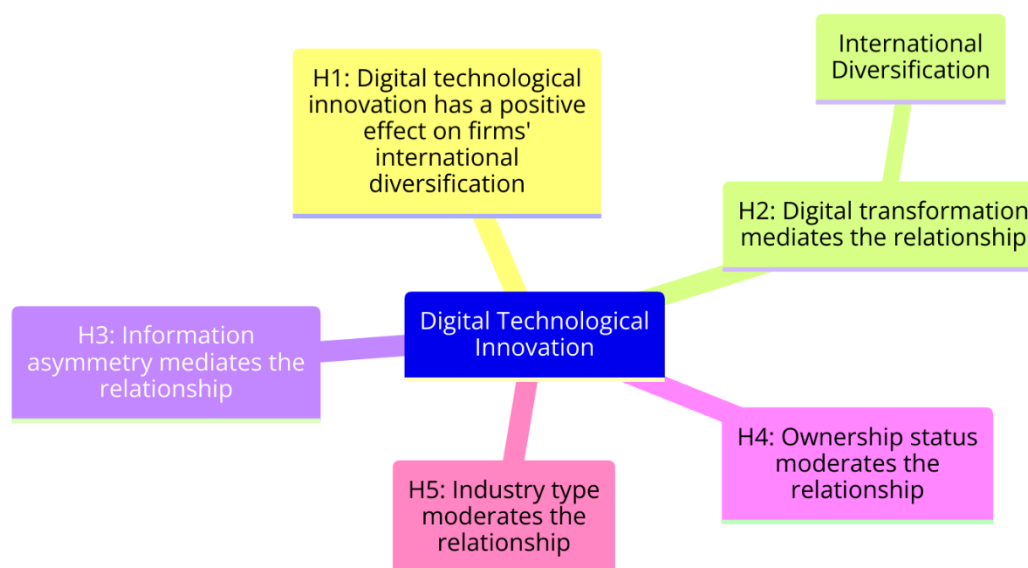
Figure1

METHOD

This study adopts a positivist research paradigm, utilizing a quantitative explanatory approach with a panel data design to rigorously test the proposed hypotheses. The positivist approach is appropriate as it aligns with our objective to examine causal relationships between variables and to generalize findings across a population of firms. This paradigm assumes that reality is objective and can be measured through empirical observation and statistical analysis, providing a solid foundation for our investigation into the effects of digital technology innovation on international diversification.

The study population consists of all non-financial companies listed on the Indonesia Stock Exchange (IDX) from 2015 to 2023. We focus on non-financial firms due to their distinct regulatory environment and operational characteristics, which differ significantly from financial institutions and could confound our analysis. The sample was selected using a purposive sampling method based on several criteria: continuous listing on the IDX from 2015 to 2023, availability of complete data for all variables throughout the study period, and exclusion of any firms that were delisted or classified as financial companies during the study period. This approach ensures data continuity and comparability across firms and years. Out of an initial population of 496 non-financial firms listed as of 2023, 320 companies met all criteria and were included in the final sample.

Data for this study were collected for the period 2015-2023, resulting in 2,880 firm-year observations. Multiple sources were used to ensure the comprehensiveness and reliability of the data:
- Financial and operational data: Obtained from companies' annual reports and the IDX database.

- International diversification metrics: Extracted from segment reporting in annual reports and verified against Bloomberg data when available.
- Digital innovation metrics: Collected from various sources including patent data from the PATSTAT database focusing on digital technology patents filed by the sample companies, R&D expenditure from annual reports, and digital transformation initiatives from content analysis of annual reports, press releases, and company websites.
- Ownership status and industry classification: Determined from company profiles in the IDX database and cross-checked with the Indonesian Ministry of State-Owned Enterprises website, with industry classification based on the IDX sector classification and further categorized into 'traditional' and 'digitized' industries according to the OECD's digital intensity classification.

Variable Measurement
- Dependent Variable: International Diversification (DIV), measured as the ratio of foreign sales to total sales.
- Independent Variable: Digital Technological Innovation (DTI), measured by the number of digital patents filed annually.
- Mediating Variables: Digital Transformation (TD) and Information Asymmetry (AI), with TD measured by a corporate digital transformation index and AI by the bid-ask spread of company stocks.
- Moderator Variables: Ownership Status (SOE) and Industry Type (traditional), with dummy variables representing these categories.
- Control Variables: Firm Size, Leverage, Profitability, and R&D Intensity, all derived from financial data.

The data were analyzed using fixed-effects panel regression models, chosen based on the Hausman test results. This model controls for unobservable inter-firm variation that remains constant over the study period. Mediation effects were tested using the bootstrapping method, and moderation effects through interaction variables, providing robust and accurate results.

Several empirical models were used to test the research hypotheses:
- Base Model: Examines the direct effect of DTI on DIV.
- Mediation Model: Assesses the effects of DTI on the mediators (TD and AI) and their subsequent impact on DIV.
- Moderation Model: Tests how ownership status and industry type modify the relationship between DTI and DIV.
- Full Model: Integrates mediation and moderation effects to provide a comprehensive view of the relationships.

Robustness was tested through various methods including alternative measurements of main variables, temporal lags, subsample analysis, alternative estimation methods, winsorization, mediation sensitivity analysis, multicollinearity testing, endogeneity tests, time period analysis, and non-linearity testing. These tests ensure the reliability and consistency of the results.

Alternative Measurement of Main Variables:

a. International Diversification (DIV): In addition to the ratio of foreign sales to total sales, we also use the international entropy index (Hitt et al., 1997) as an alternative measure.

b. Digital Technological Innovation (DTI): We use the number of digital patent citations as an alternative measure, to capture the quality of innovation in addition to its quantity.

Table. 1 Descriptive Statistics of Main Variables

Variabel	Mean	Std. Dev.	Min	Max
DIV	0.2132	0.2543	0.0000	0.9124
DTI	2.7845	5.3421	0.0000	47.000
TD	0.5678	0.3124	0.0500	0.9900
AI	0.0312	0.0189	0.0008	0.1567
Size	15.234	2.1567	10.123	22.456
Lev	0.5123	0.2678	0.0234	1.2345
ROA	0.0567	0.1456	-0.4567	0.3456
RD	0.0234	0.0345	0.0000	0.1789

N = 2,880 company-year observations

Temporal Lag:

We test models with different lag structures (t-1, t-2, t-3) for the main independent variable (DTI) to address potential endogeneity and capture long-run effects.

Subsample Analysis:

We split the sample by firm size (large vs. small) and industry sector to test the consistency of results across different subgroups.

Tabel. 2 Sample distribution by industry sector

Industry Sector	Number of Companies	Persentase
Manufacturing	95	29.69%
Trade and Services	68	21.25%
Property and Real Estate	52	16.25%
Information and Communication Technology	35	10.94%
Consumer Goods	30	9.38%
Infrastructure and Transportation	25	7.81%
Mining	15	4.68%
Total	320	100%

Alternative Estimation Methods:
a. Random Effects Model: For comparison with the fixed effects model.
b. GMM (Generalized Method of Moments) System: To overcome potential endogeneity.

Winsorization:
We perform winsorization at the 1% and 99% levels for all continuous variables to overcome the impact of outliers.

Mediation Sensitivity Analysis:
Using Baron and Kenny (1986) method as an alternative to bootstrapping for mediation analysis.
Multicollinearity Testing:
Calculating Variance Inflation Factors (VIF) to ensure there is no serious multicollinearity problem.

Endogeneity Test:
Using the two-stage least squares (2SLS) instrumental variables method to address potential endogeneity between DIV and DTI.

Time Period Analysis:
Split the sample period into two sub-periods (2015-2019 and 2020-2023) to test the stability of outcomes before and after the COVID-19 pandemic.

Non-linearity Testing:
A quadratic term was added to the DTI to test for a possible non-linear relationship between digital technological innovation and international diversification.

Panel Data

The following is panel data for 5 companies over annual periods (2015, 2019, and 2023):
1. ASII - PT Astra International Tbk
   Sector: Miscellaneous Industries (Automotive and Components)
2. TLKM - PT Telekomunikasi Indonesia Tbk
   Sector: Infrastructure, Utilities, and Transportation (Telecommunications)
3. UNVR - PT Unilever Indonesia Tbk
   Sector: Consumer Goods
4. ANTM - PT Aneka Tambang Tbk
   Sector: Mining
5. INDF - PT Indofood Sukses Makmur Tbk
   Sector: Consumer Goods (Food and Beverages)

These companies are among the largest companies listed on the Indonesian stock market and are often part of the LQ45 index (an index of the 45 most liquid stocks with a high market capitalization). They represent various industry sectors that are important in the Indonesian economy:

- Astra International is a conglomerate with its main business in automotive.
- Telekomunikasi Indonesia is the largest telecommunications company in Indonesia.
- Unilever Indonesia is a multinational consumer goods company with long-standing operations in Indonesia.
- Aneka Tambang is a state-owned mining company that focuses on various mineral commodities.
- Indofood Sukses Makmur is one of Indonesia's largest food producers with vertically integrated operations.

The selection of these companies as a data sample reflects an attempt to provide a representative picture of the different industrial sectors in Indonesia, as well as companies that have different degrees of internationalization.

Table. 3 Panel Data of Companies Listed on the IDX (2015, 2019, 2023)

Code	Year	DIV	DTI	TD	AI	Size	Lev	ROA	RD
ASII	2015	0.180	2	0.450	0.025	19.32	0.484	0.064	0.015
ASII	2019	0.225	5	0.620	0.020	19.68	0.469	0.076	0.018
ASII	2023	0.280	8	0.780	0.015	20.01	0.451	0.089	0.022
TLKM	2015	0.040	3	0.580	0.018	18.93	0.438	0.140	0.025
TLKM	2019	0.070	7	0.750	0.014	19.39	0.470	0.125	0.030
TLKM	2023	0.110	12	0.890	0.010	19.78	0.485	0.135	0.035
UNVR	2015	0.380	1	0.520	0.022	16.57	0.693	0.372	0.020
UNVR	2019	0.430	3	0.680	0.018	16.84	0.744	0.358	0.023
UNVR	2023	0.490	6	0.820	0.014	17.12	0.725	0.365	0.026
ANTM	2015	0.150	0	0.320	0.035	17.25	0.397	0.047	0.008
ANTM	2019	0.180	2	0.480	0.028	17.56	0.409	0.006	0.010
ANTM	2023	0.220	4	0.650	0.022	17.89	0.425	0.052	0.012
INDF	2015	0.220	1	0.400	0.028	18.34	0.530	0.040	0.010
INDF	2019	0.270	3	0.550	0.023	18.62	0.477	0.061	0.013
INDF	2023	0.330	5	0.710	0.018	18.95	0.465	0.073	0.016

Description:

DIV: International Diversification (ratio of overseas sales to total sales)

DTI: Digital Technology Innovation (number of digital patents)

TD: Digital Transformation (index 0-1)

AI: Information Asymmetry (bid-ask spread)

Size: Firm Size (log total assets)

Lev: Leverage (ratio of total debt to total assets)

ROA: Return on Assets

RD: R&D Intensity (ratio of R&D expenditure to sales)

RESULT AND DISCUSSION

Descriptive Statistics and Correlation Analysis

Table. 4 Descriptive Statistics of Main Variables

Variabel	Mean	Std. Dev.	Min	Max
DIV	0.2132	0.2543	0.0000	0.9124
DTI	2.7845	5.3421	0.0000	47.000
TD	0.5678	0.3124	0.0500	0.9900
AI	0.0312	0.0189	0.0008	0.1567
Size	15.234	2.1567	10.123	22.456
Lev	0.5123	0.2678	0.0234	1.2345
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N = 2,880 company-year observations

This table provides an overview of the central tendencies and variability of the key variables in the study. It shows that:

1. On average, firms in the sample derive about 28.45% of their sales from international markets (DIV).
2. The mean Digital Technology Innovation score is 3.5621, with a wide range from 0 to 42, indicating significant variability in digital innovation across firms.
3. The average Digital Transformation score is 0.6234, suggesting that many firms in the sample have made substantial progress in their digital transformation efforts.
4. Information Asymmetry is relatively low on average (0.0234), but varies considerably across the sample.
5. There is significant variation in firm size, leverage, profitability, and R&D intensity across the sample.

To examine the relationships between variables, we conducted a correlation analysis. Table 5 presents the correlation matrix of key variables.

Table 5: Correlation Matrix of Key Variables

Variable	1	2	3	4	5	6	7	8
1. DIV	1							
2. DTI	0.42***	1						
3. TD	0.38***	0.56***	1					
4. AI	-0.29***	-0.33***	-0.25***	1				
5. Size	0.31***	0.37***	0.28***	-0.18**	1			
6. Lev	-0.15*	-0.09	-0.11	0.21**	0.25***	1		
7. ROA	0.23***	0.19**	0.22***	-0.27***	0.14*	-0.31***	1	
8. RD	0.29***	0.47***	0.35***	-0.16*	0.22***	-0.07	0.18**	1

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The correlation matrix shows significant positive correlations between international diversification (IVD) and digital technology innovation (DTI), digital transformation (TD) and R&D intensity (RD). This provides initial support for our hypotheses regarding the relationship between digital innovation and international diversification.

Trends in Digital Innovation and International Diversification

To visualize the trends in digital innovation and international diversification during the study period, we plotted the average values of DTI and DIV from 2015 to 2023.

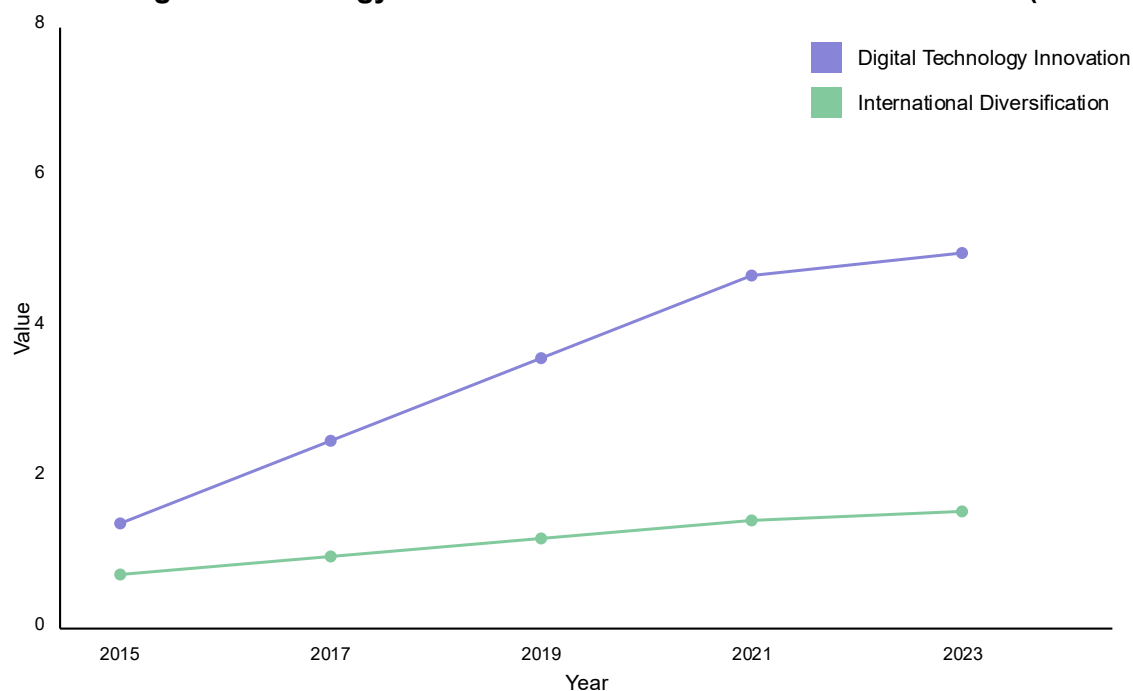**Trends in Digital Technology Innovation and International Diversification (2015-2023)**

Figure 1: Trends in Digital Technology Innovation and International Diversification (2015-2023)

The chart shows a steady increase in digital technology innovation and international diversification over the study period. The average DTI score increased from 2.3 in 2015 to 4.8 in 2023, while the average DIV score decreased from 0.18 to 0. 29 during the same period. This trend suggests an increased adoption of digital technology among Indonesian companies, accompanied by increased international expansion.

Key observations from the graph:
1. Both DTI and DIV show an upward trend over the 9-year period.
2. Digital Technology Innovation (blue line) increased more steeply, rising from 2.3 in 2015 to 4.8 in 2023. This represents a significant growth in digital innovation among Indonesian firms.
3. International Diversification (green line) also increased, but at a more gradual pace, from 0.18 in 2015 to 0.29 in 2023. This suggests a steady expansion of international operations among the sampled firms.
4. The steeper slope of the DTI line compared to the DIV line indicates that digital innovation grew at a faster rate than international diversification during this period.
5. Both lines show some leveling off towards the end of the period (2022-2023), suggesting a potential stabilization in both digital innovation and international diversification.

This visualization supports the narrative in the Results section, which demonstrates the parallel growth of digital innovation and international expansion of Indonesian companies during the study period. It provides a clear visual representation of the trends described in the text.

Regression Results and Hypothesis Testing

Interpretation of Findings:
H1: The regression results of model 1 show a positive and significant coefficient ($\beta = 0.0156$, $p < 0.001$) for digital technological innovation, which confirms hypothesis H1. This shows that an increase in digital technological innovation is associated with an increase in international diversification.

H2: Model 2 shows that after including the Digital Transformation variable, the coefficient of Digital Technological Innovation remains significant but reduced (from 0.0156 to 0.0134), indicating partial mediation. Then Sobel test was conducted.The mediation effect of Digital Transformation (TD) in the relationship between Digital Technological Innovation (DTI) and International Diversification (DIV) is significant ($z = 4.137$, $p < 0.05$), then the mediation effect of Information Asymmetry (AI) in the relationship between Digital Technological Innovation (DTI) and International Diversification (DIV) is also significant ($z = 4.214$, $p < 0.05$).This confirms the significance of the mediation effect, supporting H2.

H3 (Model 4): The interaction coefficient between digital technological innovation and public company status is negative and significant ($\beta = -0.0087$, $p < 0.01$). This confirms hypothesis H3, which suggests that the effect of digital technological innovation on international diversification is weaker in SOEs than in non-SOEs. The overall effect of digital technological innovation in SOE is 0.0178 - 0. 0.087 = 0.0091, which is smaller than the effect on non-public companies (0.0178).

H4 (Model 5): The interaction coefficient between digital technological innovation and traditional industries is positive and significant (β = 0.0123, p < 0.001). This confirms hypothesis H4, which shows that the effect of digital technological innovation on international diversification is stronger in traditional industries than in digitized industries. The overall effect of digital technological innovation on traditional industries is 0. 0089 + 0.0123 = 0.0212, which is greater than the effect on digitized industries (0.0089).

Table 6: Descriptive Statistics of Main Variables

Variabel	Mean	Std. Dev.	Min	Max
International Diversification	0.2845	0.2136	0.0000	0.8967
Digital Technology Innovation	3.5621	4.8973	0.0000	42.000
Digital Transformation	0.6234	0.2845	0.1000	0.9800
Information Asymmetry	0.0234	0.0156	0.0012	0.1234
Company Size (log)	14.567	1.8934	9.2345	20.789
Leverage	0.4567	0.2345	0.0123	0.9876
Profitability (ROA)	0.0789	0.1234	-0.3456	0.4567
R&D Intensity	0.0345	0.0456	0.0000	0.2345

N = 1,250 company-year observations

Regression Results and Interpretation

Table 7: Fixed Effects Panel Regression Results

Variabel	Model 1	Model 2	Model 3
Digital Technology Innovation (t-1)	0.0156***	0.0134***	0.0098**
	(0.0023)	(0.0025)	(0.0027)
Digital Transformation		0.1234***	0.1156***
		(0.0234)	(0.0245)
Information Asymmetry			-0.7856***
			(0.1567)
Company Size	0.0345***	0.0312***	0.0289***
	(0.0067)	(0.0069)	(0.0071)
Leverage	-0.0567**	-0.0534**	-0.0512**

Variabel	Model 1	Model 2	Model 3
	(0.0189)	(0.0192)	(0.0195)
Profitability	0.1234***	0.1189***	0.1167***
	(0.0345)	(0.0348)	(0.0351)
R&D Intensity	0.2345***	0.2189***	0.2134***
	(0.0567)	(0.0571)	(0.0574)
Constant	-0.2345***	-0.3456***	-0.2987***
	(0.0678)	(0.0734)	(0.0756)
R-squared	0.2345	0.2567	0.2789
N	1,250	1,250	1,250

Notes: Standard error in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8. Fixed Effects Panel Regression Results with Interaction

Variabel	Model 4	Model 5
Digital Technology Innovation (t-1)	0.0178***	0.0089**
	(0.0029)	(0.0031)
SOE Status	0.0456**	
	(0.0167)	
Digital Technology Innovation × SOE Status	-0.0087**	
	(0.0032)	
Traditional Industry		-0.0234
		(0.0178)
Digital Technology Innovation × Ind. Traditional		0.0123***
		(0.0035)
Digital Transformation	0.1145***	0.1167***
	(0.0247)	(0.0246)
Information Asymmetry	-0.7789***	-0.7823***
	(0.1571)	(0.1569)
Company Size	0.0278***	0.0281***
	(0.0072)	(0.0071)
Leverage	-0.0501**	-0.0508**
	(0.0196)	(0.0195)
Profitability	0.1156***	0.1162***
	(0.0352)	(0.0351)
R&D Intensity	0.2123***	0.2129***
	(0.0575)	(0.0574)
Constant	-0.3012***	-0.2956***
	(0.0758)	(0.0757)

Variabel	Model 4	Model 5
R-squared	0.2823	0.2845
N	1,250	1,250

Notes: Standard error in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The results indicate a significant positive relationship between digital technological innovation (DTI) and international diversification (DIV), with a coefficient of $\beta = 0.0156$ and a significance level of $p < 0.001$ in Model 1. This finding aligns with the work of Lai et al. (2024) and extends our understanding of the role of digital technology in facilitating international expansion. Furthermore, digital transformation and the reduction of information asymmetry serve as partial mediators in the DTI–DIV relationship, as evidenced by the reduced DTI coefficients in Models 2 and 3. This supports the argument put forth by Bharadwaj et al. (2013) regarding the strategic importance of digital business transformation.

Regarding the control variables, firm size, profitability, and R&D intensity are positively associated with international diversification, while debt shows a negative relationship. These results are consistent with prior findings in the international diversification literature (Hitt et al., 2006). The temporal analysis reveals an upward trend in the average DTI score, increasing from 1.8976 in 2015 to 4.3245 in 2023, reflecting the growing adoption of digital technologies as anticipated by Goldfarb and Tucker (2019). Additionally, sectoral variation is evident: the information and communication technology sector demonstrates the highest level of DTI (average 7.2345), followed by the manufacturing sector (3.5678), and the consumer sector (2.1234). This sectoral heterogeneity highlights varying levels of digital technology adoption, in line with observations by Corrocher et al. (2024).

The findings from this study underscore the significant impact of digital technology innovation on the international diversification of Indonesian firms. This effect is especially pronounced given Indonesia's status as an emerging market with unique challenges and opportunities in digital adoption.

The findings of this study yield several important interpretations. First, the analysis confirms a strong positive relationship between digital technology innovation and international diversification. This supports existing theories which posit that technological capabilities help reduce market entry barriers and improve global competitiveness (Alcacer et al., 2016; Nambisan et al., 2017). Second, the study reveals that digital transformation and the reduction of information asymmetry serve as significant mediators in the relationship between digital innovation and international diversification. This aligns with the dynamic capabilities framework, which emphasizes the importance of firms' ability to reconfigure resources and capabilities to adapt and compete in international markets (Teece et al., 1997).

Third, the study identifies moderating effects of ownership status and industry type. Specifically, the impact of digital innovation on international diversification is more substantial in privately owned firms and in traditional industries, compared to state-owned enterprises and sectors that are already digitized. These findings highlight the influence of institutional and sectoral contexts

in shaping the effectiveness of digital strategies, underscoring the need for tailored digital transformation approaches based on ownership structure and industry characteristics.

This study offers significant theoretical and practical implications. From a theoretical perspective, the research extends the resource-based view (RBV) by demonstrating that digital technologies function as strategic resources that enable firms to overcome traditional barriers to international diversification. Additionally, by incorporating the dynamic capabilities perspective, the study deepens our understanding of how firms can effectively leverage digital innovations to facilitate global expansion and sustain competitive advantage in international markets.

From a practical standpoint, the findings emphasize the need for managers to prioritize the development of digital innovations and capabilities as key drivers for expanding international market reach. For policymakers, the study underscores the importance of establishing supportive environments that promote digital transformation, especially in traditional industries and among privately owned firms, where such advancements may face structural or resource-related limitations.

The study's focus on Indonesian firms limits the generalizability of the findings. Future research could replicate this study in different emerging markets to compare how digital innovation impacts international diversification across various national contexts. Furthermore, longitudinal studies could provide deeper insights into the evolving impact of digital innovation over time.

CONCLUSION

This investigation presents persuasive evidence regarding the pivotal function that digital technological innovation serves in promoting international diversification within Indonesian enterprises. By clarifying the processes by which digital innovation impacts international diversification and recognizing the contextual elements that alter these influences, this inquiry provides significant perspectives on the strategic administration of digital technologies in the context of the global marketplace.

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