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What drives firms towards digital transformation adoption: evidence from Vietnam

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Abstract

Purpose – This study aims to identify factors affecting firms' adoption of digital transformation by examining firm- and macro-level factors.

Design/methodology/approach – A logistic regression model was employed to examine a sample of 618 listed firms on Vietnamese stock exchanges from 2012 to 2021.

Findings – The research results reveal that firm performance, size and age have significant positive impacts on digital transformation adoption (DTA), indicating that well-resourced and experienced firms are more inclined to embrace digital initiatives. In contrast, financial leverage and liquidity are significantly negatively related to DTA, suggesting that financial constraints or conservative financial strategies act as barriers. Both macroeconomic variables – GDP and inflation – exert a significant negative influence, highlighting the limits of economic growth in the absence of institutional support.

Research limitations/implications – The research suggests that firms should leverage strong performance and organisational maturity to drive digital investment, while recognising that liquidity alone does not ensure readiness without leadership and strategic focus. For policymakers, the results stress that fostering digital transformation requires more than GDP growth – it demands supportive institutions, incentives and national strategies.

Originality/value – This study offers an empirical analysis of digital transformation in Vietnam, an under-researched emerging economy. By combining firm-level financials and macroeconomic factors within a multi-theory framework, it reveals the novel finding that liquidity negatively relates to digital adoption – contradicting conventional wisdom. The research highlights how institutional voids and uncertainty hinder transformation, providing a localised yet generalisable model for other emerging markets.

Keywords Digital transformation, Drivers, Business strategy, Firm characteristics, Emerging market

Paper type Research article

1. Introduction

Under the Fourth Industrial Revolution, digital transformation has become an inevitable trend for nations and businesses worldwide. By enhancing internal information flows and

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automating processes, digital transformation strengthens competitiveness, revenue, labour productivity and customer engagement (Du and Jiang, 2022; Gaglio *et al*., 2022; Rashwan and Kassem, 2021; Truant *et al*., 2021; Zeng *et al*., 2022). Since 2020, awareness of its benefits has risen sharply, prompting industries such as banking, transportation, manufacturing, healthcare and retail to accelerate digital initiatives (Fujitsu Inc, 2019).

Academic interest in this topic has also grown rapidly, with numerous studies addressing technological and organisational dimensions of digital transformation (Mikalef and Parmiggiani, 2022; Nadkarni and Prügl, 2020; Rha and Lee, 2022). Research mainly focuses on two perspectives: technology and actors (Nadkarni and Prügl, 2020). The technology-oriented strand explores how digital tools affect customer experience, firm competitiveness and value creation, while the actor-oriented strand emphasises leadership and organisational capabilities. However, aspects such as company culture, work environment and integration speed remain underexplored (Nadkarni and Prügl, 2020).

Among major research branches, factors influencing firms' adoption of digital transformation receive extensive attention. Technology-centric studies highlight perceived ease of use, relative advantage, compatibility, trialability and security (Alyoussef and Al-Rahmi, 2022; Hsu and Lin, 2015; Saengavut and Jirasatthumb, 2021), while organisational studies emphasise IT knowledge, managerial support, employee resistance and resource constraints (Chouki *et al*., 2020; Wessels and Jokonya, 2022). However, most prior works assess financial resources only through leaders' perceptions or revenues, overlooking financial indicators such as profitability, leverage and liquidity. Similarly, environmental factors – mainly competition and regulation – have been examined, but broader macroeconomic variables like GDP growth and inflation remain underinvestigated (Chouki *et al*., 2020; Hsu and Lin, 2015; Wessels and Jokonya, 2022). Notably, research from developing economies is still limited despite significant disparities in infrastructure, policy and readiness (Matthess and Kunkel, 2020).

In Vietnam, recent studies have explored qualitative determinants of firms' digital transformation (Chu, 2021; Nguyen and Nguyen, 2022; Le and Ha, 2023; Nguyen, 2023, 2024), identifying key drivers such as government policy, leadership, employee capacity, business culture and technology platforms. Employees' capacity and technology platform were observed to be the most crucial determinants in the studies by Nguyen and Nguyen (2022) and Nguyen (2023), while legal regulations and government support policy, business information security and the digitisation process; business digital transformation strategy was highlighted as significant ones in the study by Chu (2021). Other studies either examined the impact of perceived usefulness and perceived ease of use on the technology acceptance of firms (Nguyen, 2024) or applied the TOE framework with digital and entrepreneurial orientation to explicate digital transformation acceptance across retailing enterprises (Le and Ha, 2023) or investigate the perception of digital transformation effect on audit quality (Tran and Hoang, 2021). However, most of these studies have overlooked quantitative financial and economic factors. Thus, to fill this research gap, this study examines how firm-level and macroeconomic variables influence DTA among Vietnamese listed firms.

Using a quantitative method, the research covers 618 listed firms on the Ho Chi Minh City and Hanoi Stock Exchanges from 2012 to 2021 (6,180 observations). The model integrates micro-level variables such as firm performance, size, age, leverage, liquidity and growth with macro-level factors such as GDP growth and inflation. A logistic regression framework is applied to identify the determinants driving DTA. This study contributes to the literature by extending the analysis of quantitative drivers to a developing context and offering policy insights to foster enterprise participation in digital transformation.

The remainder of the study is structured as follows. Section 2 provides a brief review of relevant literature on factors affecting firms' choice towards DTA. Section 3 summarises the research methodology used in the study. Section 4 discusses research results. Finally, section 5 concludes the study.

2. Literature review on factors affecting firms' choice towards digital transformation

2.1 Firm performance and firms' digital transformation adoption

Much research has been conducted into the impact of digital transformation on firm performance. However, scholars have rarely focused on the reverse relationship in which firm performance drives digital transformation. A company's performance can be broadly classified as financial and non-financial (Schnedler, 2004). In the scholarly field of digital transformation, however, academics concentrate primarily on firm financial performance, which is typically measured by return on assets (ROA), return on equity (ROE) and profits (Jardak and Ben Hamad, 2022; Kharlamov and Parry, 2020; Li *et al*., 2019; Zeng *et al*., 2022; Zhai *et al*., 2022). Most of these studies conclude that digital transformation enhances firms' long-term financial performance. Companies undergoing digital transformation may encounter short-term financial challenges that have a negative impact on ROA and ROE, but in the long run, they can maximise performance and boost market value (Kharlamov and Parry, 2020; Zeng *et al*., 2022; Zhai *et al*., 2022). Increasing total productivity is a potential mechanism through which digital transformation enhances firm financial performance (Zeng *et al*., 2022). Notably, a company's performance increases due to lower costs, higher operational efficiency, and tremendous innovation success (Zhai *et al*., 2022). Furthermore, the resource-based view (RBV) argues that firms with superior financial performance possess critical resources (e.g., capital, expertise) that enable them to invest in digital transformation (Barney, 1991; Wernerfelt, 1984). In addition, from the perspective of the dynamic capabilities theory, these firms are likely to have developed the ability to adapt and reconfigure operations in response to environmental shifts (Teece *et al*., 1997). Thus, our hypothesis is as follows:

H1. Firm financial performance is positively related to a firm's adopting digital transformation.

2.2 Firm size and firms' digital transformation adoption

It is widely believed that a company's competitiveness, market presence and internal procedures (such as formalisation, controls or decision-making processes) are proportionate to its size (Abatecola *et al*., 2012; BarNir *et al*., 2003). Consequently, leaders must always consider the company's size before making decisions, including implementing technical solutions. Across all industries and fields, most research has discovered a correlation between larger company size and the use of digital tools. After that, larger organisations are more likely to invest in digitalisation, maybe due to their more significant financial and human resources (Gaglio *et al*., 2022; Gupta and Bose, 2022; Truant *et al*., 2021; Zeng *et al*., 2022). Despite this, scholarly research indicates that firm size has minimal influence on their inclination to adopt technology (such as telecommunications, cloud services and software-as-a-service) in their operations (Benlian *et al*., 2009; Grover and Goslar, 2015; Hsu and Lin, 2015). Nonetheless, under the RBV, large firms typically have more tangible and intangible resources, such as advanced IT infrastructure, skilled labor and larger budgets, which facilitate DT adoption (Barney, 1991). Moreover, the technology-organisation-environment (TOE) framework suggests that firm size reflects organizational readiness – a key factor in technology adoption (Tornatzky and Fleischer, 1990). The prevailing theories and empirical studies present the following hypothesis.

H2. Firm size is positively associated with a firm's adopting digital transformation.

2.3 Firm age and firms' digital transformation adoption

Age, like size, influences how organisations operate and has ramifications for their competitive strategy (Abatecola *et al*., 2012; BarNir *et al*., 2003). The duration of a company's existence is frequently used as a proxy for its market credibility, the quality of its relationships and alliances, its ability to weather economic storm, and the prevalence of its internal procedures. Consequently, the limitations of new organisations include a lack of brand

recognition and economies of scale, as well as a scarcity of collaborations with established enterprises that could assist them in raising the capital they need to enter the market. Another disadvantage of new companies is that they frequently lack the internal structures that permit the formation of defined roles, the establishment of internal control and organisation, and the establishment of a generally efficient system of operation and organisation. Start-ups are, thus, less likely to be exposed to cutting-edge technologies and business methods, making it easier for them to embrace them when they become available. Additionally, due to their limited resources (such as financial capital, human capital and internal capabilities), new businesses may have trouble adopting and integrating digital technologies (Abatecola *et al*., 2012; BarNir *et al*., 2003). Older firms are likely to possess accumulated experience, established processes and reputational capital. According to the dynamic capabilities theory, such firms may be better positioned to reconfigure existing routines and adopt digital transformation (Teece *et al*., 1997). In the RBV perspective, longevity may imply access to stable financial and relational resources that support innovation. Therefore, this research proposes the following hypothesis:

H3. Firm age is positively associated with a firm's adopting digital transformation.

2.4 Financial leverage and firms' digital transformation adoption

Although financial leverage is rarely examined by academics studying the tendency of businesses to adopt digital technology, there is evidence of its influence. The degree of debt incurred by a corporation is inversely proportional to the extent of its technology integration (Diamond, 1984; Majumdar, 2016; O'Brien, 2003; Zeng *et al*., 2022). The impact of financial leverage is asserted to be both direct and indirect via the monitoring aspect and the role of collateral. For instance, if businesses obtain loans from banks and other financial intermediaries, these entities may have access to a company's entire investment history. A more effective monitoring system, provided by improved data, allows these lenders to prevent the jeopardisation of debt (Diamond, 1984); consequently, businesses are constrained in their strategic decision-making (such as whether to embrace digital transformation). If lenders cannot monitor a company's collateral asset base, they may limit its capacity to spend freely on technology rollout projects. Such loan contracts may be restrictive and inhibit strategic and operational mobility (O'Brien, 2003).

With rising change and unpredictability in the corporate environment, the risks of making significant discretionary investments in technology may increase, leading to more stringent contractual conditions. If obliged to sign one of these contracts, borrowing corporations may find it difficult or impossible to establish new non-verifiable assets. Therefore, companies with a high financial leverage ratio may be hesitant or unable to adopt technology proactively. According to the Pecking Order Theory (Myers and Majluf, 1984), highly leveraged firms prefer low-risk projects due to financial constraints and higher bankruptcy risks. Digital transformation initiatives often require long-term, high-risk investments, making them less attractive to firms with high debt levels. Thus, financial leverage can serve as a barrier to innovation, as firms prioritise solvency over transformation. Our study, therefore, proposes the following hypothesis:

H4. Financial leverage is negatively associated with a firm's adopting digital transformation.

2.5 Firm liquidity and firms' digital transformation adoption

In the digital transformation literature, the impact of liquidity on firms' tendency to adopt digital technology has received limited attention. Under the RBV, firms with higher liquidity have greater access to internal financial resources, enabling them to invest in strategic initiatives like digital transformation (Barney, 1991). In theory, this should enhance a firm's capacity to fund digital technologies without relying on external financing. According to

Falato *et al*. (2022), there are restrictions on utilising intangible assets such as trademarks and patents as collateral when seeking external finance. Therefore, firms must accumulate financial reserves to ensure sufficient internal resources to finance digital transformation expenditures. Criscuolo (2021) reached a similar finding, noting that liquidity-challenged and lagging enterprises were less likely to acquire cutting-edge digital technology or strive for increased integration of digital technologies in the pre-pandemic and post-pandemic phases of coronavirus disease 2019 (COVID-19). Against this literature background, the following hypothesis is proposed:

H5. Liquidity is positively associated with a firm's adopting digital transformation.

2.6 Firm growth rate and firms' digital transformation adoption

Analyses evaluating the impact of digital transformation on firm growth (rate) yielded similar findings (Jardak and Ben Hamad, 2022; Yao *et al*., 2023). However, earlier research on digital transformation has ignored the possibility that the growth rate may drive digital transformation itself. In other words, the relationship between firm growth rate and digital transformation may be more reciprocal than previously believed since a company's readiness to adopt digital transformation is believed to be directly proportional to its size and capabilities (Gaglio *et al*., 2022; Gupta and Bose, 2022; Truant *et al*., 2021; Zeng *et al*., 2022), which in turn reflect its financial performance and growth. Growth rate reflects a firm's momentum and strategic ambition. Firms experiencing high growth are more likely to explore new technologies to sustain and scale their operations, aligning with the dynamic capabilities theory (Teece *et al*., 1997). Furthermore, high-growth firms may exhibit an entrepreneurial orientation, enhancing their willingness to engage in digital transformation as a competitive strategy. As a result, the following hypothesis is put forward:

H6. Growth rate is positively related to a firm's adopting digital transformation.

2.7 GDP and firms' digital transformation adoption

In the Institutional Theory context, a rising GDP typically implies better infrastructure, more innovation incentives, and government support – factors that influence organisational behaviour (DiMaggio and Powell, 1983). Previous studies also suggest digital transformation can have far-reaching effects on national GDP and usher in a new era of business productivity (Agrawal *et al*., 2019; Mićić, 2017). However, discussions concerning the significance of national GDP as a contextual component in digital transformation have emerged in recent years. Švarc *et al.* (2020) propose a new paradigm suggesting several connections between a country's economic growth rate and its technological use and acceptability level. In this notion, countries with a higher GDP are expected to have a greater propensity to embrace digital transformation due to their greater economic competence and greater access to resources, both of which promote the deployment of disruptive technologies. Other researchers into the variables that drive the expansion of digital transformation, such as (Kim and Peterson, 2017; Cavalcanti *et al*., 2022), concur with this evaluation. This lends credence to the premise that a rising GDP encourages companies to embrace digital transformation. Consequently, our study proposes the following hypothesis:

H7. GDP growth rate is positively associated with a firm's adopting digital transformation.

2.8 Inflation rate and firms' digital transformation adoption

As with GDP growth rate, inflation rate is a contextual macro component that has been implausibly asserted to influence digital transformation. However, the outcomes are not

always consistent in practice. On the one hand, it is widely considered that inflation has a negative effect on the rate at which organisations adopt digital transformation. Given that digital transformation requires resources such as money, time, and human capital and that rising inflation and accompanying cost limitations could drive firms to reduce their commitment to these programs, it is apparent why this would be the case. As funding for research and development (R&D) decreases, the rate of technological progress slows (Rocha *et al*., 2021). In instances of rising inflation, however, policymakers are more likely to create programs to assist digital transformation, accelerating the digital transformation rate among firms. Digital transformation primarily affects general inflation rates through the prices of information and communication technology (ICT) products and services, market structure and competitiveness in selected industries, and productivity and labour demand (European Central Bank, 2021; Zhang *et al*., 2022). Nevertheless, high inflation increases cost uncertainty and financial pressure, causing firms to delay or avoid long-term investments like digital transformation. From the TOE framework, inflation is an unfavourable environmental factor that reduces adoption probability. Institutional theory also supports that in volatile economies, firms behave conservatively to avoid risk. Our research proposes the hypothesis as follows:

H8. Inflation rate is negatively associated with a firm's adoption of digital transformation.

3. Research methodology

3.1 Data collection and research methodology

The data used in the study were panel data collected from different sources. The independent firm-level variables were taken from the financial statements of listed firms on the two Vietnam stock exchanges – Ho Chi Minh Stock Exchange (HOSE) and Hanoi Stock Exchange (HNX) in the period from 2012 to 2021 through the database of FiinPro and VietstockFinance platforms. The study focuses on the period 2012–2021 because this decade represents the formative stage of Vietnam's digital transformation journey. The year 2012 marks the onset of measurable digital adoption following major ICT policy initiatives and expanding internet penetration. The endpoint, 2021, marks the culmination of early digital transformation efforts and the acceleration triggered by COVID-19, while ensuring data consistency before post-pandemic structural policy shifts under the National Digital Transformation Program (Decision No. 749/QĐ-TTg, 2020). Limiting the analysis to this period thus provides a coherent and comprehensive window for assessing firm-level determinants of digital transformation in Vietnam. The initial sample included 774 listed firms on HOSE and HNX. However, after filtering the firms that had been operating for 10 years or more as of December 31, 2021, to ensure the sample size is large enough for significant statistical inferences and excluding financial intermediaries due to a different nature from the rest, the final sample includes 618 firms from 2012 to 2021, which makes 6,180 observations in total. The other two macro independent variables included in this research were collected from the World Bank website. The dependent variable – DTA is a dummy variable that takes the value of 1 if firms are engaged in the digital transformation process and 0 otherwise. This variable was manually collected from the published annual reports of 618 listed firms. The data collection process of this dependent variable is described in detail in Section 3.2. A quantitative research method was employed in this study. The logit model was used to examine what drives firms towards digital transformation. STATA 14 was used to process the data and run the model.

3.2 Variables measurement

Table 1 summarises the construction of dependent and independent variables and the expected correlations between them based on the hypotheses in Section 2. The dependent variable, digital transformation, was manually collected and conceptualised through three progressive stages: digitisation, digitalisation and digital transformation.

Table 1. Variables construction

No.	Variables	Code	Measurements	Expected sign	References
1	Digital transformation adoption	DTA	Takes 1 if firms exercise digital transformation and 0 if not		
2	Firm performance	FP	ROA (Net income/Total assets) Or ROE (Net income/Total equity)	+	
3	Firm size	SIZE	Ln(Total assets)	+	Gaglio *et al*. (2022), Gupta and Bose (2022), Truant *et al*. (2021), Zeng *et al*. (2022)
4	Firm age	AGE	Ln(No of operating years)	+	Abatecola *et al*. (2012), BarNir *et al*. (2003)
5	Leverage	LEV	Total Debt/Total Assets	–	Diamond (1984), Majumdar (2016), O'Brien (2003), Zeng *et al*. (2022)
6	Liquidity	LIQ	Current assets/Current liabilities	+	Falato *et al*. (2022), Criscuolo (2021)
7	Growth rate	GROW	$(Revenue_t - Revenue_{(t-1)})/Revenue_{(t-1)}$	+	
8	Gross domestic product	GDP	–	+	Agrawal *et al*. (2019), Mićić (2017), Kim and Peterson (2017), Cavalcanti *et al*. (2022)
9	Inflation rate	INFLA	–	+	European Central Bank (2021), Zhang *et al*. (2022)

Source(s): Authors' compilation

In the first stage, digitisation refers to converting analogue information (text, images and sound) into digital form using binary encoding (0–1). This process enables efficient storage and analysis, representing a fundamental transformation of data from physical to digital form. The second stage, digitalisation, involves applying digital technologies to redesign business models and processes. It emphasises creativity – using digitised data to improve operations, employee efficiency and customer experience. The final stage, digital transformation, entails a systemic, enterprise-wide change integrating digital capabilities, culture and strategy. Its essence is a comprehensive transformation from leadership to all functional levels.

Following prior studies (Sousa-Zomer *et al*., 2020; Guo and Xu, 2021), firm-level data on digital transformation were manually extracted from the annual reports of 618 listed Vietnamese firms from 2012 to 2021. Annual reports were reviewed for keywords related to the three stages—digitisation, digitalisation and digital transformation – since major strategic initiatives must be publicly disclosed to stakeholders. A dummy variable was created: it equals 1 if a firm has initiated digital adoption, digitalisation or transformation, and 0 otherwise. This measure captures whether a listed firm has adopted digital transformation, not its intensity or depth. The independent variables include five firm-level factors – firm performance (FP), size (SIZE), age (AGE), financial leverage (LEV), liquidity (LIQ) and growth rate (GROW) – and two macroeconomic indicators: GDP growth and inflation rate (see Table 1).

3.3 Empirical model

Because DTA is represented as a binary variable, a logit model is the most appropriate estimation technique. Unlike linear regression, which assumes a continuous dependent

variable, the logit model accounts for the discrete nature of the outcome and ensures predicted probabilities remain between 0 and 1. This makes it well-suited for empirically identifying the firm- and macro-level factors influencing DTA. Therefore, our study employed a logit model, applied to panel data and was built up from a density function as follows:

$$f(y_{it}|x_{it},\theta) = \Lambda(x_{it},\theta)^{y_{it}\cdot}\left(1-\Lambda(x_{it},\theta)\right)^{1-y_{it}}$$

where: y_{it} is the binary dependent variable that measure firms' DTA which takes value of 1 if firm engaged in digital transformation and 0 otherwise; x_{it} contains the seven independent variables that affect firms' DTA including: firm performance (FP), measured by either ROA (Net income/Total assets) as Model 1 or ROE (Net income/Total equity) as Model 2; firm size (SIZE), measured by ln(Total assets); firm age (AGE), measured by ln(number of operating years); financial leverage (LEV), measured by Total debt/Total assets; liquidity (LIQ), measured by Current assets/Current liabilities; growth rate (GROW), measured by $(Revenue_t - Revenue_{(t-1)})/Revenue_{(t-1)}$; Gross Domestic Product (GDP) and inflation rate (INFLA) of Vietnam; i and t represents firm and time, respectively.

4. Research results

4.1 Descriptive statistics

Table 2 summarises the descriptive statistics of the study. DTA has the mean value of 0.244 with a slight standard deviation of 0.429. However, under 75 percentile, DTA of firms takes the value of 0, which means that among 618 listed firms, under 25 percentiles of firms adopt digital transformation, which is quite modest a number.

To explore firms' adoption of digital transformation further, descriptive statistics of digital transformation were analysed from the perspectives of mean values of the whole sample by year and mean values of firms' digital transformation by industry. The tendency of digital transformation started in 2012 at a low mean value of 0.146 and gradually increased from 2012 to 2021. From 2017, DTA began to leverage to 0.231, reaching the mean value of 0.383 in 2021. Although this value remains quite conservative, it documents the accelerating adoption of digital transformation of listed firms in Vietnam year by year (see Table 3).

Table 2. Descriptive statistics

	N	Mean	Std. dev.	p25	p50	p75
DTA	6,180	0.244	0.429	0	0	0
FP (ROA)	6,180	0.058	0.055	0.015	0.045	0.089
FP (ROE)	6,180	0.117	0.098	0.041	0.103	0.174
SIZE	6,180	11.891	0.695	11.403	11.856	12.321
AGE	6,180	1.329	0.280	1.146	1.342	1.556
LEV	6,180	0.483	0.226	0.309	0.503	0.664
LIQ	6,180	2.326	2.087	1.136	1.524	2.533
GRO	6,180	0.105	0.359	−0.096	0.062	0.218
GDP	6,180	5.591	1.543	5.200	6.097	6.812
INF	6,180	3.081	2.482	1.293	2.599	4.086

Note(s): DTA is digital transformation choice which takes value of 1 if firm engaged in digital transformation and 0 otherwise; FP is firm performance, measured by either ROA (Net income/Total assets) or ROE (Net income/Total equity); SIZE is firm size, measured by ln(Total assets); AGE is firm age, measured by ln(number of operating years); LEV is financial leverage, measured by Total debt/Total assets; LIQ is liquidity, measured by Current assets/Current liabilities; GROW is growth rate, measured by $(Revenue_t - Revenue_{(t-1)})/Revenue_{(t-1)}$; GDP is Gross Domestic Product and INFLA is the inflation rate of Vietnam

Source(s): Authors' estimation

Table 3. Descriptive statistics of firms' digital transformation adoption by year

Year	No. of firms	Mean
2012	618	0.146
2013	618	0.155
2014	618	0.167
2015	618	0.179
2016	618	0.199
2017	618	0.231
2018	618	0.291
2019	618	0.325
2020	618	0.358
2021	618	0.383

Source(s): Authors' estimation

Table 4 represents firms' adoption of digital transformation by industry. The industrial goods and services, automobile and parts industries have minimal engagement in digital transformation. Media, Real estate, and Retail industries have the lowest mean values of DTA of 0.103, 0.165 and 0.195, respectively. Other industries, including Basic resources, Chemicals, Construction and materials, Food and beverage, Industrial goods and services, Oil and gas, Personal and household goods, and Utilities and energy, share similar DTA rates around the mean values of 0.2–0.3. The highest adoption of digital transformation is found in industries such as Finance and insurance, healthcare, Information technology, and Travel and leisure, with the Information technology industry having the highest mean value of 0.68.

Table 5 presents the correlation between variables. It can be seen that firm performance positively impacts firms' adoption of digital transformation. Other factors contributing positively to firms' adoption of digital transformation are firm size and firm age. However, firm liquidity, GDP, and inflation rate have been documented to have a negative impact on firms' adoption of digital transformation. Among all the firm-level and macro factors in the model, firm size seems to have the most significant impact on DTA. This result implies that big firms tend to adopt digital transformation more than small firms.

Table 4. Descriptive statistics of firms' digital transformation adoption by industry

Industry	Mean	SD
Industrial goods and services	0	0
Automobiles and parts	0	0
Basic resources	0.213	0.410
Chemicals	0.260	0.439
Construction and materials	0.227	0.419
Finance and insurance	0.443	0.497
Food and beverage	0.269	0.444
Health care	0.420	0.495
Industrial goods and services	0.224	0.417
Information technology	0.680	0.471
Media	0.103	0.304
Oil and gas	0.320	0.471
Personal and household goods	0.227	0.421
Real estate	0.165	0.371
Retail	0.195	0.396
Travel and leisure	0.443	0.500
Utilities and energy	0.299	0.458

Source(s): Authors' estimation

Table 5. Variables correlation

Variables	DTA	FP (ROA)	FP (ROE)	SIZE	AGE	LEV	LIQ	GRO	GDP	INF
DTA	1.000									
FP (ROA)	0.088*	1.000								
FP (ROE)	0.091*	0.867*	1.000							
SIZE	0.319*	−0.060*	0.077*	1.000						
AGE	0.076*	0.085*	0.093*	0.073*	1.000					
LEV	0.026	−0.390*	−0.022	0.329*	0.093*	1.000				
LIQ	−0.049*	0.162*	−0.018	−0.199*	−0.100*	−0.575*	1.000			
GRO	0.031	0.135*	0.193*	0.091*	−0.158*	0.074*	−0.034*	1.000		
GDP	−0.095*	0.063*	0.080*	−0.044*	−0.079*	−0.001	0.002	0.068*	1.000	
INF	−0.091*	−0.022	−0.005	−0.095*	−0.165*	0.040*	−0.056*	−0.010	0.034*	1.000

Note(s): * signifies a level of significance at 1%. DTA is digital transformation adoption which takes value of 1 if firm engaged in digital transformation and 0 otherwise; FP is firm performance, measured by either ROA (Net income/Total assets) or ROE (Net income/Total equity); SIZE is firm size, measured by ln(Total assets); AGE is firm age, measured by ln(number of operating years); LEV is financial leverage, measured by Total debt/Total assets; LIQ is liquidity, measured by Current assets/Current liabilities; GROW is growth rate, measured by $(\text{Revenue}_t - \text{Revenue}_{(t-1)})/\text{Revenue}_{(t-1)}$; GDP is Gross Domestic Product and INFLA is the inflation rate of Vietnam

Source(s): Authors' estimation

4.2 Robustness check

To test the linearity assumption, two moments, including skewness and kurtosis of variables, were tested. Variables such as ROA, ROE, liquidity and growth rate were winsorised at 5% to ensure linearity. Other assumptions regarding multicollinearity, heteroskedasticity and autocorrelation were also tested. The results show that multicollinearity is not present in the model since the VIFs are evident to be below 5. In addition, correlations between independent variables are shown to be below ±0.85 (see Table 5). In terms of heteroskedasticity, robust Huber–White sandwich standard errors were used to ensure homoskedasticity. In addition, autocorrelation is not an issue in our model. Empirical studies suggest that leverage can be influenced by firm-specific characteristics, implying that leverage may be an endogenous explanatory variable. To verify this, we conducted a residual-based endogeneity test (Wooldridge, 2010), which confirmed that leverage is indeed endogenous. To address this issue and improve the robustness of our findings, Models 3 and 4 adopt a control-function approach. In the first stage, leverage was regressed on the set of explanatory variables (ROA/ROE, firm size, age, liquidity and growth rate). In the second stage, the residuals from this regression were then predicted and incorporated into the logit models (Models 3 and 4). The results remain consistent with those of Models 1 and 2 (see Table 6), supporting the robustness of our baseline conclusions.

Table 6. Logistic regression results (whole sample)

Variables	Model 1 (M1-ROA)	Model 2 (M2-ROE)	Model 3 (M1 controls for endogeneity)	Model 4 (M2 controls for endogeneity)
FP (ROA)	4.395***		8.076***	
	(0.657)		(1.764)	
FP (ROE)		1.802***		1.997**
		(0.331)		(0.899)
SIZE	1.200***	1.199***	0.213	−6.426***
	(0.052)	(0.052)	(0.447)	1.167
AGE	0.378***	0.425***	−0.063	0.722***
	(0.123)	(0.121)	(0.239)	(0.133)
LEV	−0.715***	−1.188***	−11.398***	−6.426***
	(0.185)	(0.167)	(6.344)	(1.167)
LIQ	−0.053**	−0.058***	0.733**	−0.360***
	(0.019)	(0.019)	(0.353)	(0.071)
GRO	0.012	0.031	−0.451**	0.388***
	(0.092)	(0.091)	(0.228)	(0.120)
GDP	−0.12***	−0.119***	−0.119***	−0.119***
	(0.020)	(0.020)	(0.020)	(0.020)
INF	−0.057***	−0.056***	−0.57***	−0.057***
	(0.014)	(0.014)	(0.014)	(0.014)
residual			−11.744***	6.080***
			(6.187)	(1.328)
Constant	−15.031***	−14.803***		
No of obs	6,180	6,180	6,180	6,180
Pseudo *R*-squared	0.119	0.117	0.119	0.119
Akaike crit. (AIC)	6064.404	6079.310	6061.764	6061.764
Bayesian crit. (BIC)	6124.966	6139.872	6129.054	6129.054

Note(s): ***$p < 0.01$, **$p < 0.05$. Standard errors are presented in the parentheses. DTA is digital transformation adoption, which equals 1 if the firm engaged in digital transformation and 0 otherwise; FP is firm performance, measured by either ROA or ROE; SIZE is firm size; AGE is firm age; LEV is financial leverage; LIQ is liquidity; GROW is growth rate; GDP is Gross Domestic Product and INFLA is the inflation rate of Vietnam

Source(s): Authors' estimation

4.3 Research results discussion

Table 6 provides the logistic regression results for two models with different measurements of firm performance (ROA and ROE) for the whole sample, while Table 7 divided the whole sample into two subsamples, including samples of the Ho Chi Minh stock exchange (HOSE) and the Hanoi stock exchange (HNX). Model 1 used ROA to measure firm performance, while Model 2 employed ROE to measure firm performance. However, despite the different measurements, the results share similarities. Models 3 and 4 address potential endogeneity concerns, and their results are largely consistent with those from Models 1 and 2. Nevertheless, because some of the instrumental variables used to determine leverage overlap with explanatory variables in the baseline models, the estimated coefficients of leverage display relatively high standard errors. In addition, when alternative proxies for firm performance are employed, Models 3 and 4 yield some contradicting findings – for example, in the cases of liquidity and growth rate – compared with Models 1 and 2. Despite these variations, our final conclusions rely on the most recurrent and consistent results across different specifications, thereby reinforcing the robustness of the empirical findings.

Firm performance is proven to significantly and positively impact DTA at a 1% significance level consistently in the whole sample and the two subsample results. This finding supports our hypothesis in which our study inferred that firm performance may act as one of the key motivations for firms to adopt digital transformation. Although some firms might be

Table 7. Logistic regression results (by exchanges)

Variables	Model 1 (HOSE)	Model 1 (HNX)	Model 2 (HOSE)	Model 2 (HNX)
FP (ROA)	3.727***	5.101***		
	(0.947)	(0.940)		
FP (ROE)			1.546***	2.137***
			(0.457)	(0.487)
SIZE	1.225***	1.296***	1.226***	1.283***
	(0.073)	(0.084)	(0.073)	(0.083)
AGE	−0.200	0.731***	−0.182	0.820***
	(0.168)	(0.187)	(0.167)	(0.182)
LEV	−0.549**	−0.948**	−0.972***	−1.455***
	(0.185)	(0.258)	(0.234)	(0.240)
LIQ	−0.020	−0.093***	−0.025	−0.098***
	(0.025)	(0.029)	(0.025)	(0.028)
GRO	0.100	−0.151	0.115	−0.131
	(0.123)	(0.143)	(0.122)	(0.141)
GDP	−0.14***	−0.101***	−0.139***	−0.100***
	(0.028)	(0.029)	(0.028)	(0.029)
INF	−0.074***	−0.042**	−0.074***	−0.040**
	(0.019)	(0.020)	(0.019)	(0.020)
Constant	−14.655***	−16.492***	−14.444***	−16.167***
No of obs	3,120	3,060	3,120	3,060
Pseudo *R*-squared	0.121	0.129	0.119	0.126
Akaike crit. (AIC)	3173.082	2823.908	3177.554	2833.574
Bayesian crit. (BIC)	3227.492	2877.966	3231.964	2887.632

Note(s): ***$p < 0.01$, **$p < 0.05$. Standard errors are presented in the parentheses. DTA is digital transformation adoption which takes value of 1 if firm engaged in digital transformation and 0 otherwise; FP is firm performance, measured by either ROA (Net income/Total assets) or ROE (Net income/Total equity); SIZE is firm size, measured by ln(Total assets); AGE is firm age, measured by ln(number of operating years); LEV is financial leverage, measured by Total debt/Total assets; LIQ is liquidity, measured by Current assets/Current liabilities; GROW is growth rate, measured by $(\text{Revenue}_t - \text{Revenue}_{(t-1)})/\text{Revenue}_{(t-1)}$; GDP is Gross Domestic Product and INFLA is inflation rate of Vietnam

Source(s): Authors' estimation

doubtful and hesitate to engage in the process of digital transformation due to the high-cost digital technology investment and application and other obstacles, in the long run it has been proved that digital transformation enhances firms' long-term financial performance and increase the firm value (Kharlamov and Parry, 2020; Zeng *et al*., 2022; Zhai *et al*., 2022). With this motivation, firms can overcome the barriers in the digital transformation process and, step by step, complete the three stages of this process and achieve their goals. Our results support the RBV and dynamic capabilities theory, which posit that firms with stronger resources and adaptive capabilities are better positioned to pursue strategic innovation. High-performing firms are motivated and financially capable of investing in digital technologies, reinforcing their long-term competitiveness.

Additionally, firm size is found to be an important factor in driving firms towards digital transformation. Firms of a bigger size have more competence in investing and applying digital solutions as they have enough resources in terms of labour and finance for digital activities. Our finding is consistent with a majority of previous studies, such as Gaglio *et al*. (2022), Gupta and Bose (2022), Truant *et al*. (2021) and Zeng *et al*. (2022). However, unlike some previous research, which signifies that firm size has a minimum impact on firms' inclination to digital transformation (Benlian *et al*., 2009; Grover and Goslar, 2015; Hsu and Lin, 2015), our study documents that firm size plays a crucial role in driving firms towards DTA. Our finding is consistent with our hypothesis.

Similar to firm size, our research also finds evidence that firm age has a significant positive impact on firms adopting digital transformation. With comparative advantages such as financial capital, human resources, reputation and long-term relationships with stakeholders, long-established firms are readily equipped with the necessary conditions to be pioneers in adopting digital transformation. Especially when digital transformation has been an innovative trend for businesses worldwide, well-established firms obviously cannot stay out of this trend. This result has been proven to support our hypothesis and is consistent with other arguments by Abatecola *et al*. (2012) and BarNir *et al*. (2003). The positive relationship between DTA and firm size and firm age are robust in both the whole sample model and the two subsample models and consistent with the RBV and TOE framework, suggesting that larger and older firms benefit from resource advantages, organisational readiness and accumulated knowledge that facilitate digital initiatives.

In terms of financial leverage, our findings found a significant reverse relationship between leverage and DTA at a 1% level of statistical significance. This relationship is robust throughout the whole sample and two subsamples in both HOSE and HNX. This finding implies that highly leveraged firms may have a low inclination to adopt digital transformation and vice versa. This result can be explained from the perspective of bankruptcy risk of debt. Firms with high financial leverage are already under the pressure of loan payments, and indeed, this pressure prevents firms from taking on extra risky projects with high costs, such as digitalisation projects. Digital transformation is a long process that requires much financial capital, and it might take a long time to return the initial outlay and generate profits for firms. Therefore, firms with a financial burden may find it challenging to embrace digital transformation. As a result, high-level firms might be reluctant to adopt digital transformation proactively. Our finding shares similarities with previous studies by Diamond (1984), Majumdar (2016), O'Brien (2003) and Zeng *et al*. (2022), which imply that firms' level of debt is inversely proportional to their technology integration. Our finding also aligns with the pecking order theory, which suggests that firms with high debt are more risk-averse and less willing to engage in long-term, capital-intensive projects like digital transformation. This highlights how financial constraints can limit innovation despite potential strategic gains.

Furthermore, liquidity is found to be significantly negatively related to firms' propensity to use digital technologies. This conclusion contradicts our hypothesis and most previous research findings, notably Falato *et al*. (2022). This mismatch may be mainly attributable to the firms' desire throughout the research phase. Even though firms face few risks regarding their ability to repay loans and have sufficient financial reserves to meet digital transformation

costs, digital transformation may not be a top-priority strategy for Vietnam-listed firms during our research window. During this period, most Vietnamese firms were at the early stage of exploring the digital transformation process. In addition, firms that have not recognised the importance of digital transformation might experience apathy and reluctance. Firms with high liquidity, such as large-scale digital transformation, entail numerous transformation risks, expenses and short-term financial constraints. This finding supports insights from Institutional Theory, indicating that institutional context and national innovation culture play critical roles in shaping firm behaviour—especially in emerging markets like Vietnam.

The last firm-level factor – growth rate- is documented to positively impact firms' adoption of digital transformation. A firm's propensity to adopt digital transformation is believed to be directly proportional to its size and capabilities (Gaglio *et al*., 2022; Gupta and Bose, 2022; Truant *et al*., 2021; Zeng *et al*., 2022). Put differently, firms with sound financial performance and growth rates are more motivated towards digital transformation than others. Nevertheless, growth alone may not drive DTA unless accompanied by a clear strategic direction and leadership commitment to innovation, consistent with the dynamic capabilities perspective. Unfortunately, our study did not find statistical significance in either the whole sample model or subsample models, so we cannot draw further conclusions about this relationship.

The two macro variables, including GDP and inflation rate, are both found to have robust negative impacts on firms' adoption of digital transformation. These results diverge from findings in more industrialised settings and reinforce the argument from Institutional Theory that economic development alone is insufficient to promote digital transformation without supporting institutional frameworks, government policies, and targeted incentives. The negative relationship between GDP and firms' DTA contradicts previous findings by Kim and Peterson (2017), Cavalcanti *et al*. (2022), and Agrawal *et al*. (2019). This contradiction can be explained by the variances in research settings, legal backgrounds, and digital transformation investment levels (Matthess and Kunkel, 2020). Specifically, these findings imply that industrialised nations will have more resources to invest in digital transformation as their GDP rises. With existing national agendas for digital transformation development, the government can capitalise on this expanding economic potential to enact numerous programs, such as low-interest loan programs for corporations, to systematically support digital transformation for businesses that may be more efficient (Agrawal *et al*., 2019; Cavalcanti *et al*., 2022). These programs lessen the financial strain and hazards associated with DTA, thereby encouraging firms to be well-prepared for digital transformation.

Our study's research context is Vietnam, a developing nation that lacks a particular framework or strategy for encouraging digital transformation in organisations (Ha and Nguyen, 2022; Le and Le, 2023). Hence, despite its robust economic potential throughout the years, Vietnam has been unable to harness this resource to fully drive digital transformation. Programs to assist firms with digital transformation may be limited, ad hoc or underdeveloped (not many businesses can access government support) (Le and Le, 2023). Thus, these assistance programs and expenditures are ineffective. In addition, the increase in GDP is unlikely to have a good impact on the digital transformation of businesses if a robust national development of core technologies and fundamental platform systems does not accompany it. Our study also demonstrates that a growing inflation rate can prevent businesses from adopting digital transformation, corroborating the findings of Rocha *et al*. (2021). The correlation between high inflation rates can cause rising corporate costs and market volatility. Under such uncertainties, firms are forced to limit their emphasis and investment in digitalisation projects to avoid risk and to cover operating expenses.

The applied models share similar results with consistent correlation signs and statistical significance. Pseudo *R-squared* are reported at 0.119 and 0.117, which signifies that independent variables can help explain 11.9% and 11.7% of the changes in dependent variables. The Pseudo *R*-squared increases slightly when it comes to the models using subsamples in HOSE and HNX. This finding implies that other quantitative factors might help explain the key motivations of firms in digital transformation. In addition, other qualitative

factors should be considered to provide a more reasonable explanation of firms' drivers towards digital transformation.

5. Conclusions

This study identifies key drivers and barriers influencing firms' adoption of digital transformation by examining both firm-level and macroeconomic factors. The results reveal that firm performance, size and age significantly promote DTA. Well-performing, large and mature firms possess the financial resources, capabilities, and reputational advantages needed to pioneer digital initiatives – consistent with Gaglio *et al*. (2022), Gupta and Bose (2022), Truant *et al*. (2021), Zeng *et al*. (2022), Abatecola *et al*. (2012), and BarNir *et al*. (2003).

In contrast, financial leverage and liquidity negatively affect adoption. Highly leveraged firms face financial constraints and are less willing to invest in long-term digital projects. In contrast, firms with high liquidity may delay adoption to preserve short-term solvency or because of a cautious strategic orientation toward new technologies. At the macro level, GDP growth and inflation also show negative relationships with digital transformation. High inflation pressures firms to conserve resources, while GDP growth alone does not drive transformation unless accompanied by adequate institutional support, regulatory frameworks and targeted government programs that facilitate large-scale digital adoption.

Theoretically, this research extends the RBV and TOE frameworks to an emerging-market context, empirically supports the Dynamic Capabilities Theory, and highlights how Pecking Order and Institutional Theories explain barriers to digital innovation under financial and institutional constraints. In terms of practical implications, our findings suggest that firms with strong performance and scale should leverage these strengths through strategic alignment and leadership commitment. At the same time, policymakers should complement economic growth with digital infrastructure, financial incentives and institutional reforms to accelerate transformation.

Future research could develop more detailed measures of digital transformation beyond the binary proxy, such as through textual analysis of corporate disclosures and explore causal relationships or comparisons with SMEs and start-ups. Moreover, addressing endogeneity through more robust instruments remains an avenue for methodological refinement.

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