



Digitalization, Financial Development, and Institutional Quality on ASEAN Economic Growth

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Abstract

This study assesses the impact of digital transformation and advancements in the financial sector on economic growth in the ASEAN area, with institutional quality acting as a moderating variable. The methodology employed is dynamic panel data analysis utilizing the System-Generated Method of Moments (SYS-GMM) and Moderated Regression Analysis (MRA). The estimation results indicate that the impacts of digital transformation and financial development on economic growth are not consistently direct and significant. Nonetheless, institutional quality generally enhances this association, although the effect is not uniform across all sampled nations. The results demonstrate that the impacts of digitalization and the financial sector on growth are not consistently straightforward, but are significantly influenced by the efficacy of governance in each nation. This emphasizes that technology advancement must be paired with the enhancement of supporting institutions to facilitate optimal economic growth.

Keywords: digital transformation, financial development, economic growth, institutional quality, ASEAN

Introduction

In ASEAN nations, the digitalization of the economy and the advancement of the financial sector have become two interdependent topics in discussions about the expansion of the digital economy. In recent decades, ASEAN nations have experienced swift digitalization, encompassing the proliferation of the internet, e-commerce platforms, and fintech services, which have become essential to daily life. Digitalization has transcended technology, evolving into a fundamental component of strategies aimed at increasing national production, improving economic efficiency, and broadening market access. Numerous studies demonstrate that digitization, facilitated by enhanced internet access, positively correlates with ASEAN's economic growth, augmenting market efficiency and regional economic integration (Novianti 2025). The financial industry in the Association of Southeast Asian Nations

(ASEAN) region has experienced substantial advancement due to enhanced loan accessibility, augmented investment, and the proliferation of financial markets (Haini 2020). The region is simultaneously seeing swift digital transition, driven by technological progress and enhancements in telecommunications infrastructure (Ha and Chuah 2026). In certain nations, financial expansion and digital transformation are propelling economic advancement and social progress (Ali et al. 2019; Kraus et al. 2021).

An institution is anticipated to integrate these concepts into its strategic and operational agendas to confront urgent global concerns, including significant social inequality, resource limitations, and the intensification of global warming. Furthermore, swift advancements in digital technologies, such as the Internet of Things (IoT), blockchain, and artificial intelligence (AI), are demonstrating the potential to convert economic systems into more sustainable models in practice (Elisha Elikon Kofi Senoo; Lia Anggraini; Jacqueline Asor Kumi; Luna Bunga Karolina 2025; Ijomah 2024). The deep integration of digital technology across various economic sectors has emerged not only as an accelerator for operational efficiency and innovation but also as a potential driver of ESG performance a phenomenon known as digital transformation (Li and Zhao 2024). Digital transformation can enhance operational efficiency, promote sustainable practices, and optimize resource utilization (Ou 2023). However, digital transformation also presents challenges, such as increased electronic waste, rising data center energy consumption, and limitations in digital access that can exacerbate inequality (Singh 2022; Verdolini 2023).

Digital transformation and financial development exert significant and intricate effects on the environment (Tarigan and Muharam 2025). Beyond guaranteeing economic stability, the stability of the financial system can also promote economic growth (Katircioglu 2012). Several publications investigate the relationship between the financial industry and economic growth. (Patrick 1966) elucidates that, initially, financial development can stimulate economic growth; but, this effect wanes over time. Conversely, economic growth may also affect the relationship between the two. Financial development exerts a dual influence on economic growth. An advanced domestic financial market can enhance capital accumulation efficiency and thus elevate GDP (Id et al. 2021; Jose De Gregorio 1995). Consistent with research by Goldsmith (1959) research, a positive correlation exists between financial development and economic growth.

Financial development is intimately associated with economic progress. Orji et al.(2023) illustrate that financial development, via the human capital channel, can stimulate economic growth. In debates of economic growth, external factors such as the quality of governance and institutions, together with strong political stability, are essential components. This remains valid even

when institutional elements are deemed to have an indirect impact on economic growth. Appiah & Li (2020) discovered in their study that the efficacy of governance can enhance the influence of financial development on economic growth in emerging markets. In accordance with Olofin (2023) research, technical digitalization exerts a greater economic impact in nations with superior governance rankings.

Good governability, a steady political climate, and effective governability contribute to creating a well-coordinated environment, which is vital for the productive economic sector and can drive economic growth (Abaidoo and Agyapong 2026). Countries with weak institutions, unstable politics, and inadequate regulatory frameworks may exhibit weak growth (Amal and Wibowo 2024; Ogbuabor et al. 2020). Furthermore, various studies indicate that the quality of governance can influence economic performance (Ariff 2024; Ghardallou and Sridi 2019; Rizki and Didenko 2025).

This study utilizes the Endogenous Growth Theory as its principal framework, highlighting that technological innovation (digital transformation) is central to its analysis. Additionally, it incorporates institutional theory, which identifies institutional quality as a moderating variable that influences the efficacy of digital transformation and financial development on economic growth. The endogenous growth theory elucidates the financial sector's contribution to economic growth. An advanced financial system can stimulate heightened investment in productive industries, such as research and innovation. In this environment, financial development directly influences economic growth and simultaneously augments technological capacity.

Research conducted by Olczyk and Kuc-Czarnecka (2022) demonstrates that technological revolution positively and significantly influences economic growth by enhancing productivity and efficiency within the industrial sector. Le (2025) using Generalized Least Squares (GLS) and (Tram 2025) utilizing the ARDL panel methodology, elucidate that technology transformation is crucial in enhancing ASEAN economic integration, hence fostering sustainable economic performance. Consistent with Mili (2025), who discovered that governance quality and financial development exert a large and favorable impact on economic growth through the Cross-Sectionally Augmented Autoregressive Distributed Lag (CS-ARDL) model. The finance-led growth hypothesis elucidates how an advanced financial system can enhance resource allocation and bolster productive investment, hence fostering economic growth.

Yang et al. (2023) contend that an advanced financial system fosters an atmosphere conducive to innovation and beneficial economic endeavors. Farah, Nor, and Musse (2026) elucidate that financial inclusion contributes to

economic growth by enhancing access to finance and fostering investment in productive areas. A study by Hasan, Ibrahim, and Salim (2026) demonstrates that financial development and inclusion substantially enhance economic growth in emerging nations. Kurnia (2025) found that the financial sector can favorably and considerably stimulate economic growth in the ASEAN area. Bajwa et al. (2025) who examined digital financial inclusion in ASEAN utilizing GMM, discovered that it can enhance economic growth. According to Zhou, Zhang, and Id (2024), the use of System GMM revealed that digital financial inclusion considerably enhances economic growth..

Technology Diffusion Theory posits that innovation must undergo a process of diffusion and adoption before yielding economic effects. In other words, digital transformation will influence financial development only when the technology is widely adopted within the economic system. A study Li, Li, and Ahmad (2024) indicated that the spread of ICT has a significant impact on the financial sector's development, particularly through improved operational efficiency and financial service innovation. Tan, Cheng, and Liu (2024) also emphasize that technology evolves through mechanisms of economic and financial interaction. In fact, the digital financial sector plays an active role in accelerating technology diffusion through financing, investment, and market integration. Wu and Peng (2024) find that the perceived usefulness and convenience of financial technology are key factors in accelerating its adoption among the public. This theory explains that the impact of digitalization occurs through mechanisms of adoption, knowledge, and the integration of technology into economic activities. Digital transformation does not directly enhance financial development, but rather operates through a process of technology diffusion that determines how widely and effectively the technology is integrated into the financial sector.

Institutional theory emphasizes that economic activity does not occur in a neutral space, but is influenced by a set of formal and informal rules that shape the behavior of economic actors. These institutions include the quality of regulation, the effectiveness of governance, law enforcement, and the level of control over corruption. Institutions serve as a framework governing the interaction between technology, the financial sector, and broader economic activities. Digital transformation and institutional quality are key determinants in optimizing the benefits of technology (Alfikri and Riofita 2025). Hung (2025) states that the efficacy of transformation is highly linked to institutional quality. In other words, institutions not only act as enabling factors but also as mechanisms that can amplify or diminish the impact of transformation on economic growth. Ramzan (2026) demonstrates that institutional quality serves as a catalyst that determines the ability of fiscal policy to support sustainable growth.

Correa and Esquivias (2025) discovered that digitalization and institutional quality positively influence economic growth. This research is corroborated by Kai et al. (2026) indicating that nations with superior quality may utilize digitalization more efficiently to enhance economic performance. The quality of institutions influences the relationship between financial development and economic growth, indicating that the efficacy of the financial sector is significantly contingent upon a nation's institutional framework (Islam and Alhamad 2022). Institutional quality can enhance economic growth through the GMM system in SADC nations. In the context of emerging ASEAN nations, the significance of institutions becomes progressively vital. This suggests that the effectiveness of digital transformation and financial development is influenced not only by the degree of adoption but also by the quality of the supporting institutional conditions. Consequently, the utilization of Institutional Theory in this research offers a robust conceptual framework for elucidating the institution's moderating influence on the interplay between digital transformation, financial development, and economic growth.

Based on the research gaps outlined, this study aims to provide a more comprehensive empirical contribution by analyzing how digital transformation and financial development influence economic growth across ten ASEAN countries. This study is expected to provide relevant policy implications, particularly for ASEAN countries, regarding the simultaneous digitalization and strengthening of the financial sector. Additionally, this study is expected to serve as concrete input for policymakers within the context of the ASEAN Digital Master Plan 2025 and the ASEAN Digital Economy Framework Agreement (DEFA), as digital infrastructure and financial sector deepening remain insufficient in ASEAN countries that are still in the development stage.

Methods

The study examines ASEAN nations, considering the region's rather diverse attributes. The disparities in digital development, financial sector capabilities, and institutional quality among countries render ASEAN a pertinent empirical setting for examining the correlation between digital transformation and economic growth (Novianti 2025). The digital divide in this region is substantial and may hinder the efficacy of digitalization in promoting economic progress.

This research utilizes a dynamic panel data model employing the Generalized Method of Moments (GMM) technique established by Arellano and Bond (1991) and Blundell and Bond (1998). The choice of this strategy is predicated on the understanding that economic growth is inherently dynamic, with prior conditions impacting present circumstances. This corresponds with endogenous growth theory, which highlights the significance of internal forces

in the economic growth process. Moreover, GMM can effectively tackle potential endogeneity concerns that often emerge in panel models (Putri and Huruta 2025). This study analyzes the relationship between financial development, institutional quality, and economic growth by modeling the direct effects of financial development and institutional quality on economic growth, adjusted for time-invariant effects (Lisbinski and Burnquist 2024). This study formulates the following by specifying the following dynamic panel regression:

$$GDP_{it} = \alpha GDP_{i,t-1} + \beta_1 DT_{it} + \beta_2 FD_{it} + \beta_3 IQ_{it} + \mu_i + \varepsilon_{it}$$

Notes:

GDP_{it}	= Economic growth (GDP growth rate)
$\alpha GDP_{i,t-1}$	= Lagged GDP growth
DT_{it}	= Digital Transformation
FD_{it}	= Financial Development
IQ_{it}	= Institutional Quality
X_{it}	= Control variables
μ_i	= Fixed effects
ε_{it}	= Error term

As an additional analysis, Moderated Regression Analysis (MRA) was employed to explicitly investigate moderation effects and compute marginal effects on panel data (cross-section/pooled) (Memon et al. 2019). This study posits that the variable of institutional quality may enhance or diminish the impact of digital transformation and financial development on economic growth. The preliminary phase commenced with an assessment to ascertain the direct impacts of digital transformation and financial development on economic growth, alongside the direct influence of institutional quality as a moderating element. Subsequently, interaction terms are created by multiplying each independent variable by the moderating variable, specifically the interactions between digital transformation and institutional quality, as well as between financial development and institutional quality. This methodology is anticipated to offer a comprehensive analysis of the significance of institutional quality as a pivotal element influencing the efficacy of digital transformation and financial sector advancement on economic growth, especially within the ASEAN area. To evaluate the moderating influence of institutional quality:

$$GDP_{it} = \alpha GDP_{i,t-1} + \beta_1 DT_{it} + \beta_2 FD_{it} + \beta_3 IQ_{it} + \beta_4 (DT_{it} \times IQ_{it}) + \beta_5 (FD_{it} \times IQ_{it}) + \mu_i + \varepsilon_{it}$$

Notes:

i = ASEAN-10 countries

t = time period

The secondary data in this study consists of a combination of time-series and cross-sectional data. The ASEAN-10 comprises Indonesia, Malaysia, Thailand, Laos, Brunei Darussalam, Myanmar, the Philippines, Singapore, and Vietnam. This study uses the economic growth variable (Y) proxied by GDP growth (annual %), digital transformation (X1) proxied by Individuals using the Internet (% of population), financial development (X2) proxied by Domestic credit to private sector (% of GDP), and institutional quality (Z) proxied by regulatory quality.

Table 1.
Grouping of variables

Variable	Data Sources
Economic Growth (Y)	World Development Indicators
Transformation Digitalization (X1)	World Development Indicators
Financial Development Index (X2)	World Development Indicators
Institutional Quality (Z)	World Governance Indicators (WGI)

Result and Discussion

Generalized Method of Moment (GMM)

Table 2.

Result of the GMM Estimation

Dynamic panel-data estimation, two-step system GMM

Group variable: id	Number of obs	=	100
Time variable : Tahun	Number of groups	=	10
Number of instruments = 13	Obs per group: min	=	10
F(6, 9) = 1098.56	avg	=	10.00
Prob > F = 0.000	max	=	10

EG	Coefficient	Corrected std. err.	t	P> t	[95% conf. interval]
EG L1.	.8099306	.7766412	1.04	0.324	-.9469538 2.566815
DT	-.0258763	.1463169	-0.18	0.864	-.3568681 .3051155
FD	.0332961	.0448052	0.74	0.476	-.0680604 .1346526
IQ	.0506376	.2363608	0.21	0.835	-.4840478 .5853229
DT_IQ	.0001916	.0026232	0.07	0.943	-.0057425 .0061256
FD_IQ	-.0006357	.0007503	-0.85	0.419	-.002333 .0010616
_cons	-.3625632	15.96196	-0.02	0.982	-36.47103 35.74591

Arellano-Bond test for AR(1) in first differences: z = -1.14 Pr > z = 0.253
 Arellano-Bond test for AR(2) in first differences: z = 0.16 Pr > z = 0.876

Sargan test of overid. restrictions: chi2(6) = 2.46 Prob > chi2 = 0.873
 (Not robust, but not weakened by many instruments.)
 Hansen test of overid. restrictions: chi2(6) = 6.43 Prob > chi2 = 0.377
 (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
 GMM instruments for levels
 Hansen test excluding group: chi2(3) = 6.27 Prob > chi2 = 0.099
 Difference (null H = exogenous): chi2(3) = 0.15 Prob > chi2 = 0.985
 iv(IQ DT_IQ FD_IQ)
 Hansen test excluding group: chi2(3) = 6.79 Prob > chi2 = 0.079
 Difference (null H = exogenous): chi2(3) = -0.37 Prob > chi2 = 1.000

Source: STATA 14 (processed), 2026

The AR(2) value and the Hansen Test result are above 0.05. This means that the model is free of autocorrelation and the instruments used are valid (not over-identified). This study covers 10 ASEAN countries. However, such extreme variation often renders the average coefficient insignificant because the number of instruments used exceeds the number of country groups (10). Therefore, it is necessary to perform a natural logarithmic (Ln) transformation combined with instrument reduction:

Table 3.

GMM Results after Ln

Dynamic panel-data estimation, two-step system GMM

Group variable: id	Number of obs	=	100
Time variable : Tahun	Number of groups	=	10
Number of instruments = 10	Obs per group: min	=	10
F(6, 9) = 98.48	avg	=	10.00
Prob > F = 0.000	max	=	10

ln_EG	Coefficient	Corrected std. err.	t	P> t	[95% conf. interval]	
ln_EG L1.	.9718131	.5539784	1.75	0.113	-.2813731	2.224999
ln_DT	-10.57343	15.07096	-0.70	0.501	-44.66631	23.51945
ln_FD	-7.792475	9.507813	-0.82	0.434	-29.30064	13.71569
ln_IQ	-18.96103	23.51669	-0.81	0.441	-72.15948	34.23742
lnDT_IQ	2.638165	3.869735	0.68	0.513	-6.115783	11.39211
lnFD_IQ	2.229947	2.751414	0.81	0.439	-3.994185	8.454079
_cons	70.51157	86.9425	0.81	0.438	-126.166	267.1892

Arellano-Bond test for AR(1) in first differences: z = -1.40 Pr > z = 0.162
 Arellano-Bond test for AR(2) in first differences: z = 0.81 Pr > z = 0.418

Sargan test of overid. restrictions: chi2(3) = 1.27 Prob > chi2 = 0.735
 (Not robust, but not weakened by many instruments.)

Hansen test of overid. restrictions: chi2(3) = 3.94 Prob > chi2 = 0.268
 (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:

GMM instruments for levels

Hansen test excluding group: chi2(0) = 0.00 Prob > chi2 = .
 Difference (null H = exogenous): chi2(3) = 3.94 Prob > chi2 = 0.268
 iv(ln_IQ lnDT_IQ lnFD_IQ)

Hansen test excluding group: chi2(0) = 0.00 Prob > chi2 = .
 Difference (null H = exogenous): chi2(3) = 3.94 Prob > chi2 = 0.268

Source: *STATA 14 (processed)*, 2026

Based on the results in Table 3, the following findings were obtained. The coefficient for the economic growth variable (Y) is 0.971. This means that ASEAN's economic growth is highly persistent, such that a 1% increase in last year's growth contributes to a 0.97% increase in this year's growth. Although the p-value of 0.113 indicates a strong trend economically. The coefficient of the DT & IQ variable (lnDT_IQ) is 2.63, indicating that institutional quality tends to amplify the impact of digitalization on the economy, although it is not yet statistically significant ($P > |t| = 0.513$) and The coefficient of the FD & IQ variable (lnFD_IQ) is 2.22. Thus, there is a tendency that institutional quality helps the financial sector drive economic growth.

Technically, the *System GMM* model has met the criteria for instrumental validity and parameter consistency. Although the IQ variable shows a positive coefficient direction consistent with theory (amplifying the impact). However, it is not yet statistically significant at the 5% level, indicating that in the ASEAN region, the role of institutions in optimizing the digital and financial economy still faces the challenge of high heterogeneity among countries. This necessitates an adjustment by excluding two countries from the study to ensure the resulting data is more optimal.

Table 4.
GMM Results After Correction

Dynamic panel-data estimation, two-step system GMM						
Group variable: id			Number of obs	-	80	
Time variable : Tahun			Number of groups	-	8	
Number of instruments = 10			Obs per group: min	-	10	
F(6, 7)	-	0.09	avg	-	10.00	
Prob > F	-	0.995	max	-	10	
ln EG	Coefficient	Corrected std. err.	t	P> t	[95% conf. interval]	
ln EG L1.	.9928241	.2107793	4.71	0.002	.4944103	1.491238
ln DT	-10.21231	20.36603	-0.50	0.631	-58.37032	37.94569
ln FD	-10.21074	25.18822	-0.41	0.697	-69.7714	49.34993
ln IQ	-21.37435	46.93631	-0.46	0.663	-132.3611	89.61239
lnDT_IQ	2.578165	5.061799	0.51	0.626	-9.391086	14.54742
lnFD_IQ	3.024539	7.436569	0.41	0.696	-14.56015	20.60923
_cons	76.70449	168.5962	0.45	0.663	-321.9622	475.3712
Instruments for orthogonal deviations equation						
Standard						
FOD.(ln IQ lnDT_IQ lnFD_IQ)						
GMM-type (missing=0, separate instruments for each period unless collapsed)						
L2.(L.ln EG ln DT ln FD) collapsed						
Instruments for levels equation						
Standard						
ln IQ lnDT_IQ lnFD_IQ						
_cons						
GMM-type (missing=0, separate instruments for each period unless collapsed)						
DL.(L.ln EG ln DT ln FD) collapsed						
Arellano-Bond test for AR(1) in first differences: z = -1.40 Pr > z = 0.162						
Arellano-Bond test for AR(2) in first differences: z = 1.16 Pr > z = 0.247						
Sargan test of overid. restrictions: chi2(3) = 0.20 Prob > chi2 = 0.977						
(Not robust, but not weakened by many instruments.)						
Hansen test of overid. restrictions: chi2(3) = 0.22 Prob > chi2 = 0.975						
(Robust, but weakened by many instruments.)						
Difference-in-Hansen tests of exogeneity of instrument subsets:						
iv(ln IQ lnDT_IQ lnFD_IQ)						
Hansen test excluding group: chi2(0) = 0.00 Prob > chi2 = .						
Difference (null H = exogenous): chi2(3) = 0.22 Prob > chi2 = 0.975						

Source: STATA 14 (processed), 2026

Based on Table 4, the results show that; 1) The variable L1.ln_EG has a positive and significant p-value regarding economic growth ($P > |t| = 0.002$). The coefficient of 0.992 indicates that economic growth in ASEAN-8 increases by 1%. Every 1% increase in last year's growth contributes to a 0.92% increase in this year's growth. 2) The coefficient of the DT & IQ variable (lnDT_IQ) is 2.57 with a p-value of 0.626. This supports the theory that institutional quality

tends to amplify the positive impact on economic growth. 3) The coefficient of the variable FD & IQ (lnFD_IQ) is 3.02 with a p-value of 0.696, indicating that in the developing ASEAN-8 countries, the role of institutions is more crucial in overseeing the financial sector to drive economic growth.

Moderated Multiple Regression Analysis (MRA)

Table 5.
MRA Interaction Variables

. gen c_FD = FD - r(mean)
. gen c_DT = DT - r(mean)
. gen c_IQ = IQ - r(mean)
. gen DT_IQ = c_DT * c_IQ
. gen FD_IQ = c_FD * c_IQ

The purpose of including an interaction term in moderation regression analysis is to determine the conditional effect of a variable. To reduce interpretation issues and multicollinearity, the recommended solution for panel data is to mean-center the variables in the panel data (Fixed Effects) to ensure accurate interpretation. The interaction term is intended to allow the moderation hypothesis to be statistically tested (Memon et al. 2019).

Test of Classical Assumptions

Multicollinearity Test

Table 6.
Results of the Multicollinearity Test

Source	SS	df	MS	Number of obs		
Model	109.593855	5	21.918771	F(5, 93)	-	4.84
Residual	421.271279	93	4.5297987	Prob > F	-	0.0006
Total	530.865134	98	5.41699117	R-squared	-	0.2064
				Adj R-squared	-	0.1638
				Root MSE	-	2.1283

EG	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
c_DT	-.0455032	.0121226	-3.75	0.000	-.0695763	-.02143
c_FD	.0074325	.0049566	1.50	0.137	-.0024104	.0172753
c_IQ	-.0098056	.0176557	-0.56	0.580	-.0448664	.0252552
DT_IQ	.0001233	.0005066	0.24	0.808	-.0008827	.0011293
FD_IQ	-.0001843	.0002418	-0.76	0.448	-.0006646	.0002959
_cons	5.634655	.3178516	17.73	0.000	5.003465	6.265845

Variable	VIF	1/VIF
c_IQ	3.14	0.318775
DT_IQ	2.23	0.448492
c_DT	1.79	0.558715
c_FD	1.32	0.759101
FD_IQ	1.29	0.778075
Mean VIF	1.95	

Source: Stata14 (processed), 2026

The results of the multicollinearity test show that all variables have a Variance Inflation Factor (VIF) below the threshold of 10, with the highest VIF value being 3.14 and the mean VIF being 1.95. This indicates that there are no serious multicollinearity issues in the regression model because the mean-centering process was effective in minimizing the correlation between the independent variables and the interaction terms. Thus, this research model is deemed to satisfy the classical assumptions and is suitable for use in further analysis.

Autocorelation

Table 7.

Autocorrelation Test Results

. xtscg EG c_DT c_FD c_IQ DT_IQ FD_IQ, fe						
Regression with Driscoll-Kraay standard errors			Number of obs	=	99	
Method: Fixed-effects regression			Number of groups	=	9	
Group variable (i): negara			F(5, 10)	=	53.39	
maximum lag: 2			Prob > F	=	0.0000	
			within R-squared	=	0.2099	
EG	Coef.	Drisc/Kraay Std. Err.	t	P> t	[95% Conf. Interval]	
c_DT	-.023254	.0078444	-2.96	0.014	-.0407323	-.0057756
c_FD	-.034835	.0190805	-1.83	0.098	-.077349	.0076791
c_IQ	.0515127	.0375992	1.37	0.201	-.0322636	.1352889
DT_IQ	.0008926	.0003578	2.49	0.032	.0000954	.0016898
FD_IQ	-.000986	.0003825	-2.58	0.028	-.0018383	-.0001336
_cons	5.269567	.1250593	42.14	0.000	4.990918	5.548217

Source: Stata 14 (*processed*), 2026

The estimation findings in Table 7, employing the Driscoll-Kraay fixed-effects method with standard errors, demonstrate that the overall model is significant at the 1% level (Prob > F = 0.0000). The R-squared score of 0.2099 signifies that about 20.99% of the variation in economic resilience and growth (EG) is elucidated by the model's variables, with the balance attributable to external causes.

Digital transformation (DT) demonstrates a negative and statistically significant coefficient at the 5% level ($\beta = -0.023$; $p = 0.014$). This outcome indicates that enhanced digital transformation has not yet completely resulted in improved economic resilience. Simultaneously, financial development (FD) has a negative coefficient, significant only at the 10% level ($\beta = -0.035$; $p = 0.098$), indicating its effect is rather moderate and lacks consistency at a more stringent significance threshold. Conversely, institutional quality (IQ) does not exhibit a significant direct impact on economic growth (EG) ($\beta = 0.052$; $p = 0.201$). Nonetheless, when incorporated as a moderating variable, its function becomes more evident. The interaction of DT and IQ (DT×IQ) has a positive

and significant effect ($\beta = 0.00089$; $p = 0.032$), whereas the interaction of FD and IQ (FD×IQ) demonstrates a negative and significant effect ($\beta = -0.00099$; $p = 0.028$).

These results affirm that statistical inferences derived from panel data are contingent upon the selection of standard error correction techniques. The application of the Driscoll–Kraay technique enhances the robustness of this study's findings by efficiently addressing heteroscedasticity, autocorrelation, and cross-sectional dependence, which are prevalent in cross-country panel data. As a result, the estimation outcomes exhibit more stability and reliability in comparison to the clustered standard errors method. This work is consistent with Driscoll and Kraay (1998), who advocate for the application of the Driscoll–Kraay correction in research utilizing cross-country macroeconomic data.

Conclusion

This study seeks to analyze the influence of digital transformation and financial development on economic growth in eight ASEAN nations, while investigating the potential moderating effect of institutional quality on this relationship. Utilizing System GMM and Moderated Regression Analysis (MRA) estimations with the Driscoll–Kraay standard errors methodology, numerous findings merit consideration. Initially, digital transformation does not inherently result in substantial economic development across all sampled nations. This analysis corroborates the findings of (Olczyk and Kuc-Czarnecka 2022), which indicate that the advantages of digitalization are varied and significantly contingent upon each nation's ability to assimilate technology. This further substantiates the perspective of (Zghidi and Trabelsi 2025) who discovered that the influence of digitalization on economic development differs between developed and developing nations, a dynamic clearly illustrated by the varied conditions within ASEAN, from Singapore at one extreme to Cambodia and Myanmar at the other.

Secondly, financial development demonstrates an inconsistent impact on economic growth among countries. These results refute the optimism of (Patrick 1966) regarding finance-led growth theory, while aligning with the more measured viewpoint of (Jose De Gregorio 1995), who posits that financial development propels growth mostly through enhanced efficiency in capital accumulation rather than solely through credit expansion. The significance lies not in the magnitude of the financial sector's expansion, but in the productivity of the capital circulating within it. Third, institutional quality was identified as a moderating factor in the relationship between digital transformation and financial development concerning economic growth, but the effect varied among the sample countries. This study substantiates the institutional

hypothesis posited by (Alfikri and Riofita 2025), which asserts that institutions are not just supplementary but essential for the proper operation of technical innovation and financial intermediation. Empirically, this corresponds with the findings of (Michael Appiah, Fanglin Li 2020), who determined that institutional quality significantly enhances the influence of financial development on economic growth in emerging markets, and with (Olofin 2023) , who contends that digitalization exerts a more pronounced economic impact in nations with superior governance ratings. This study parallels (Haini 2020) research inside the ASEAN framework, demonstrating that institutional quality affects the financial sector's capacity to stimulate growth.

The variability of the moderating impact among the sample countries does not undermine the findings; instead, it accurately represents the regional reality. ASEAN is not a uniform region; disparities in governance quality, rule of law, and corruption control among its member states are significant. This circumstance amplifies the moderating influence of institutions in nations with a robust institutional framework, while exerting a comparatively weaker effect in countries undergoing transformation. (Žugić 2026) asserts in a study on digitalization in Southeast Asia that the deficiency in institutional capacity is the principal impediment to the equitable distribution of digital advantages in the region. This study theoretically supports the relevance of the three frameworks: endogenous growth theory, finance-led growth theory, and institutional theory. Digital technology and the financial sector provide significant development potential, as posited by (Patrick 1966) but this potential is completely actualized only when the governing framework is robust enough to establish suitable incentives, enforce contracts, and mitigate rent-seeking behavior (Hung 2025).

This study has several limitations. First, the use of a single proxy for each main variable may not fully capture the true breadth of the concept. Second, this analysis has not explicitly distinguished between short-term and long-term effects. An ARDL Panel approach or an Error Correction Model (ECM) could be considered for future research to capture the temporal dynamics that may differ between the immediate effects and the long-term structural effects of digital transformation on economic growth. Third, the limited sample scope to eight ASEAN countries means that generalizations to other regions must be made with caution. Expanding the sample to South Asian or Sub-Saharan African countries with similar development characteristics could be an interesting agenda for future comparative research.

References

- Abaidoo, Rexford, and Elvis Kwame Agyapong. 2026. "Financial Development and Institutional Quality among Emerging Economies." *Journal of Economics and Development* 24(3):198–216. doi:10.1108/JED-08-2021-0135.
- Alfikri, Nashihuddin Sahil, and Hendra Riofita. 2025. "Transformasi Ekonomi Digital Dan Kontribusinya Terhadap Pendapatan Nasional Di Indonesia." *Jurnal Pendidikan Tambusai* 9:5191–95. doi:10.31004/jptam.v9i1.27775.
- Ali, Muhammad, Toan Luu, Duc Huynh, Huong Thi, and Xuan Tram. 2019. "Role of Financial Development , Economic Growth & Foreign Direct Investment in Driving Climate Change : A Case of Emerging ASEAN." *Journal of Environmental Management* 242:131–41. doi:10.1016/j.jenvman.2019.03.112.
- Amal, Muhammad Ahsanul, and Muhammad Ghafur Wibowo. 2024. "The Role Foreign Direct Invesment, Financial Development and Institutions Quality of Economic Growth: Empirical Evidence From WANA Countries." *Journal of Business Management and Islamic Banking* 03(2):101–16. doi:10.14421/jbmib.v3i1.2343.
- Arellano, Manuel, and Stephen Bond. 1991. "Some Test of Spesification for Data Panel: Monte Carlo Evidence and an Aplication of Employment Equations." *Source: The Review of Economic Studies* 58(2):277–97. doi:https://doi.org/10.2307/2297968.
- Ariff, Wasim Ullah; Ahmad Shauqi Mohamad Zubir; Akmalia Mohamad. 2024. "The Impact of Political Instability on Financial Development, Economic Growth, Economic Growth Volatility and Financial Stability in Developing Countries." *Journal of Theoretical and Practical Research in Economics* 15(2):453–70. doi:10.14505/tpref.v15.2(30).22.
- Bajwa, Farooq Ahmad, Jingtao Fu, Ishtiaq Ahmad Bajwa, Manzar Rehman, and Karim Abbas. 2025. "Digital Financial Inclusion and Its Dual Impact on Economic and Environmental Outcomes in ASEAN Countries." *Data Science in Finance and Economics* 5(1):53–75. doi:10.3934/DSFE.2025004.
- Blundell, Richard, and Stephen Bond. 1998. "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models." *Journal of Econometrics* 87 115–43. doi:10.1016/j.jeconom.2023.03.001.
- Correa, Ebou, and Miguel Angel Esquivias. 2025. "The Impact of Digitalization, Education, and Institutional Quality on Economic Growth: A Comparative Analysis between Sub-Saharan Africa and

- Middle East Countries.” *Social Sciences and Humanities Open* 11(October 2024):101423. doi:10.1016/j.ssaho.2025.101423.
- Elisha Elikon Kofi Senoo; Lia Anggraini; Jacqueline Asor Kumi; Luna Bunga Karolina, Ebenzer Akansah; Hafeez Ayo Sulyman; Israel Mendonça; Masayoshi Aritsugi. 2025. “IoT Solutions with Artificial Intelligence Technologies for Precision Agriculture: Definitions, Applications, Challenges, and Opportunities.” *Journal of Electronics. Systematic Review* 14(14):1–89. doi:10.3390/electronics13101894.
- Farah, Abdikarim Abdullahi, Bile Abdisalan Nor, and Osman Sayid Hassan Musse. 2026. “Financial Inclusion and Green Economic Growth a Systematic Review of SCOPUS Indexed Studies from 2015 to 2025.” *Discover Environment* 4(1). doi:10.1007/s44274-026-00550-5.
- Ghardallou, Wafa, and Dorsaf Sridi. 2019. “Democracy and Economic Growth: A Literature Review.” *Journal of the Knowledge Economy* 11(3):982–1002. doi:10.1007/s13132-019-00594-4.
- Goldsmith, Raymond W. 1959. *The Comparative Study of Economic Growth and Structure*. NBER.
- Ha, Huong, and C. K. Peter Chuah. 2026. “Digital Economy in Southeast Asia: Challenges, Opportunities and Future Development.” *Southeast Asia: A Multidisciplinary Journal* 23(1):19–35. doi:10.1108/SEAMJ-02-2023-0023.
- Haini, Hazwan. 2020. “Examining the Relationship between Finance, Institutions and Economic Growth: Evidence from the ASEAN.” *Economic Change and Restructuring* 53(4):519–42. doi:10.1007/s10644-019-09257-5.
- Hasan, Amiratul Nadiah, Mansor Ibrahim, and Kinan Salim. 2026. “Financial Inclusion and Macroeconomic Outcomes in Developing Economies : Pre - COVID Insights on Growth , Stability , and Inequality.” *Future Business Journal* 12(30):1–14. doi:10.1186/s43093-026-00729-5.
- Hung, Assoc. Prof. Dr. Le Manh. 2025. “Institutional Transformation And Economic Governance In The Digital Age : Evidence From Emerging Economies.” *International Journal of Advances in Signal and Image Science* 11(2):107–26. doi:10.29284/ijasis.11.2.2025.107-126.
- Id, Emmanuel Asafo-adjei, Ebenezer Boateng, Zangina Isshaq, Anthony Aduasare Idun, Peterson Owusu, Junior Id, and Anokye M. Adam. 2021. “Financial Sector and Economic Growth Amid External Uncertainty Shocks: Insights into Emerging Economies.” *PLoS ONE* 16(11):1–26. doi:10.1371/journal.pone.0259303.

- Ijomah, Osemeike Gloria Eyieyien; Courage Idemudia; Patience Okpeke Paul; Tochukwu Ignatius. 2024. "Strategic Approaches for Successful Digital Transformation in Project Management across Industries." *International Journal of Frontiers in Engineering and Technology Research* 7(1):1–11. doi:10.53294/ijfetr.2024.7.1.0037.
- Islam, Md Saiful, and Ibrahim A. Alhamad. 2022. "Impact of Financial Development and Institutional Quality on Remittance-Growth Nexus: Evidence from the Topmost Remittance-Earning Economies." *Heliyon* 8(12):e11860. doi:10.1016/j.heliyon.2022.e11860.
- Jose De Gregorio, Pablo E. Guidotti. 1995. "Financial Development and Economic Growth." *World Development* 23(3):433–48. doi:10.1016/0305-750x(94)00132-i.
- Kai, Ma, Qi XU, Muhammad Sibte Ali, Mohd Abass Bhat, Akhtar Rehman, and Laeeq Razzak Janjua. 2026. "Digitalization and Institutional Quality as Drivers of Global Value Chains: Evidence from ASEAN Using CS-ARDL Analysis." *Humanities and Social Sciences Communications* 13(2026):1–15. doi:10.1057/s41599-025-06421-3.
- Katircioglu, Salih Turan. 2012. "Financial Development, International Trade and Economic Growth: The Case of Sub-Saharan Africa." 15(1):117–27.
- Kraus, Sascha, Paul Jones, Norbert Kailer, Alexandra Weinmann, and Nuria Chaparro-banegas. 2021. "Digital Transformation: An Overview of the Current State of the Art of Research." *SAGE Open* 11(3):1–15. doi:10.1177/21582440211047576.
- Kurnia, Regina Safira Amaranti and Akhmad Syakir. 2025. "Financial Development, Human Capital, and Investment in 7 ASEAN Countries: A Triangular Analysis of Economic Growth." *JOURNAL OF ECONOMICS* 14(3):141–50. doi:10.14710/djoe.52526.
- Le, Thi Anh Tuyet. 2025. "The Impact of Digital Transformation on Economic Integration in ASEAN-6: Evidence from a Generalized Least Squares (GLS) Model." *Journal of Risk and Financial Management* 18(4):1–13. doi:10.3390/jrfm18040189.
- Li, Yang, and Tianye Zhao. 2024. "How Digital Transformation Enables Corporate Sustainability: Based on the Internal and External Efficiency Improvement Perspective." *Journal of Sustainability* 16(12):1–20. doi:10.3390/su16125037.
- Li, Ying, Xiao Guang Li, and Haseeb Ahmad. 2024. "ICT Diffusion and Financial Development: Comparing High, Middle, and Low-Income

- Countries.” *PLoS ONE* 19(5 May):1–17. doi:10.1371/journal.pone.0295183.
- Lisbinski, Fernanda Cigainski, and Heloisa Lee Burnquist. 2024. “Institutions and Financial Development : Comparative Analysis of Developed and Developing Economies.” *Journal of Institutions and Financial Development* 25(2):347–76. doi:10.1108/ECON-11-2023-0201.
- Memon, Mumtaz Ali, Jun Hwa Cheah, T. Ramayah, Hiram Ting, Francis Chuah, and Tat Huei Cham. 2019. “Moderation Analysis: Issues and Guidelines.” *Journal of Applied Structural Equation Modeling* 3(1):i–xi. doi:10.47263/jasem.3(1)01.
- Michael Appiah, Fanglin Li, Dorren Idan Frowne. 2020. “Financial Development , Institutional Quality and Economic Growth : Evidence from ECOWAS Countries.” *Organizations and Markets in Emerging Economies* 11(1):6–17. doi:10.15388/omee.2020.11.20.
- Mili, Hela. 2025. “Institutional Quality as a Determinant of the Finance – Growth Relationship: Evidence from Developing and Middle-Income Nations.” *Journal of Cultural Analysis and Social Change* 10(2):2984–95. doi:10.64753/jcasc.v10i2.2042.
- Novianti, Sendy Watazawwadu’Ilmi; Fuad Wahdan Muhibuddin; Alfa Chasanah; Tanti. 2025. “Digitalization and Economic Growth: Business Strategies in the ASEAN Market.” *Jurnal Aplikasi Bisnis Dan Manajemen (JABM)* 11(2):486–98. doi:10.17358/jabm.11.2.486.
- Ogbuabor, Jonathan E., Anthony Orji, Charles O. Manasseh, and Onyinye I. Anthony-orji. 2020. “Institutional Quality and Growth in West Africa: What Happened after the Great Recession?” *International Advances in Economic Research* 26(4):343–61. doi:10.1007/s11294-020-09805-0.
- Olczyk, Magdalena, and Marta Kuc-Czarnecka. 2022. “Digital Transformation and Economic Growth – Desi Improvement and Implementation.” *Technological and Economic Development of Economy* 28(3):775–803. doi:10.3846/tede.2022.16766.
- Olofin, Olabode Philip. 2023. “Digital Economy, Institutional Quality and Economic Growth in Selected Countries.” *CBN Journal of Applied Statistics* 14(1):25–46. doi:10.33429/Cjas.14123.2/5 This.
- Orji, Anthony, Ikubor O. Jude, and Jonathan E. Ogbuabor. 2023. “Investigating the Financial Inclusion, Domestic in Nigeria Investment, and Financial Development Nexus.” *Journal of Academic Research in Economics* 41(1):1–16. doi:10.20885/unisia.vol41.iss1.art1.

- Ou, Chuanlin Wang; Guowan Yan; Juan. 2023. "Does Digitization Promote Green Innovation? Evidence from China." *International Journal of Environmental Research and Public Health Article* 20(5):1–27. doi:10.3390/ijerph20053893.
- Patrick, Hugh T. 1966. "Financial Development in Underdeveloped Countries." *Economic Development and Cultural Change* 14(2):174–89. doi:10.1086/450153.
- Putri, Kharisma, and Andrian Huruta. 2025. "Digitalization and Economic Growth Nexus in the ASEAN Region." *The European Journal of Applied Economics* 22(1):53–70. doi:10.5937/ejae22-55546.
- Ramzan, Hengyu Shi; Dingwei Song; Muhammd. 2026. "Institutional Quality, Public Debt, and Sustainable Economic Growth: Evidence from a Global Panel." *Sustainability* 18:18073446. doi:10.3390/su17146487.
- Rizki, Setyo Wira, and Nikolay I. Didenko. 2025. "Institutional Performance and Its Impact on Economic Growth in ASEAN Countries: Trend and Panel Data Analysis." *Journal of Economics RUDN* 33(2):285–303. doi:10.22363/2313-2329-2025-33-2-285-303.
- Singh, Badreya Gharib Khamis Mohammed Alblooshi; Syed Zamberi Ahmad; Matloub Hussain; Sanjay Kumar. 2022. "Sustainable Management of Electronic Waste: Empirical Evidences from a Stakeholders' Perspective." *Journal of Business Strategy and the Environment* 31(4):1856–74. doi:10.1002/bse.2987.
- Tan, Xiujie, Si Cheng, and Yishuang Liu. 2024. "Green Digital Finance and Technology Diffusion." *Humanities and Social Sciences Communications* 11(1). doi:10.1057/s41599-024-02902-z.
- Tarigan, Edi Suranta, and Harjum Muharam. 2025. "Digital Transformation, Green Finance and Fintech in a Sustainable Digital Economy." *Jurnal Ilmiah Manajemen Kesatuan* 13(3):1363–74. doi:10.37641/jimkes.v13i3.3291.
- Tram, Nguyen Huynh Mai. 2025. "Digital Transformation, Financial Development and Economic Growth as Determinants of Environmental Sustainability in ASEAN Countries." *Discover Sustainability* 6(1). doi:10.1007/s43621-025-01721-9.
- Verdolini, Elena. 2023. *Interlinkages between the Just Ecological Transition and the Digital Transformation*. Brussels.
- Wu, Guo, and Qinglin Peng. 2024. "Bridging the Digital Divide: Unraveling the Determinants of FinTech Adoption in Rural Communities." *SAGE Open* 14(1):1–16. doi:10.1177/21582440241227770.

- Yang, Zhengrong, Prince Asare Vitenu-Sackey, Lizhong Hao, and Yuqi Tao. 2023. "Economic Freedom, Inclusive Growth, and Financial Development: A Heterogeneous Panel Analysis of Developing Countries." *PLoS ONE* 18(7 JULY):1–20. doi:10.1371/journal.pone.0288346.
- Zghidi, Nahed, and Riadh Trabelsi. 2025. "Impact of Digitalization on Sustainable Development: A Comparative Analysis of Developed and Developing Economies." *Journal of Risk and Financial Management* 18(7):1–21. doi:10.3390/jrfm18070359.
- Zhou, Wenhai, Xiaoyu Zhang, and Xiaomin Wu Id. 2024. "Digital Inclusive Finance , Industrial Structure , and Economic Growth : An Empirical Analysis of Beijing-Tianjin-Hebei Region in China." *PLoS ONE* 19(3):1–18. doi:10.1371/journal.pone.0299206.
- Žugić, Beni Suranto; Nataša Kovač; Kholid Haryono; Siti Fadzillah Abdul Rahman; Amer Fareed Mohd Shukri; Marcin Suder; Rafał Kusa; Dragica. 2026. "State of Digitalization in the Southeast Asia Region – Bibliometric Analysis." *Kualitas & Kuantitas: Jurnal Metodologi Internasional* 60(1):1053–80. doi:10.1007/s11135-025-02296-3.

