

CAN DIGITALIZATION REDUCE UNEMPLOYMENT IN EMERGING MUSLIM ECONOMIES? CONDITIONAL EVIDENCE

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Abstract

This study examines whether digitalization contributes to reducing unemployment in emerging Muslim economies and explores the conditional roles of financial development, human capital, and economic uncertainty. Despite the rapid expansion of internet access and digital technologies, evidence on their employment effects remains inconclusive, particularly in developing and Muslim-majority countries. Using panel data from 14 emerging Muslim economies over the period 2005–2024, this study employs a Random Effects model to estimate both the direct and moderating effects of digitalization on unemployment. Internet penetration is used as a proxy for digitalization, while domestic credit to the private sector, human capital, and inflation volatility represent financial development, human capital, and economic uncertainty, respectively. The findings indicate that digitalization does not have a significant direct effect on unemployment. However, financial development significantly reduces unemployment, while human capital exhibits a positive direct relationship with unemployment, suggesting the presence of labor-market mismatches. Furthermore, the interaction analysis reveals that human capital and economic uncertainty significantly strengthen the unemployment-reducing effect of digitalization, whereas financial development does not play a significant moderating role. These results suggest that digital transformation alone is insufficient to improve labor-market outcomes and that supportive structural conditions are necessary to realize its employment benefits. The study contributes to the growing literature by providing new evidence from emerging Muslim economies and highlighting the importance of complementary factors in shaping the digitalization–unemployment nexus.

Keywords: Digitalization, Unemployment, Financial Development, Human Capital, Economic Uncertainty.

Introduction

Unemployment remains one of the most persistent socioeconomic challenges confronting emerging economies, particularly those undergoing rapid structural transformation. While economic growth has expanded across many developing countries over recent decades, labor markets have often struggled to generate sufficient employment opportunities to absorb growing labor forces. This challenge is especially relevant for emerging Muslim economies, where demographic expansion, urbanization, and economic diversification have intensified pressures on labor markets. At the same time, these economies have experienced substantial progress in digital transformation, reflected in rising internet penetration, expanding digital infrastructure, and increasing adoption of information and communication technologies (ICT). The growing digitalization of economic activities has transformed production processes, business models, and labor-market interactions, creating both opportunities and risks for employment outcomes. Consequently, understanding whether digitalization contributes to reducing unemployment has become an increasingly important issue for policymakers seeking to promote inclusive and sustainable economic development.

The relationship between digitalization and unemployment, however, remains theoretically ambiguous and empirically unresolved. On the one hand, digital technologies can improve labor-market efficiency by reducing information asymmetries, facilitating job matching, lowering job-search costs, and creating new employment opportunities within digital and technology-intensive sectors. Empirical evidence from the European Union, Africa, Kazakhstan, and several developing economies suggests that digitalization and ICT diffusion contribute to lower unemployment rates and improved labor-market performance (Barzhaksyyeva et al., 2026; Başol et al., 2023; Ogbonna et al., 2023; Uddin et al., 2026). Internet access has also been shown to increase job-finding rates and improve employment outcomes by expanding access to labor-market information and digital employment platforms (Denzer et al., 2021; Njiepue Nouffeussie et al., 2024; Yunisvita et al., 2024). Furthermore, digital technologies may stimulate structural transformation by supporting ICT services exports,

entrepreneurship, and productivity growth, thereby generating additional labor demand (Li et al., 2023; Ronen, 2021; Talla Fokam et al., 2023).

On the other hand, digitalization does not automatically translate into employment creation. Several studies suggest that technological change may initially displace workers, widen skill mismatches, and increase labor-market uncertainty when institutions and educational systems fail to adapt. Evidence from Indonesia indicates that digitalization may increase unemployment under certain conditions, particularly when labor-market adjustment mechanisms are weak (Arifin, 2023). Similar concerns have been raised by (Titarenko & Rezanova, 2021), who argue that digital transformation may intensify labor-market instability by altering skill requirements faster than workers can adapt. Likewise, (Barna & Epure, 2020) demonstrate that inadequate digital literacy limits the ability of workers to benefit from digital transformation, while (Dah, 2026) identifies nonlinear effects in which digitalization generates employment benefits only after a certain threshold of digital maturity is achieved. These contrasting findings suggest that the employment consequences of digitalization are highly heterogeneous and depend on country-specific structural conditions rather than digital expansion alone.

Recent literature increasingly emphasizes the importance of complementary factors that condition the relationship between digitalization and labor-market outcomes. Among these factors, financial development plays a crucial role by facilitating investment, entrepreneurship, technological adoption, and business expansion, all of which can influence employment creation. Similarly, human capital determines the capacity of workers to adapt to technological change and exploit emerging digital opportunities. Studies consistently show that digital skills, education quality, and workforce readiness strengthen the positive employment effects of digital technologies (Kee et al., 2023; Kholifah et al., 2025; Richiardi et al., 2025; Sabirova et al., 2022). In contrast, skill mismatches may prevent labor markets from benefiting fully from digital transformation (Alao & Brink, 2022; Othman, 2025). Economic uncertainty represents another important but often overlooked factor. Periods of heightened uncertainty may discourage investment and hiring decisions, potentially weakening labor-market performance. However, digital technologies may also enhance resilience by enabling firms and workers to adjust more rapidly to changing economic conditions. Despite growing interest in these channels, existing studies have rarely examined whether financial development, human capital, and economic uncertainty jointly shape the effectiveness of digitalization in reducing unemployment.

Although the literature on digitalization and employment has expanded considerably, several important gaps remain. First, most existing studies focus on advanced economies, individual countries, or broad global samples, with limited attention devoted specifically to emerging Muslim economies despite their growing importance in the global digital landscape. Second, previous research generally examines the direct effect of digitalization on employment or unemployment, while paying insufficient attention to the conditional mechanisms through which digitalization influences labor-market outcomes. Third, the moderating roles of financial development, human capital, and economic uncertainty have rarely been investigated simultaneously within a unified empirical framework. Finally, evidence regarding the employment effects of digitalization remains fragmented and often contradictory, highlighting the need for further investigation in contexts characterized by diverse levels of economic development, institutional capacity, and digital readiness. Addressing these gaps is particularly important because emerging Muslim economies exhibit substantial heterogeneity in digital infrastructure, financial systems, educational attainment, and macroeconomic stability.

This study seeks to address these limitations by examining the relationship between digitalization and unemployment in a panel of emerging Muslim economies. Specifically, the study addresses three research questions: (RQ1) Is there a relationship between digitalization and unemployment? (RQ2) Does financial development directly affect unemployment and condition the impact of digitalization? (RQ3) Do human capital and inflation volatility, as a proxy for economic uncertainty, influence unemployment and shape the effectiveness of digitalization? The novelty of this study lies in its integrated examination of digitalization, financial development, human capital, and economic uncertainty within the context of emerging Muslim economies, a setting that remains largely overlooked in the existing literature. By investigating both the direct and conditional effects of digitalization on unemployment, this study contributes to the growing literature on the digital economy and labor markets, provides new evidence from an underexplored group of countries, and offers policy insights regarding the complementary conditions required for digital transformation to translate into meaningful employment gains.

Methods

3.1 Data and Sample

This study investigates the relationship between digitalization and unemployment in a panel of emerging Muslim economies over the period 2005–2024. The sample consists of fourteen countries, namely Indonesia, Malaysia, Bangladesh, Pakistan, Egypt, Morocco, Brunei Darussalam, Saudi Arabia, Oman, Qatar, Algeria, Tunisia, Iran, and Türkiye. These countries were selected because they represent diverse levels of economic development, digital transformation, financial sector development, and labor market performance within the Muslim world.

Annual data were collected from internationally recognized databases. The unemployment rate (UNEMP) serves as the dependent variable. Digitalization is proxied by internet penetration (INTERNET), measured as the percentage of individuals using the internet. Financial development is represented by domestic credit to the private sector (CREDIT), while human capital (HUMAN) captures workforce skills and educational attainment. Economic uncertainty (UNCERTAINTY) is proxied by inflation volatility. In addition, GDP per capita (GDPPC) and trade openness (TRADE) are included as control variables to account for differences in economic development and international integration. Due to data availability constraints, the final estimation is based on an unbalanced panel comprising 260 observations.

3.2 Model Specification

To examine the direct relationship between digitalization and unemployment, the following baseline model is estimated:

$$UNEMP_{it} = \alpha + \beta_1 INTERNET_{it} + \beta_2 CREDIT_{it} + \beta_3 HUMAN_{it} + \beta_4 GDPPC_{it} + \beta_5 TRADE_{it} + \beta_6 UNCERTAINTY_{it} + \varepsilon_{it} \dots (1)$$

where i denotes country and t denotes year.

To investigate whether financial development, human capital, and economic uncertainty condition the effect of digitalization on unemployment, the following interaction model is estimated:

$$UNEMP_{it} = \alpha + \beta_1 INTERNET_{it} + \beta_2 CREDIT_{it} + \beta_3 HUMAN_{it} + \beta_4 GDPPC_{it} + \beta_5 TRADE_{it} + \beta_6 UNCERTAINTY_{it} \dots (2)$$

$$+ \beta_7 (INTERNET \times CREDIT)_{it} + \beta_8 (INTERNET \times HUMAN)_{it} + \beta_9 (INTERNET \times UNCERTAINTY)_{it} + \varepsilon_{it} \dots (3)$$

The interaction terms allow the study to assess whether the unemployment effects of digitalization vary according to the level of financial development, human capital accumulation, and economic uncertainty.

3.3 Estimation Technique

The empirical analysis begins with descriptive statistics and pairwise correlation analysis to provide an overview of the variables and examine preliminary relationships among them. Subsequently, both Fixed Effects (FE) and Random Effects (RE) models are estimated to account for potential heterogeneity across countries. To determine the most appropriate estimator, the Hausman specification test is employed. The test produces a chi-square statistic of 9.499 with a p-value of 0.147. Since the p-value exceeds the conventional significance level of 5%, the null hypothesis cannot be rejected, indicating that the Random Effects model is more appropriate for the analysis. Accordingly, the Random Effects estimator is adopted as the preferred model. The baseline Random Effects model reports an overall R^2 of 0.146 and a Wald chi-square statistic of 24.527 ($p < 0.001$), indicating that the explanatory variables are jointly significant. The extended model incorporating interaction effects yields an overall R^2 of 0.149 and a Wald chi-square statistic of 38.535 ($p < 0.001$), suggesting improved explanatory power and supporting the relevance of the moderating variables in shaping the relationship between digitalization and unemployment.

3.4 Variable Description

The dependent variable is the unemployment rate (UNEMP). The key explanatory variable is internet penetration (INTERNET), which serves as a proxy for digitalization. Financial development is measured by domestic credit to the private sector (CREDIT), while human capital (HUMAN) is a proxy of School enrollment, tertiary (% gross) to capture the stock of skills and education available in the economy. Economic uncertainty (UNCERTAINTY) is proxied by inflation volatility. GDP per capita (GDPPC) and trade openness (TRADE) are included as control variables because higher income levels and greater integration into international markets are generally associated with improved labor market outcomes. Finally, three interaction terms— $INTERNET \times CREDIT$, $INTERNET \times HUMAN$, and $INTERNET \times UNCERTAINTY$ —are

introduced to examine whether the impact of digitalization on unemployment depends on financial development, human capital, and economic uncertainty, respectively.

Results and Discussions

Results

Table 1. Descriptive Statistics of the Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
unemp	294	7.084	4.285	.1	18.334
internet	294	51.233	30.757	.242	101
lcredit	274	3.752	.584	2.439	4.933
lhuman	293	3.384	.65	1.465	4.849
lgdppc	294	8.832	1.149	6.606	11.31
Trade	294	71.876	34.576	24.702	203.855
luncertainty	280	1.498	1.079	-1.756	3.586

Source: Data Processing Result, 2026

Table 1 presents the descriptive statistics for all variables included in the analysis. The average unemployment rate across the sampled emerging Muslim economies is 7.08%, with substantial variation ranging from 0.1% to 18.33%, indicating considerable differences in labor market conditions among countries and over time. Internet penetration, used as a proxy for digitalization, records a mean value of 51.23%, suggesting that, on average, approximately half of the population had access to the internet during the study period, although the wide range (0.24%–101%) reflects significant disparities in digital development. Financial development (lcredit) has a mean of 3.75, while human capital (lhuman) averages 3.38, indicating moderate levels of financial and human capital development across the sample. The mean value of GDP per capita (lgdppc) is 8.83, highlighting differences in economic prosperity among the selected countries. Trade openness averages 71.88% of GDP, suggesting a relatively high degree of integration into the global economy. Finally, economic uncertainty (luncertainty), measured through inflation volatility, exhibits a mean of 1.50 and considerable dispersion, indicating varying levels of macroeconomic stability across countries. Overall, the descriptive statistics reveal substantial cross-country and temporal variation in unemployment, digitalization, and other explanatory variables, providing a suitable basis for panel data analysis.

Table 2. Pairwise Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) unemp	1.000						
(2) internet	-0.124*	1.000					
	(0.033)						
(3) lcredit	-0.075	0.533*	1.000				
	(0.215)	(0.000)					
(4) lhuman	0.403*	0.562*	0.372*	1.000			
	(0.000)	(0.000)	(0.000)				
(5) lgdppc	-0.294*	0.601*	0.331*	0.308*	1.000		
	(0.000)	(0.000)	(0.000)	(0.000)			
(6) Trade	-0.148*	0.430*	0.602*	0.137*	0.539*	1.000	
	(0.011)	(0.000)	(0.000)	(0.019)	(0.000)		
(7) luncertainty	-0.270*	0.397*	-0.139*	0.209*	0.608*	0.117*	1.000
	(0.000)	(0.000)	(0.025)	(0.000)	(0.000)	(0.050)	

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Data Processing Result, 2026

Table 2 reports the pairwise correlation coefficients among the study variables. The results indicate that unemployment is negatively and significantly correlated with internet penetration ($r = -0.124$, $p < 0.10$), GDP per capita ($r = -0.294$, $p < 0.01$), trade openness ($r = -0.148$, $p < 0.05$), and economic uncertainty ($r = -0.270$, $p < 0.01$), suggesting that higher levels of digitalization, economic development, and trade integration are generally associated with lower unemployment rates. In contrast, human capital exhibits a positive and significant correlation with unemployment ($r = 0.403$, $p < 0.01$), indicating a potentially complex relationship that warrants further investigation through multivariate analysis. Regarding the independent variables, internet penetration is positively correlated with financial development, human capital, GDP per capita, trade openness, and economic uncertainty, reflecting the close association between digital development and broader economic

advancement. The highest correlation coefficient is observed between trade openness and financial development ($r = 0.602$, $p < 0.01$), followed by GDP per capita and economic uncertainty ($r = 0.608$, $p < 0.01$). Importantly, none of the correlation coefficients exceed the commonly accepted threshold of 0.80, suggesting that multicollinearity is unlikely to be a serious concern in the subsequent regression analysis. Overall, the correlation results provide preliminary evidence of significant relationships among the variables while supporting the suitability of the dataset for panel econometric estimation.

Table 3. Random Effects Regression Results

unemp	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
internet	-.006	.006	-0.96	.338	-.018	.006	
lcredit	-1.357	.462	-2.93	.003	-2.264	-.451	***
lhuman	1.146	.415	2.76	.006	.332	1.96	***
lgdppc	-1.527	.587	-2.60	.009	-2.678	-.376	***
Trade	-.021	.007	-2.92	.003	-.035	-.007	***
luncertainty	-.202	.13	-1.56	.119	-.456	.052	
Constant	23.957	5.702	4.20	0	12.782	35.132	***
Mean dependent var	7.008		SD dependent var		4.367		
Overall r-squared	0.146		Number of obs		260		
Chi-square	24.527		Prob > chi2		0.000		
R-squared within	0.089		R-squared between		0.164		

*** $p < .01$, ** $p < .05$, * $p < .1$

Source: Data Processing Result, 2026

Table 3 presents the results of the Random Effects estimation, which was selected as the preferred model based on the Hausman test. The overall model is statistically significant, as indicated by the Wald chi-square statistic of 24.527 ($p < 0.001$), suggesting that the explanatory variables jointly explain variations in unemployment across the sampled emerging Muslim economies. The results show that internet penetration has a negative but statistically insignificant effect on unemployment ($\beta = -0.006$, $p = 0.338$), indicating that digitalization alone does not directly reduce unemployment. Financial development, measured by domestic credit to the private sector, exerts a negative and highly significant effect on unemployment ($\beta = -1.357$, $p < 0.01$), suggesting that deeper financial systems contribute to job creation and labor market improvement. Human capital is positively and significantly associated with unemployment ($\beta = 1.146$, $p < 0.01$), implying that higher levels of education or skills do not automatically translate into employment opportunities, possibly reflecting skill mismatches or structural labor market challenges. GDP per capita exhibits a negative and significant coefficient ($\beta = -1.527$, $p < 0.01$), indicating that economic development contributes to lower unemployment rates. Similarly, trade openness negatively affects unemployment ($\beta = -0.021$, $p < 0.01$), suggesting that greater integration into international markets supports employment generation. In contrast, economic uncertainty, proxied by inflation volatility, has a negative but statistically insignificant coefficient ($\beta = -0.202$, $p = 0.119$). Overall, the findings suggest that while digitalization does not directly reduce unemployment in emerging Muslim economies, financial development, economic growth, and trade openness play important roles in improving labor market outcomes.

Table 4. Moderating Effects of Financial Development, Human Capital, and Economic Uncertainty

unemp	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
internet	.025	.029	0.86	.389	-.032	.083	
lcredit	-1.459	.601	-2.43	.015	-2.637	-.282	**
lhuman	1.431	.517	2.77	.006	.418	2.443	***
lgdppc	-2.096	.601	-3.49	0	-3.273	-.919	***
Trade	-.016	.007	-2.21	.027	-.03	-.002	**
luncertainty	.168	.201	0.84	.403	-.226	.563	
int_credit	.008	.007	1.18	.238	-.005	.02	
int_human	-.013	.007	-1.82	.069	-.027	.001	*
int_uncertainty	-.008	.004	-2.10	.036	-.015	-.001	**
Constant	27.351	5.853	4.67	0	15.879	38.823	***
Mean dependent var	7.008		SD dependent var		4.367		
Overall r-squared	0.149		Number of obs		260		
Chi-square	38.535		Prob > chi2		0.000		
R-squared within	0.140		R-squared between		0.162		

*** $p < .01$, ** $p < .05$, * $p < .1$

Source: Data Processing Result, 2026

Table 4 reports the results of the Random Effects model incorporating interaction terms to examine whether financial development, human capital, and economic uncertainty condition the relationship between digitalization and unemployment. The model is jointly significant, as indicated by the Wald chi-square statistic of 38.535 ($p < 0.001$), and explains a greater proportion of variation in unemployment compared to the baseline model. Similar to the baseline results, internet penetration does not exert a direct significant effect on unemployment ($\beta = 0.025$, $p = 0.389$). Financial development remains negatively and significantly associated with unemployment ($\beta = -1.459$, $p < 0.05$), confirming its role in improving labor market outcomes. Likewise, GDP per capita ($\beta = -2.096$, $p < 0.01$) and trade openness ($\beta = -0.016$, $p < 0.05$) continue to reduce unemployment, while human capital retains a positive and significant coefficient ($\beta = 1.431$, $p < 0.01$). Economic uncertainty remains statistically insignificant in its direct effect on unemployment ($\beta = 0.168$, $p = 0.403$).

Regarding the moderating effects, the interaction between internet penetration and financial development (INTERNET $\times$ CREDIT) is positive but statistically insignificant ($\beta = 0.008$, $p = 0.238$), indicating that financial development does not significantly alter the impact of digitalization on unemployment. In contrast, the interaction between internet penetration and human capital (INTERNET $\times$ HUMAN) is negative and weakly significant at the 10% level ($\beta = -0.013$, $p = 0.069$), suggesting that the unemployment-reducing effect of digitalization becomes stronger in countries with higher levels of human capital. This finding implies that digital technologies are more effective when supported by a skilled and educated workforce capable of utilizing digital opportunities. Furthermore, the interaction between internet penetration and economic uncertainty (INTERNET $\times$ UNCERTAINTY) is negative and statistically significant ($\beta = -0.008$, $p < 0.05$), indicating that digitalization plays a more important role in mitigating unemployment during periods of higher economic uncertainty. Overall, the results suggest that the effectiveness of digitalization in reducing unemployment depends less on financial development and more on complementary factors such as human capital and the broader macroeconomic environment. These findings support the argument that digital transformation alone is insufficient to improve labor market outcomes and that supportive structural conditions are required for digitalization to generate meaningful employment benefits.

Discussions

The primary objective of this study was to examine whether digitalization reduces unemployment in emerging Muslim economies and whether this relationship is conditioned by financial development, human capital, and economic uncertainty. Regarding RQ1, the findings reveal that internet penetration does not exert a statistically significant direct effect on unemployment. This result suggests that digitalization alone is insufficient to generate broad labor-market improvements across emerging Muslim economies. While internet access has expanded substantially in countries such as Indonesia, Türkiye, Saudi Arabia, and Malaysia during the last two decades, the employment benefits of digitalization appear to depend on additional structural conditions. This finding is consistent with studies reporting weak or insignificant employment effects of digitalization in developing economies (Azu et al., 2021; Hesda, 2023) and supports the argument that digital technologies do not automatically translate into job creation. It also aligns with the findings of (Arifin, 2023), Titarenko and Rezanova (2021), and Barna and Epure (2023), who argue that rapid technological adoption may generate labor-market disruptions when workers and institutions fail to adapt. However, the insignificant direct effect contrasts with studies documenting unemployment-reducing effects of digitalization in Europe, Africa, and Central Asia (Barzhaksyyeva et al., 2026; Başol et al., 2023; Ogbonna et al., 2023; Uddin et al., 2026). The divergence may reflect the heterogeneous nature of the sampled economies. For example, Malaysia and Türkiye possess relatively advanced digital ecosystems capable of generating digital employment opportunities, whereas countries such as Pakistan, Bangladesh, and Egypt continue to face challenges related to digital infrastructure, labor-market informality, and technological readiness. Consequently, internet expansion alone may not be sufficient to absorb unemployed workers across the entire sample.

The findings related to financial development provide a clearer picture. Financial development exerts a significant negative effect on unemployment, indicating that deeper financial systems contribute to employment generation. This result is economically intuitive because access to finance facilitates business expansion, entrepreneurship, technological adoption, and investment, all of which stimulate labor demand. This finding is consistent with the finance-growth literature, which emphasizes that well-developed financial systems improve capital allocation, reduce financing constraints, and support productive economic activities (Levine et al., 2004). Moreover, financial development can promote employment creation by easing firms' access to credit and enabling business expansion (Pagano & Pica, 2012). In countries such as Indonesia and Malaysia, expanding access to credit has supported the growth of small and medium-sized enterprises, which remain major sources of employment. This argument is supported by (Ayyagari et al., 2014), who demonstrate that SMEs play a crucial role in job creation, particularly in developing economies. Similarly, Saudi Arabia's

Vision 2030 and Türkiye's support for digital entrepreneurship increasingly rely on financial-sector development to stimulate private-sector job creation.

However, the interaction between digitalization and financial development is statistically insignificant. This suggests that although financial development independently reduces unemployment, it does not necessarily enhance the effectiveness of digitalization in generating jobs. One possible explanation is that financial resources in many emerging Muslim economies are not always directed toward productive digital sectors capable of creating substantial employment opportunities. In line with (Cecchetti & Kharroubi, 2012), greater financial deepening does not necessarily imply a more efficient allocation of resources toward sectors with the highest productivity or employment potential. Consequently, financial resources may be concentrated in capital-intensive activities rather than labor-intensive digital sectors. Therefore, digitalization and financial development appear to operate through separate channels rather than reinforcing one another. This finding contributes to the literature by showing that financial development alone cannot guarantee that digital transformation translates into employment gains.

The results concerning human capital are particularly noteworthy. The direct effect of human capital is positive and significant, implying that higher levels of education and skills are associated with higher unemployment. Although this finding appears counterintuitive, it is consistent with the growing literature on skill mismatch and graduate unemployment. Several emerging Muslim economies have experienced rapid expansion of higher education without a corresponding increase in high-skilled employment opportunities. This phenomenon is visible in countries such as Tunisia, Egypt, Algeria, and Morocco, where university graduates often face unemployment rates substantially above the national average. Similar concerns are highlighted by (Alao & Brink, 2022; Barna & Epure, 2020; Othman, 2025; Titarenko & Rezanova, 2021), who argue that educational systems frequently fail to provide the digital and practical skills demanded by modern labor markets. Nevertheless, the interaction between digitalization and human capital is negative and statistically significant, suggesting that human capital strengthens the unemployment-reducing effect of digitalization. This finding supports the arguments of (Kee et al., 2023; Kholifah et al., 2025; Lu et al., 2026; Richiardi et al., 2025; Sabirova et al., 2022; Talla Fokam et al., 2023), who emphasize that digital technologies generate stronger employment benefits when workers possess the skills necessary to utilize them effectively. In other words, internet access alone does not create jobs, but internet access combined with adequate digital skills, education, and workforce readiness can improve labor-market outcomes. This result may explain why digitalization has produced stronger employment gains in Malaysia and Türkiye than in countries where digital skills remain relatively limited.

The findings regarding economic uncertainty offer additional insights. Although inflation volatility does not directly affect unemployment, the interaction between digitalization and economic uncertainty is negative and statistically significant. This suggests that digitalization becomes more valuable in reducing unemployment during periods of elevated uncertainty. One possible explanation is that digital technologies enhance labor-market resilience by enabling remote work, digital entrepreneurship, online commerce, and platform-based employment. During periods of economic disruption, workers and firms may increasingly rely on digital channels to maintain economic activity. Evidence from Indonesia following the COVID-19 pandemic illustrates how online labor-market platforms, digital businesses, and internet-based employment opportunities became increasingly important for job seekers (Bachtiar, 2024). Similar patterns have been observed in other developing economies where digital platforms improved job matching and labor-market flexibility (Denzer et al., 2021; Gafurova, 2025; Njiepue Nouffeussie et al., 2024). This finding extends the existing literature by demonstrating that digitalization can function as a labor-market stabilizer under adverse macroeconomic conditions. Therefore, the benefits of digitalization may become more visible not during periods of economic stability, but during periods characterized by heightened uncertainty and structural change.

Overall, the findings support the broader argument that the relationship between digitalization and unemployment is highly conditional rather than universal. Consistent with the heterogeneity literature (Azu et al., 2021; Dah, 2026; Hesda, 2023; Postuła et al., 2021; Rivaldo & Susilowati, 2025; Saeed, 2025), digitalization does not generate employment benefits automatically. Instead, its effectiveness depends on complementary factors that enable workers and firms to transform digital access into productive economic activity. The main contribution of this study is therefore not the identification of a direct unemployment-reducing effect of digitalization, but rather the demonstration that human capital and economic uncertainty significantly shape how digitalization influences labor-market outcomes in emerging Muslim economies. These findings help explain why previous studies have produced conflicting results and highlight the importance of considering contextual and structural conditions when evaluating the labor-market consequences of digital transformation.

Based on these findings, policymakers in emerging Muslim economies should move beyond policies that focus solely on expanding internet access. First, governments should prioritize investments in digital skills, vocational training, and labor-market-oriented education to reduce skill mismatches and strengthen the capacity of workers to benefit from digital opportunities. Second, educational curricula should be aligned more closely with the needs of the digital economy, particularly in fields such as information technology, artificial intelligence, data analytics, and digital entrepreneurship. Third, governments should encourage the development of digital labor-market platforms and online employment services to improve job matching and reduce information asymmetries. Fourth, financial-sector reforms should focus on expanding access to finance for technology-based startups, digital entrepreneurs, and small businesses rather than merely increasing aggregate credit. Finally, policymakers should view digitalization as a tool for enhancing labor-market resilience during periods of economic uncertainty by supporting remote work infrastructure, digital business ecosystems, and platform-based employment opportunities. Together, these measures can help ensure that digital transformation contributes not only to technological progress but also to sustainable and inclusive employment growth across emerging Muslim economies.

Conclusion

This study examined whether digitalization reduces unemployment in fourteen emerging Muslim economies over the period 2005–2024 while considering the conditional roles of financial development, human capital, and economic uncertainty. The findings reveal that internet penetration does not have a significant direct effect on unemployment, suggesting that digitalization alone is insufficient to generate broad labor-market improvements. In contrast, financial development, GDP per capita, and trade openness significantly reduce unemployment, highlighting the importance of economic development and market integration in supporting job creation. The results also show a positive association between human capital and unemployment, which may reflect skill mismatches and graduate unemployment in several emerging Muslim economies. More importantly, the moderating analysis demonstrates that the effectiveness of digitalization depends on the surrounding economic environment. While financial development does not significantly alter the impact of digitalization on unemployment, both human capital and economic uncertainty play important conditioning roles. Specifically, digitalization becomes more effective in reducing unemployment when supported by higher levels of human capital and during periods of greater economic uncertainty. These findings suggest that policymakers should move beyond simply expanding internet access and instead focus on developing digital skills, improving education quality, promoting digital entrepreneurship, and strengthening labor-market adaptability. Overall, the study contributes new evidence from emerging Muslim economies and highlights that the employment benefits of digitalization depend on complementary structural conditions rather than digital expansion alone.

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