Global Scientific and Academic Research Journal of Economics, Business and Management
ISSN: 2583-5645 (Online)
Frequency: Monthly
Published By GSAR Publishers
Journal Homepage Link- https://gsarpublishers.com/journals-gsarjebm-home/

Digital Transformation and Economic Growth in MENA Countries

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Article History

Received: 01/05/2025
Accepted: 10/05/2025
Published: 13/05/2025

Vol –4 Issue – 5

PP: -01-07

Abstract

This article studies the link between digital transformation and economic growth in a panel of 7 Middle East and North Africa (MENA) countries, namely Tunisia, Morocco, Algeria, Egypt, Oman, Qatar and and United Arab Emirates over the 2008-2021 period. Using the generalized method of moment (GMM) estimator for linear dynamic panel data models, we find a positive relation between digital transformation and economic growth in MENA countries. The policy suggestions in this study advocate a global approach and seizing opportunities for industry to leverage digitalization, integrate it into the world of work, and provide a sound understanding of digital infrastructure, which will improve economic performance in the digital economy era. Furthermore, the findings provide policymakers with a basis for better formulating policies aimed at achieving the Sustainable Development Goals.

Keywords: *Digitalization development, Economic growth, Dynamic panel data analysis*

JEL Classification: *F63, F43, C23*

1. Introduction

The widespread use of information and communication technologies (ICTs) has been one of the most significant developments of the past three decades. ICTs have become a key driver of economic and social activity in both developed and developing countries. In the second half of the 1990s, many developed and newly industrialized countries increased their investments in ICTs, which led to increased productivity growth. Primarily, ICTs have reshaped the transaction patterns of e-commerce and online businesses, increased the flexibility of the banking sector, and improved communication with digital channels, ultimately increasing productivity and economic growth. In addition, ICTs have significantly improved the efficiency of resource allocation, significantly reduced production costs, and stimulated demand and investment across all economic sectors.

With the onset of the Fourth Industrial Revolution (RI 4.0), the global economy is transforming into a digital economy. Digitalization has become a major factor in the sustainable development of all countries around the world. The rise of new technological economic paradigms within the international economy has impacted almost every aspect of the economy. Digitalization stimulates technological innovation and process reengineering, acting as a catalyst for large-scale job creation via digital platforms, thus contributing to a country's industrial and economic growth. Moreover, the digitalization of many developing countries, in particular, has given a new dimension to migration in the international labour market and led to demographic changes linked to technological advancements. Online job opportunities are now more numerous than ever before worldwide, and a large number of young experts from developing countries are accessing them. According to Hosan et al. (2022), the current technology-savvy generation and young workforce are likely to drive digitalization advancements and inclusion, which will ultimately lead to the creation of a digital economy.

ICT has meaningly donated to the development of globalization. The liberalization of the market has elevated competition and amplified the significance of cost and economy of scale. For his part, Drori (2010) pointed that the process of globalization produces innovation and accelerates the technology transmission. Globalization has enhanced as cross-border trade in goods and services, technological advancements, and investment flows. To accomplish the Sustainable Development Goals (SDGs), it is vital to inspire globalization in a more open, inclusive, balanced, and sustainable manner. Globalization has made possible the development of technologies, the liberalization of international investment regimes, the reduction of trade barriers, and the softening of domestic regulations. For their part, Rahman and Miah (2017) showed that economic integration, political relations, communication networks, and cultural exchanges contribute to globalization and economic

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growth. Academics have confirmed that business adoption of ICT is strictly related with productivity gains. However, the association among ICT and globalization is repetitive, and global competition among different suppliers has put pressure on service provider companies to innovate the market with the latest edge technologies (Luo and Bu, 2016). On the other hand, the return of these technologies has encouraged further advances in globalization, and this cycle continues. Since globalization impacts economic development, digitalization plays a vital role in the economic development of several countries.

In the era of IR 4.0, the world no longer depends entirely on the old industrial revolution, as the new one has proven beneficial to a country's economy. Therefore, some countries are embracing the idea of digitalization long before others. As for Arendt (2015), he claimed that technological change is considered one of the indispensable drivers for prosperous countries to take advantage of ICT and benefit from other growth drivers. More and more studies show that ICT development promotes economic growth (Adeleye and Eboagu, 2019; Remeikiene et al. 2021). However, some studies still show a difference. For their part, Ward and Zheng (2016) showed that, although telecommunications services play a more important role in economic growth, their effect may depend on a country's level of development.

For their part, Dewan and Kraemer (2000) claimed that investments in ICT provide more economic benefits to developed countries than to developing countries. For her part, Arendt (2015) argued that low-income countries converge towards high-income countries due to the leapfrog effect of ICT use. However, there is a huge digital divide between developing and developed countries in Favor of high-income countries. Therefore, it is unclear whether digitalization has a beneficial or detrimental effect on economic growth. This suggests that some countries seem to believe that digitalization has the effect of strengthening the economy and are striving to achieve this.

The dynamic nature of contemporary information technologies requires frequent changes in technology adoption patterns. Technology adoption is a complex social and developmental process that depends on individual constructions. According to Straub (2009), globalization promotes technology adoption through the transfer of foreign knowledge and strengthens international competition. Globalization offers development opportunities, but also new challenges and threats. However, it is unclear whether rapid globalization stimulates economic development due to increased competition in global markets (Gurgul and Lach, 2014). As for Foo et al. (2023), they argued that globalization continues to promote economic integration and reduce trade barriers, thereby improving trade.

The contributions of this article enrich the existing body of knowledge on digital transformation and economic growth. First, to our knowledge, limited studies explicitly highlight the role of digital transformation as a key factor in explaining economic growth. Thus, this study aims to quantitatively assess the effect of digital transformation on economic growth in a panel of 7 MENA countries, namely Tunisia, Morocco, Algeria, Egypt, Oman, Qatar, and the United Arab Emirates over the period 2008–2021.

This study is structured as follows. Section 2 covers the literature review. Section 3 presents the methodology and data. Section 4 describes the interpretation of the empirical results and the discussion. Section 5 presents the conclusion and policy recommendations.

2. Literature review

The role of key factors in economic development in different countries is a hot topic for academic and practical research. Economic growth is necessary to maintain and improve a country's international competitiveness. Considered as a means of improving the living standards of its population, it has been the subject of numerous theoretical and empirical studies. According to Coe et al., (1997), the importance of international economic growth for national development cannot be overstated. It is recognized in growth theories, particularly with regard to production spillovers between developed and developing countries.

In the other hand, Swan (1965) and Solow (1956) developed a neoclassical growth model to show the importance of capital, labour, and technical developments in the impact on total national output. Solow's (1956) model emphasized that capital and labour in the production function have constant returns to scale, and that labour increases technical progress. Economists have paid much attention to the effect of globalization on economic growth in recent decades. Theoretically, international economic integration has long been considered an efficient way to allocate resources, stimulate economic growth, and sustainable development. According to Salahuddin and Gow (2015), based on endogenous growth theory, technological innovation such as the Internet would be able to stimulate economic growth because it would promote the spread of ideas and information, as well as the diffusion of knowledge between firms, regions, and countries by helping to develop and adopt innovation processes.

Innovation and the development of new technologies bring new knowledge and benefit the country's economy. Moreover, technological change enriches citizens and the nation, allowing them to access new technologies and experience new things. Therefore, the growth in the number of internet users, mobile phone subscriptions, and fixed broadband would lead to an increase in digitalization, which would promote better knowledge dissemination and the development of new products, processes, and services. Consequently, increasing innovation capabilities would ultimately stimulate economic growth (Çalışkan, 2015).

In theory, the use of digital technologies promotes economic growth. In general, the use of digital technologies influences economic growth through the way ICTs transform online and e-commerce, increase the flexibility of banking operations, and improve communications, which ultimately boost

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productivity and economic growth (Myovella et al., 2020). Though, an important difference between developed and developing countries is that developed countries also produce digital technologies, while developing countries are merely users of these technologies. Moreover, developed countries already have substantial human capital, physical infrastructure, and appropriate government institutions and policies that reinforce and intensify the benefits of ICT investments (Dewan and Kraemer, 2000).

Several studies have argued the significant contributions of ICT capital to economic growth (Jorgenson and Stiroh, 2000; Stiroh, 2005). For their part, Dimelis and Papaioannou (2011) showed that ICT capital has a positive impact on economic growth in the UK and the US. As for Aker and Mbiti (2010), they pointed out that telecommunications, especially mobile technology, have also significantly changed people's lives and increased GDP in African countries. On the otrher hand, Habibi and Zabardast (2020) argued that digitalization has a significant positive impact on economic growth in the Middle East and OECD countries. As for Chowdhury (2006), he showed that investment in ICT has a negative impact on productivity. For their part, Thompson and Garbacz (2011) showed that digitalization has a negative impact on economic growth. In addition, Nguyen and Doytch (2022) revealed the negative link between ICT and economic growth for emerging countries. On the other hand, Xie and Jin (2023) found that digitalization would lead to a weakening of economic growth in the long run. As for Maneejuk and Yamaka (2020), they demonstrated a nonlinear relationship between ICT and economic growth. A large empirical literature has studied, implicitly or explicitly, the impact of digitalization on economic growth and has proposed mixed results. More recently, Hammache (2024) analysed the influence of economic digitalization on economic growth in 15 MENA countries from the period of 2012 to 2016. She found that the digitalization is positively associated with economic growth. She recommended the MENA governments to invest more in ICT, especially in ICT human capital to enhance economic growth in the region, and use efficiently labour force when adopting the frontier technology.

3. Data and Empirical Methodology

3.1. Data

This article examines a sample of 7 Middle East and North Africa (MENA) countries, namely Tunisia, Morocco, Algeria, Egypt, Oman, Qatar and and United Arab Emirates over the 2008-2021 period. The choice of countries selected for this study is mainly dictated by the availability of reliable data over the sample period. The panel covers the 2008-2021 period. The dependent variable is economic growth, measured by the rate of real per capita GDP growth at 2015 prices in US dollars.

The main variable of interest (digital transformation) and other control variables are obtained from the World Development Indicators (2024) published by the World Bank. In this study, we use individuals using the Internet (% of population) to measure digital transformation. Internet users are individuals who have used the Internet (from any location) in the last 3 months. The Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc.

The dependent variable is the real GDP per capita growth. Our base model includes the explanatory variables common to most growth regressions found in the literature:

- Initial GDP per capita (log): log of real GDP per capita. A negative coefficient is expected, signifying the existence of conditional convergence (La Porta et al., 1998; Beck et al., 2003).
- The rate of inflation: Consumer price index growth measures the annual percentage change in the consumer price index to determine the inflation rate. This rate reflects the change experienced by the prices paid by the average consumer during a given period when purchasing goods and services. A negative coefficient is expected, as high inflation can contribute to deteriorating price competitiveness leading to negative effects of the external sector on economic growth (Elder, 2004)
- Financial development**:** is measured by domestic credit to private sector by banks (% of GDP) which measures how much intermediation is performed by the banking sector, including credit to the public and private sectors. Calderon and Liu (2003) suggested that this indicator has an advantage because it only takes into account credits to the private sector and isolates credits extended to the private sector, as opposed to credits extended to governments, government agencies and businesses. public. In addition, it eliminates credits issued by the central bank.
- Total natural resources rents (% of GDP): Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents. Natural resources rents measure the extent to which the economy relies on natural resources to create income. The contribution of natural resources to economic output has important implications for economic development. Revenues from natural resources such as fossil fuels and minerals account for a significant share of GDP in different countries. Natural resources give rise to economic rents because they are not produced; since their supply is relatively fixed, they generally generate returns that exceed their cost of production (Koirala and Pradhan, 2019).

3.2. Empirical Methodology

The objective of our empirical analysis is to examine whether digital transformation (DIG) plays an important role in influencing economic growth in 7 MENA countries, namely Tunisia, Morocco, Algeria, Egypt, Oman, Qatar and and United Arab Emirates over the 2008-2021 period. As a starting point we formulate the standard growth model in a manner consistent with Foo et al. (2024). For this purpose, we use the following specification:

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$$GDP_{i,t} = \alpha_0 + \alpha_1 GDP_{i,t-1} + \alpha_2 DIG + \beta' X_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} (1)$$

where $GDP_{i,t-1}$ denotes the (logarithm of) level of GDP per capita of country i at the end of period t, DIG measures the proxy of digital transformation, $X_{i,t}$ is a vector of economic determinants of economic growth including: inflation rate; financial development, and the total natural resources rents, and μ_t is a time specific effect, η_i is an unobserved country-specific fixed effect and $\varepsilon_{i,t}$ is the error term.[1]

The model in question has both a problem of endogeneity of the variables, and a correlation between the lagged endogenous variable and the residuals. Indeed, any model of convergence is dynamic and, as a result, it introduces additional endogeneity within explanatory variables. In general, dynamic models are treated in first differences by the GMM.

Two econometric methods specific to panel data were successively used: the method of generalized moments in first differences (GMM in differences, Arellano and Bond, 1991) and the method of generalized moments in systems (System GMM, Blundell and Bond, 1998). This last method is the one used in the most recent applied work on the relationship between financial development and economic growth, notably that of Levine et al. (2000); It is on the results of this second method that we mainly base our conclusions.

System GMM estimations not only make it possible to take into account the heterogeneity of countries but also to deal with the problem of the endogeneity of variables, which necessarily arises when examining the association between financial development and economic development. The first authors who were interested in this relationship highlighted the two-way causality (Patrick, 1966) between the two forms of development, if only because the increase in income is accompanied by an increase in savings and therefore acquisitions of financial assets. Work on the theory of endogenous growth has further reinforced the idea of double causality. The sharing of risks that financial intermediation allows and which promotes investment in new technologies involves costs and itself implies a certain level of product per capita (Greenwood and Jovanovic, 1990).

The System GMM estimator for dynamic panel data models combines consists for each period the equation in first differences with that in levels. In the first difference equation, the variables are then instrumented by their level values lagged by at least one period. On the other hand, in the level equation, the variables are instrumented by their first differences. The system of equations thus obtained is estimated simultaneously, using the generalized method of moments. Blundell and Bond (1998) tested this method using Monte Carlo simulations. They showed that the System GMM estimator is more efficient than that of the difference GMM (Arellano and Bond, 1991) which only exploits the moment conditions of the difference equation.

To test the validity of lagged variables as instruments, Arellano and Bond (1991), Arellano and Bover (1995), and Blundel and Bond (1998) suggest the Sargan overidentification test (later replaced by the Hansen test) and the second-order autocorrelation test. In most regressions, the results of these two tests are as expected. The statistics of Hansen's overidentification test do not allow us to reject the Ho hypothesis, that of the validity of lagged variables. For the autocorrelation test, the test results do not reject the hypothesis of absence of second-order autocorrelation of the residuals. The results from this estimation are presented in Table (1).

4. Empirical results

At the level of table (1), the results clearly show that the estimated coefficient of the digital transformation variable is statistically significant at the 10% level. The result means that, a 1% increase in digital transformation will lead to 0.278% increase in real GDP growth in the MENA countries. Thus, this result is consistent with those obtained by Zhang et al. (2024), Olczyk and Kuc-Czarnecka (2022) and Raeskyesaa and kas (2019).

Table 1. Digitalization development and economic growth (2008-2021)

Variable	Estimation
Initial GDP per capita	-0.487*** (-4.091)
Digital transformation	0.278* (1.863)
Inflation	-0.59* (-1.853)
Financial development	0.702** (2.258)
Total natural resources rents	0.628*** (4.921)
Constant	3.786*** (2.331)
R-squared AR(2) test (p-value) Sargan test (p-value)	0.88 0.621 0.634

Note: AR(2) is a test of second order residual serial correlation while the J-test is the Hansen over-identification test. The t-statistics is in parentheses. *, ** and *** indicate a statistical significance at 10%, 5% and 1% levels, respectively.

[1] *Note that Eq. (1) can be alternatively written with the economic growth as dependent variable as:* $Growth_{i,t} = GDP_{i,t} - GDP_{i,t-1} = \alpha_0 + (\alpha_1 - 1)GDP_{i,t-1} + \alpha_2 FD + \beta' X_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}$, *where (* $\alpha_1 - 1$ *) is the convergence coefficient.*

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The coefficient of initial per capita GDP is negative and statistically significant at 1% level, which means that the conditional income convergence across countries hypothesis is verified: holding constant the additional factors of growth, countries with lower GDP per capita tend to grow more quickly. The initial position of the economy is therefore a central factor in economic growth, as documented by neoclassical theory. This finding is reliable with preceding studies (see, for example, Barro and Sala-i-Martin, 1997; Bekaert et al., 2003).

The coefficient of the inflation rate has a negative sign and is then statistically significant at 10% level, suggesting that a high inflation rate will have an adverse impact on economic growth. The result shows that a 1% increase in inflation would decrease real GDP growth by 0.59%. This finding suggests that inflation harms the economic growth. Indeed, inflation reduces the purchasing power of money, discourages investment and consequently slows down economic growth. Therefore, this result corroborates the work of Aydin et al. (2016).

The coefficient of the financial development variable is positive and statistically significant at the 5% level, which advocates that the financial development, proxied by domestic credit to private sector by banks (% of GDP), play a vital role in economic growth in the MENA countries. The result means that, a 1% increase in financial development will lead to 0.702% increase in real GDP growth. Economic theory argues that financial development contributes to better information about potential investment opportunities and capital allocation, which helps to stimulate economic growth. Our findings corroborate the predictions of the supply-side hypothesis, endogenous growth models, and the findings of some empirical studies such as those of Al-Jarallah (2022) and Riache et al. (2024).

On the other hand, total natural resources rents, which is measured as a percentage of GDP, is also significant, at 1% level, in explaining the economic growth in MENA countries. The positive sign on this variable suggests that the higher the natural resources rent, the higher economic growth. The results show that for every 1% change in the natural resources rent, the economic growth will increase by 0.628% suggesting total natural resources rents also have an important effect on economic growth. These results are consistent with the natural resource blessing hypothesis that the abundance of natural resources aids economies overcome obstacles to economic growth. In a similar study, Ben-Salha et al. (2021) confirmed that total natural resources rents exert a positive impact on economic growth in a sample of top resource-abundant countries during the period 1970-2013.

5. Conclusion

The link between digital transformation and economic growth has long been the subject of significant debate in the literature. Therefore, this article aims to re-investigate the role of digital transformation and economic growth in a panel of seven MENA countries, namely Tunisia, Morocco, Algeria, Egypt, Oman, Qatar, and the United Arab Emirates, over the period 2008-2021. Based on the empirical results, we conclude that digital transformation measured by individuals using the Internet (% of the population) has a positive and significant impact on economic growth after other variables such as inflation, financial development, and total natural resource rent.

These findings have crucial implications for policymakers, as the promotion of globalization through digitalization has created more advanced technologies to boost economic growth in MENA countries. Policymakers should consider this approach globally and appreciate the opportunities digitalization offers for industry, integrate it into the world of work, and provide greater awareness of digital infrastructure, which will improve economic performance in the digital economy era. Furthermore, policymakers are implementing programs to improve the availability of mobile applications, which can simplify distance learning and other activities. Governments could improve the use of digital technologies and technological capabilities through appropriate science, technology, and innovation policies. Furthermore, the findings provide policymakers with a basis for better articulating their policies to achieve the Sustainable Development Goals.

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