

Digital Economy, Institutional Quality and Economic Growth in Selected Countries

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This study examines the role of digital economy and institutional quality on economic growth of Bangladesh, Ethiopia, Kenya, and Nigeria. The study adopts the feasible generalized least square method with annual panel data from 1985 to 2017. Results show that digital economy, human capital and knowledge worker, and democratic accountability promote economic growth, while corruption, socioeconomic conditions, and bureaucratic quality retard economic growth. Furthermore, interaction of digital economy with corruption promotes growth. However, the interaction of digital economy with institutional quality retards economic growth, which could be due to the deteriorating institutional quality and low level of economic digitalization in these countries. The study concludes that digital economy and institutional quality could play positive roles in the quest to becoming emerging markets. The study suggests more involvement of the countries in digital economy and improved institutional quality.

Keywords: Digital economy, economic growth, institutional quality.

JEL Classification: D73, D83, E02, O33

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1. Introduction

A major focus of many countries of the world, especially developing countries is how to grow their economies and join the group of emerging markets, which is, at least closer to becoming developed. This is because emerging markets are noted for their peculiar characteristics such as lower-than-average per capita incomes, rapid growth rate, high volatility, less advanced capital markets and higher-than-average returns on investment (Broner & Rigobon, 2004; Bilgili *et al.*, 2016; Bekaert & Harvey, 2014). According to World Economic Forum (2016), 10 countries have been identified as likely emerging markets of the future by the Business Monitor International (BMI). These countries are Bangladesh, Egypt, Ethiopia, Indonesia,

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Kenya, Myanmar, Nigeria, Pakistan, Philippines, and Vietnam. The BMI noted that these countries are set to become new drivers of economic growth over the next 10 years, and that they will cumulatively add \$4.3 trillion to global gross domestic product (GDP) by 2025, which is roughly the equivalent of Japan's current economy. For a country to become an emerging economy, studies have noted that digitalization of the economy matters (Myovella *et al.*, 2020). This is due to the fact that digital markets can yield significant economic and social benefits to the people. Other studies have also noted that digitization has the potential to boost productivity, create new jobs, and enhance the quality of life for the society at large (Habibi & Zabardast, 2020). However, most of these studies failed to consider the role of institutional quality on economic growth. Understanding the role that institutional quality plays in growth-targeted countries like Bangladesh, Ethiopia, Kenya and Nigeria will enable policymakers to consider the role of good institutions alongside promotion of digitalization in their policy decisions.

It should be noted that achieving higher economic growth without good institutions may not necessarily lead to sustainable economic development. Studies have shown that among the serious problems facing emerging markets are the poor rule of law which could lead to poor protection of investors (Klapper & Love, 2004), and corruption which might create additional costs on trade through extortion (Rodriguez *et al.*, 2005; Dutt & Traca, 2010). Many studies have found that adequate institutional quality is capable of promoting investment, facilitating trade, thereby leading to economic development, while digitalization has also been noted for its ability to promote growth as well as enhance the performance of institutional quality in driving the growth of an economy (Francois & Manchin, 2007; Katz & Callorda, 2013). Moreover, poor institutions can hinder trade facilitation, while poor policies and infrastructure can impede trade gains in emerging and developing markets (Otsuki *et al.*, 2013; Francois & Manchin, 2007).

Given the above potentials of institutional quality and digitalization, and considering the fact that most of the studies on emerging economies lay more emphasis on digitalization and improvement in economic growth with little attention to the intervening role of institutional quality, this study examines the effect of digitalization

and institutional quality on economic growth in Bangladesh, Ethiopia, Kenya and Nigeria. The selection of these four countries was based on their similar characteristics, in terms of corruption level, poverty rate, high income inequality as well as weak institutional quality (World Atlas, 2020).

While digitalization can improve an economy's progress, institutional quality can enhance its efficiency. Studies have shown that government functions can be effectively digitalized in a way that they are performed with modern technology (Klapper, 2014; Pillai, 2016). For example, information and communications technology (ICT) has been noted for its ability to influence the way and pattern of government functions through horizontal and vertical interactions and information flows.

It has also been noted that using ICT, government functions can be improved. For example, we have: (i) electronic-Government (e-Govt.), an application for inter-organizational relationships, which includes policy coordination, policy implementation and public service delivery; (ii) electronic-Administration, an application for intra-organizational relationships which includes policy development, organizational activities and knowledge management; and (iii) electronic-Governance, an application for interaction among citizens, government organizations, public and elected officials which includes democratic processes, open government, and transparent decision-making (United Nations, 2004). Among the benefits of e-governance are: (i) demystification of complicated government processes and empowerment of citizens; (ii) improvement in government performance and facilitation of multiplier effect on economic progress.

Digitization of government functions can ensure efficiency, responsiveness and accountability of government, which improve the quality of life and productivity of citizens, especially the poor; and consequently, fostering economic growth. Overall, e-Governance is a channel through which government functions can be fundamentally changed, and this implies a new set of responsibilities for the government officials. Also, it should be noted that, no matter how effective digitization can be in promoting the growth of a country, institutional quality can slow down or promote its success. This implies that institutional quality has an important role to play in determining the effectiveness of digitization towards ensuring the growth of an

economy.

The rest of this paper is structured as follows: Section 2 discusses literature review, while Section 3 contains the data and methodology. Section 4 presents the results and discussions, while Section 5 provides the conclusion and policy recommendations.

2. Literature Review

2.1 Theoretical Literature

Earlier theories of economic growth concentrate on physical capital accumulation as engine of economic growth. This is noted in Neoclassical growth models where labor, capital, and knowledge were assumed to be the basic sources of economic growth. It was also assumed that the growth rates of knowledge and labor are constant. For example, Solow-Swan neoclassical growth model was based on the long run growth and the model is limited to exogenous factors such as population growth and technological progress which are independent of savings rate. Recently, economic growth theorists extended their view on economic growth towards endogenous technological change. The endogenous growth model focuses on technological innovation which is formed in the research and development (R&D) areas with the inclusion of human capital and the existing knowledge stock, (Romer, 1986).

According to the endogenous growth theory, various factors that can create opportunities and incentives that will generate technological knowledge are essential for long run growth. To this theory, long run growth depends on the rate of growth of total factor productivity, and this in turn depends on the rate of technological progress. The endogenous growth theory argued against the proposition of the Neoclassical growth theory of Solow (1956) and Swan (1956) which assumed that long-run growth rate can be taken as given, that is, it can be exogenously determined from outside the economic system. In contrast to the view of Neoclassical theory, endogenous growth theory proposed that long run growth rate can be influenced by economic factors. This is because technological progress comes through innovation, which could be in form of new products, processes and markets which are also end products of economic activities. Not only this, innovation can also come from R&D undertaken by profit-seeking firms, and or economic policies with respect to trade and competition. An early version of endogenous growth theory that was developed by Frankel

(1962), posited that aggregate production function can exhibit constant or increasing marginal product of capital. The reason is, as firms accumulate more capital, some of these capitals are likely to be intellectual capital that can create technological progress, which essentially can offset the tendency for marginal product of capital to diminish. In a situation where marginal product of capital demonstrates constant returns to scale, aggregate output (Y) is taken to be proportional to the aggregate stock of capital (K) as shown in equation 1, also called AK theory:

$$Y = AK \tag{1}$$

Where A is a positive constant. The AK theory assumes that an economy’s long-run growth rate depends on its saving rate. Accordingly, if a fixed fraction of output (s) is saved and there is a fixed rate of depreciation (d), the rate of aggregate net investment will be $\frac{dk}{dt} = sY - \delta K$ which along with (1) implies that the growth rate is given by:

$$g \equiv \frac{1}{Y} \frac{dY}{dt} = \frac{1}{K} \frac{dK}{dt} sA - \delta \tag{2}$$

The above therefore suggests that an increase in the saving rate (s) will lead to a permanently higher growth rate. Similar argument with a more general production structure, under the assumption that saving is generated by intertemporal utility maximization instead of the fixed saving rate of Frankel (1962) was made by Romer (1986). Also, Lucas (1988) while analyzing human capital rather than physical capital in following the work of Uzawa (1965) produced similar results. Lucas explicitly assumed that human capital and technological knowledge were one and the same.

The foundation of digital economy according to Knichrehm *et al.* (2016) in broader terms, is “the share of total economic output derived from a number of broad digital inputs. These digital inputs include digital skills, digital equipment (hardware, software and communications equipment) and the intermediate digital goods and services used in production. Such broad measures reflect the foundations of the digital economy”. Theoretically, the impact of digital economy on economic growth works through its influence on total productivity of workers. It improves the skill and allows innovation and self-learning through information flows.

2.2 Empirical Literature

Recent interest on the contribution of digitalization to modern day economy, especially to the emerging markets is on the rise. For example, it has been noted that ICT has the capacity to increase growth of GDP (Stanley *et al.*, 2018; OECD, 2019; Remes *et al.*, 2018). Studies such as Koutroumpis (2009) and Czernich *et al.* (2009) concluded that a 10 percent rise in internet penetration correlates with a 0.9 to 1.5, and a 0.3 to 0.9 percentage points in GDP growth, respectively. Qiang *et al.* (2009) examined the impact of various components of ICT on GDP growth during the period 1980-2006 for 120 developing and developed countries. The findings show that a 10-percentage point rise in broadband penetration correlates with a 1.38 percentage point growth in GDP. Similarly, in the work of Vu (2011) which reviewed ICT cross-country studies as well as national studies, and examined 107 countries, economic growth was found to be positively affected by ownership of personal computers, mobile phones and the internet, while Katz and Callorda (2013) in their studies of Ecuadoran households between 2009 and 2011 where they used fixed effect method submitted that broadband penetration increased average annual income by 3.67 percent in Ecuador, but the gains were higher for computer and internet users at 3.92 and 5.01 percent respectively. Also, Paunov and Rollo (2014) used ordinary least squares and quantile regression methods to investigate a sample of 49,610 firms in 117 developing nations between 2006 and 2011. It was found that firms that were using internet, including firms facing electricity, financial and skill constraints, corruption and heavy labour regulations reported increased productivity, although to a lesser extent than firms not facing these constraints. The findings of McKinsey Global Institute (2011) suggested that firms with online presence grow two times faster, and export twice as much as those that were offline, while businesses allocating at least 30 percent of their budget to web technologies increased revenues nine-fold, compared to firms allocating less than 10 percent.

It has also been confirmed that the impacts of broadband in emerging countries are more compared to countries with a higher rate of income, with a percentage increase of 1.21 per capita GDP growth and 10 per cent increase in broadband subscription in the work of Qiang *et al.*, (2009) where they used cross country analysis. To become emerging market, businesses in a country need to gain a competitive edge over

rivals in a particular industry through advanced technology. However, technology differs among countries. The implication is that a multinational corporation cannot necessarily take advantage of technological advancements in another country if that country lacks necessary infrastructure such as telephone systems and satellite communications systems to support new technology, as well as organized and well-functioning institutions.

With the recent meteoric popularity in ICT, it has been noted that, internalizing digital economy into the traditional economic system, can benefit almost all sectors of the economy. Empirical findings have also shown that, digital economy can solve various bottlenecks that may hinder the smooth running of an economy (Rogoff, 2016). In other words, digitalization of an economy can facilitate breakthroughs for developing countries toward becoming emerging markets. Recent knowledge and experience on the increased usage of ICT have shown that digitalization of an economy can improve countries' institutional quality. Also noted is the fact that majority of government manual processes can be replaced by digital technology. Aside from this, the use of ICT has been recognized to be among what can be used to reshape government functions, thus the positive effect of digitalization on the economy is well documented in literature (Meijers, 2014; Hanclova *et al.*, 2015). Noted by the estimates of The European Commission is that digitalization could contribute up to USD 3.7 trillion to the world economy (The European Commission, 2016), and at the same time be a powerful anti-corruption tool (Andersen *et al.*, 2011).

Another important determinant of a country becoming an emerging market is the quality of her institutions. Some of the characteristics of developing countries are poor institutional qualities such as high level of corruption, poor democratic accountability and poor bureaucratic quality. Corruption has been seen as one of the major impediments, frustrating the advancement of sustainable development in these countries. Corruption can exist in various forms. For example, it shows in democratic accountability, as well as delay in government's functioning. Unfortunately, despite the rapid economic growth in the countries under study, all efforts to cross over from low per capita income, less developed capital markets and high volatility are fruitless. These countries are constrained by poor institutional quality which is mostly

caused by government officials. For example, the detrimental effect of corruption on economic growth where perpetrators are mostly government officials has been well documented in the literatures such as Méon & Sekkat (2005) and Mo (2001). However, it has been noted that one of the ways through which institutional quality can be improved is the adoption of digitalization into the economy (Meijers, 2014).

According to Acemoglu and Robinson (2010), institutions play a significant and fundamental role in determining economic growth and development stages across countries. It was also noted by Murphy *et al.*, (1993) that Poor quality institutions may slow down economic activities, thereby causing economic agents to remain busy in redistributive politics with lower economic returns rather than growth promoting economic activities, while good quality institutions may promote incentive structure that will spur economic growth through reducing uncertainty and promoting efficiency (North, 1990). Aside from the above, Hall and Jones (1999) argued that overall productivity of factors of production in a country is determined by the quality of her institutions. Also noted by Bernard and Jones (1996) is that good quality institution is capable of enabling country's adoption of new technologies which could promote development.

Considering the above, the role of digital economy and institutional quality in fostering efforts towards becoming emerging countries cannot be overemphasized. Moreso, it is extremely difficult to underrate the role that digital economy can play when it comes to the functions of public institutions. Probably this is why various governments have been trying to introduce e-Governance with the aim of reducing cost of governance as well as ensuring well organized, appropriate and transparent services to citizens through the use of ICT. E-Governance involves making decision through the use of ICT in such a way that wider participation of citizens in public affairs is ensured. Government functions include: maintenance of law and order, ensuring of peace and justice, funding of public utilities, and collection of taxes. Records on these functions are not always accurate since most of them are performed by corrupt officials. In view of the above, we argue in this study that, becoming an emerging economy without a sound institutional quality might be an illusion, thus, digitalization and institutional quality might complement each other in the quest to become an

emerging economy.

3. Data and Methodology

3.1 Data

Annual data between 1985 and 2017 were used in this study. We capture digital economy with ICT using data on imports of ICT goods (% total goods imports), mobile cell phone (number of postpaid subscriptions, number of active prepaid accounts [i.e. those that have been used during the last three months] including all mobile cellular subscriptions that offer voice communications) and fixed telephone subscription [i.e. active number of analogue fixed telephone lines, voice-over-IP (VoIP) subscriptions, fixed wireless local loop (WLL) subscriptions, ISDN voice-channel equivalents and fixed public payphones]. Human capital is proxied with secondary school enrolment (total % net). Data on the above variables were obtained from the World Development Indicators. Data on institutional qualities (i.e. corruption (crpt), democratic accountability (dat), bureaucratic quality (bq)) and socioeconomic conditions index were obtained from the publication of International Country Risk Guide. Socioeconomic condition is an assessment of the socioeconomic pressures at work in societies that could constrain government action or fuel social dissatisfaction. Concerning the computation of socioeconomic conditions, the risk rating assigned is the sum of three subcomponents, each with a maximum score of 4 points and a minimum score of 0. A score of 4 equates to very low risk and a score of 0 to very high risk. The subcomponents are unemployment, consumer confidence and poverty (International Country Risk Guide Methodology, 2014).

3.2 Model Specification

While the contributions of innovation in technology to economic growth cannot be underrated, its relation to productive resources is not direct. Its impact on economic growth works through total factor productivity. Following endogenous growth model, and given the roles of ICT capital, as well as considering the role of technology in output growth, we can specify a technology function as:

$$A_{it} = A_{i0} C_{it}^{\gamma} e^{\rho t + \varepsilon_{it}} \quad (3)$$

where A_{it} is the level of technology at time t , A_{i0} is the initial information technology

at time t , C_{it} is the current information technology at time t , ρt is the growth rate of current information technology, while $\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2)$ is the error term. Taking the logarithm of equation (3), we have the following transformation, which shows that technology is a component of the initial technological level, elements of ICT, influence of time and stochastic error term:

$$\ln A_{it} = \ln A_{i0} + \gamma \ln C_{it} + \rho t + \varepsilon_{it} \quad (4)$$

In growth rate term, Equation (4) can be rewritten as:

$$\frac{\ln A_{it} - \ln A_{i0}}{t} = \gamma \frac{\ln C_{it} - \ln C_{i0}}{t} + \rho + \check{\varepsilon}_{it} \quad (5)$$

where the model implies that the initial ICT level is set to 1, its log-transformation is set to zero as $\ln C_{i0} = 0$. We assume an output-augmented production function given by:

$$Y_{it} = A_{it} F(K_{it}, H_{it}, I_{it}, Z_{it}) \quad (6)$$

Where Y_{it} = output; A_{it} = technology; H_{it} = human capital; K_{it} = physical capital; I_{it} = institutional quality and Z_{it} denotes other variables such as socioeconomic conditions that affect output at time t . This specification suggests that output is non-neutral to technological advancement and with respect to capital, labour or any other production factor presupposed by the alternative specifications such as the labour- or capital-augmented technology. More specifically, we assume a Cobb-Douglas production function given as:

$$Y_{it} = A_{it} K_{it}^\alpha H_{it}^\beta I_{it} Z_{it}^\lambda \quad (7)$$

Where all variables remain as earlier defined while α , β and λ are estimatable parameters. In logarithm term, we have:

$$\ln Y_{it} = \ln A_{it} + \alpha \ln K_{it} + \beta \ln H_{it} + \ln I_{it} + \lambda \ln Z_{it} \quad (8)$$

This then implies that the average growth rate between periods 0 and t is:

$$\begin{aligned} \frac{\ln Y_{it} - \ln Y_0}{t} &= \frac{\ln A_{it} - \ln A_0}{t} + \alpha \frac{\ln K_{it} - \ln K_0}{t} + \beta \frac{\ln H_{it} - \ln H_0}{t} \\ &+ \vartheta \frac{\ln I_{it} - \ln I_0}{t} + \lambda \frac{\ln Z_{it} - \ln Z_0}{t} \end{aligned} \tag{9}$$

In a more compact form, equation (9) can be written as follows:

$$y_{it} = \rho + \gamma c_{it} + \alpha k_{it} + \beta h_{it} + \vartheta I_{it} + \lambda z_{it} + \varepsilon_{it} \tag{10}$$

Where all the variables in (10) are in their growth rates, Méon & Sekkat (2005). We proxy digital economy with imports of ICT goods (c_t), number of active mobile cell phones (mbc) and fixed telephone subscriptions (ftl), where mbc and ftl represent primary platform for mitigating digital divide and telephone infrastructure respectively (Forenbacher *et al.*, 2019). We also consider the role of human capital (h) to economic growth (Mutula, 2010). We use different types of institutional quality (I) such as corruption (crpt), democratic accountability (dat) and bureaucratic quality (bq), as well as socioeconomic conditions (sec), and specify the following:

$$\begin{aligned} y_{it} = \rho + \gamma_1 c_{it} + \gamma_2 mbc_{it} + \tilde{\alpha}_3 ftl_{it} + \beta_1 h_{it} + \alpha_1 crpt_{it} + \alpha_2 dat_{it} + \alpha_3 bq_{it} + \\ \alpha_4 sec_{it} + \check{\varepsilon}_{it} \end{aligned} \tag{11}$$

To determine the role institutional quality plays in becoming an emerging economy, we interact ICT (c_t) with bq, dat, sec, and crpt to obtain equation (12)

$$\begin{aligned} y_{it} = \rho + \gamma_1 c_{it} + \gamma_2 mbc_{it} + \gamma_3 ftl_{it} + \beta_1 h_{it} + \alpha_1 crpt_{it} + \alpha_2 dat_{it} + \alpha_3 bq_{it} \\ + \alpha_4 sec_{it} + \alpha_5 ccrpt_{it} + \alpha_6 cdat_{it} + \alpha_7 cbq_{it} + \alpha_8 csec_{it} + \check{\varepsilon}_{it} \end{aligned} \tag{12}$$

where ccrpt, cdat, cbq and csec are the interaction variables, where ccrpt is the interaction of corruption and digital economy, cdat is the interaction of digital economy and democratic accountability, cbq is the interaction of bureaucratic quality and digital economy and csec is the interaction of digital economy and socioeconomic conditions.

3.4 Estimation Technique

To determine the influence of ICT on economic growth and institutional quality in the four countries studied, we use feasible generalized least square (FGLS) Method. The use of FGLS is justified by the model's capability to tackle the problem of outliers, heteroskedasticity and bias in data. In this study, we use data with missing values. Moreover, our panel is less than the time period ($N < T$), further justifying the use of FGLS (Beck & Katz, 1995). Although FGLS standard errors underestimate true variability, at least for normal errors (Freedman & Peters, 1984), it performs well in large samples and that in the limit, it is equivalent to full maximum likelihood, and so has all the optimal asymptotic properties of maximum likelihood (Cramer, 1986). It is also known that it yields unbiased estimators under general conditions that are usually met in practice (Kakwani, 1967).

4. Results and Discussion

4.1 Descriptive Statistics

We first examine the descriptive statistics of our data, and the results are presented in Table 1. Economic growth (Y) has a mean of 24.5%, while that of human capital is 13.37%. Mobile cell phone (a) has a mean of -0.07. Equally, human capital has a high standard deviation, indicating that it has a high dispersion from the mean. Democratic accountability (dat) has a standard deviation of 0.38. Overall, the deviation of all our variables from their mean is minimal, indicating that the variables used in the study are adequate.

We also examine the unit root of the variables used, using Fisher's unit root test to ensure whether there is presence of unit root or not (i.e., we establish whether the mean and the variance are constant overtime). This test is suitable for unbalanced panel data that we use in this study. Our results show that all the variables are stationary at first difference except corruption that is stationary at levels (Table 3). We also tested for serial correlation of our model. Our results show that there is no first order autocorrelation. This confirms the evidence of no model misspecification in the study. The results of autocorrelation test are presented in Table 2.

Table 1: Summary Statistics

	Obs	Mean	Sd	Min	Max
y	117	24.5	1.16	22.47	27.07
c	72	1.50	1.66	5.30e-06	6.66
sec	128	3.25	1.62	1.5	7
crpt	128	1.91	0.78	0.00	3.46
h	40	13.37	11.56	4.00	42.66
dat	108	1.18	0.38	0.5	1.70
bq	129	1.46	0.86	0.00	3.0
mbc	103	-0.07	4.24	0.00	4.54
ftl	50	10.53	2.74	10.53	1.52
cbq	71	-3.22	3.34	5.30e-06	13.33
cdat	71	6.13	6.29	0.00	19.99
csec	71	3.01	3.94	8.80e-06	16.66
ccrpt	71	6.13	3.57	5.30e-06	12.14

Note: y is GDP growth; c is digital economy (i.e. import of ICT goods); sec is socioeconomic conditions; crpt is corruption; h is human capital and knowledge workers; dat is democratic accountability; bq is bureaucratic quality; mbc is mobile cell phone; ftl is fixed telephone subscription; cbq is the interaction of digital economy and bureaucratic quality; cdat is the interaction of digital economy and democratic accountability; csec is the interaction of digital economy and socioeconomic conditions and ccrpt is the interaction of digital economy and corruption.

Table 2: Autocorrelation Test

Wooldridge test for autocorrelation in panel data
H0: no first order autocorrelation
F(1, 3) = 4.508
Prob > F = 0.1238

We also examined the correlation of the variables used in the study to ensure the absence of perfect multicollinearity. The results also showed that the correlation among the variables was not too high. These results are presented in Table 4.

Table 3: Fisher's Unit Root Test

Variables	Probability (Level)	Probability (1 st difference)	Decision
y	1.00	0.00	I(1)
c	0.48	0.00	I(1)
sec	0.32	0.00	I(1)
crpt	0.002	0.00	I(0)
h	0.99	0.005	I(1)
dat	0.55	0.00	I(1)
bq	0.25	0.00	I(1)
mbc	1.00	0.00	I(1)
ftl	0.97	0.00	I(1)
cbq	0.49	0.00	I(1)
cdat	0.44	0.00	I(1)
csec	0.54	0.00	I(1)
ccrpt	0.50	0.00	I(1)

Note: y is GDP growth; c is digital economy (i.e. import of ICT goods); sec is socioeconomic conditions; crpt is corruption; h is human capital and knowledge workers; dat is democratic accountability; bq is bureaucratic quality; mbc is mobile cell phone; ftl is fixed telephone subscription; cbq is the interaction of digital economy and bureaucratic quality; cdat is the interaction of digital economy and democratic accountability; csec is the interaction of digital economy and socioeconomic conditions and crpt is the interaction of digital economy and corruption.

Table 4: Correlation matrix of the variables

	c	sec	crpt	h	dat	bq	mbc	ftl	cbq	cdat	csec	ccrpt
c	1.00											
sec	-0.05	1.00										
crpt	0.52	0.17	1.00									
h	0.39	-0.28	0.31	1.00								
dat	-0.71	-0.09	-0.32	-0.41	1.00							
bq	0.66	-0.14	-0.01	0.05	-0.27	1.00						
mbc	0.36	-0.06	-0.03	0.22	-0.38	0.25	1.00					
ftl	-0.30	-0.07	-0.04	0.03	0.53	-0.35	-0.21	1.00				
cbq	0.44	-0.40	0.18	0.17	-0.24	0.21	-0.4	-0.19	1.00			
cdat	-0.59	-0.09	-0.47	-0.04	0.42	-0.22	-0.35	0.36	-0.07	1.00		
csec	0.51	-0.33	0.22	-0.08	-0.27	0.25	0.07	-0.07	0.26	-0.29	1.00	
ccrpt	0.62	-0.52	0.47	0.07	-0.19	0.06	0.29	0.35	0.05	0.05	-0.37	1.00

Note: y is GDP growth; c is digital economy (i.e. import of ICT goods); sec is socioeconomic conditions; crpt is corruption; h is human capital and knowledge workers; dat is democratic accountability; bq is bureaucratic quality; mbc is mobile cell phone; ftl is fixed telephone subscription; cbq is the interaction of digital economy and bureaucratic quality; cdat is the interaction of digital economy and democratic accountability; csec is the interaction of digital economy and socioeconomic conditions and ccrpt is the interaction of digital economy and corruption.

4.2 Estimation Results

After ensuring absence of autocorrelation in our data set, we estimate the study model. Our results show that digital economy captured, human capital and knowledge worker, democratic accountability, mobile cell phone and fixed telephone subscription promote economic growth in the four countries. These results were statistically significant and confirm the importance of these variables in promoting economic growth in these countries. These findings support Stanley *et al.* (2018), Lambdordff (1999), and the European Commission (2016). Perhaps, this could be one of the major reasons why many countries are striving towards improving on digitalization.

In addition,, the study found that, corruption and bureaucratic quality retard economic growth. The study found that a one percent increase in corruption causes 0.45% decrease in economic growth. The negative relation between economic growth and corruption is supported by “the sand in the wheel” hypothesis in Mauro (1995).

Also, Rahman *et al.* (2000) found that if Bangladesh, an example of highly corrupt nation, had reduced corruption to a moderate level, its GNP during the period 1990-1997 would have increased by 18%. Corruption has also been described as both the cause and effect of poor government performance. It reduces trust in the government’s capacity to address citizens’ demands (Della Porta, 2000). These results might not be far-fetched for the countries in this study given their rating on Human Development Index. For example, in 2012, Nigeria was estimated to have lost more than \$400 billion to corruption since independence (United Nations Office on Drugs and Crimes). In 2018, she was ranked 144th in the 180 countries listed in Transparency International Corruption Index. Ethiopia that is presently battling with political instability was ranked 96th least corrupt nation out of 180 countries in 2019, while Kenya was ranked 137th least corrupt nation (Corruption Perception Index, 2018 and 2019). One thing that is common among these countries is that, they share almost the same characteristics in terms of corruption, poverty, high income inequality as well as weak institutional quality. On the other hand, socioeconomic conditions are not significant in fostering economic growth.

Table 5: Estimation Results

Dependent variable: y	Coef.	Std.Err	z	P> z
c	5.08	0.88	5.75	0.000
sec	-0.10	0.08	-1.17	0.244
crpt	-0.45	0.15	-3.08	0.002
h	0.03	0.01	2.80	0.005
dat	1.01	0.23	4.49	0.000
bq	-2.62	0.11	-23.52	0.000
mbc	0.50	0.03	14.74	0.000
ftl	0.04	0.02	2.20	0.028
cbq	-2.29	0.45	-5.13	0.000
cdat	-0.15	0.03	-4.33	0.000
csec	-0.16	0.26	-0.63	0.530
ccrpt	0.26	0.06	4.42	0.000

Wald chi2(12): 6172.34

Prob>chi2: 0.0000

N: 22

Number of groups: 4

Note: y is GDP growth; c is digital economy (i.e. import of ICT goods); sec is socioeconomic conditions; crpt is corruption; h is human capital and knowledge workers; dat is democratic accountability; bq is bureaucratic quality; mbc is mobile cell phone; ftl is fixed telephone subscription; cbq is the interaction of digital economy and bureaucratic quality; cdat is the interaction of digital economy and democratic accountability; csec is the interaction of digital economy and socioeconomic conditions and ccrpt is the interaction of digital economy and corruption.

Interacting ICT with corruption (ccrpt), socioeconomic conditions (csec), democratic accountability (cdat) and democratic bureaucratic quality (ctbq), we find that ccrpt relates positively with economic growth, while cbq, cdat and csec relate negatively with it. The implication of these results is that the influence of digital economy on corruption (ccrpt) has suppressed the negative impact of corruption on economic growth and caused it to spur economic growth instead of retarding it, while its influence on bureaucratic quality (cbq), democratic accountability (cdat) and socioeconomic conditions (csec) failed to promote economic growth. These results were statistically significant except for the influence of ICT on socioeconomic conditions (csec). This confirms the possibility of the countries not becoming emerging economies as predicted by World Economic Forum, given their current institutional quality. Our findings also reveal the potentials of digitalization in propelling these countries to become emerging economies. This is possible in the sense that if corrupt officials

know they could be caught, they are likely to refrain from corruption. Our results also support that of Andersen *et al.* (2011) where they found that internet is a powerful anti-corruption technology. The findings confirmed the role that digital economy can play when countries focus on reducing corruption to ensure sustainable development as well as becoming emerging economy (Table 5).

After obtaining our results, we conduct cross-sectional dependence test of the residual to confirm validity. The results show no cross-sectional dependence. These results are presented in Table 6.

Table 6: Correlation matrix of residuals

	C1	C2	C3	C4
r1	0.000			
r2	0	0.003		
r3	0	0	0.007	
r4	0	0	0	0.005

Note: r1, r2, r3 and r4 are the residuals for each of the four countries studied and C1, C2, C3 and C4 are country 1, country 2, country 3 and country 4 respectively.

5. Conclusion and Policy Recommendations

This study considered the characteristics of Bangladesh, Ethiopia, Kenya and Nigeria that were predicted by World Economic Forum as likely emerging market economies and examined the roles that digitalization and institutional quality can play in making this prediction a reality. Corruption, democratic accountability, socioeconomic conditions, fixed telephone subscription, human capital and knowledge workers, interaction of ICT and corruption, bureaucratic quality, democratic accountability and socioeconomic conditions were regressed on growth rate of real GDP using the FGLS. Our results showed that digitalization can play an active role of suppressing negative effect of corruption on growth as well as fast-tracking the process of becoming an emerging economy. However, institutional qualities and socioeconomic conditions retard the efficiency of digital economy from promoting economic growth. This suggests that without improvement in institutional quality, the prediction of these countries becoming emerging markets might be an illusion.

The study recommends that, countries studied should promote the digitalization of their economies to bridge the gap between them and the emerging economies. Fur-

thermore, timely and urgent policies that can improve various institutional qualities of their economies should be implemented.

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