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DIGITALIZATION, EDUCATION AND ECONOMIC GROWTH: AN ANALYSIS OF DEVELOPING COUNTRIES

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ABSTRACT

Education can increase the human capital of the labor force, which would increase labor productivity and levels of economic growth. Existing research highlights the role of digitalization and education in enhancing the economic growth path of developing countries. The study has used data from 2002 to 2020 for the 12 selected developing economies. We have used economic growth as a dependent variable and digitalization, education, health, foreign direct investment, and life expectancy as independent variables. The unit root test and random effect technique are used to highlight the role of digitalization with education on the economic growth of developing economies. The study findings pointed out that digitalization with the help of education contributed much to enhancing the economic growth of these countries. The result also concluded that health, life expectancy, and foreign direct investment also boosted up economic growth of these nations. The study suggested more utilization of digitalization for high economic growth. Moreover, the Government must provide a stable environment to attract more foreign direct investment. Finally, there is a dire need to allocate more budget for education and health sectors to improve the welfare of the concerned nations.

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INTRODUCTION

Over the past thirty years, the increasing extensive usage of information, communication, and technology has been generally inspiring developments. Digitalization has come out as a major vectors of economic and communal movement in advanced and rich nations. Amplified investment in information communication and technology has caused increasing production and increasing growth in the second half of the 1990s in numerous rich nations (Lee et al., 2012). A significant characteristic of technical development existing in various studies is telecommunication infrastructure. Usually, one of the ways throughout which growth is exaggerated by the usage of digital technologies is the method the information communication technology redesigns traditions of managing by means of electronic exchange and online trade, making possible suppleness in bank functioning, and better interactions or relations, which ultimately promote the output and economic growth (Myovella et al., 2020). In developing nations, digitalization plays a significant part, mostly through decreasing communication expenses from the early 2000s. This has helped the poor people in remote areas with the provision of inadequate approaches to approximately every necessary service, like water and electricity (Pradhan et al., 2015).

Empirical work focused on the part of human capital in modernization, and subsequently in long-term growth. The studies showed that the nexus of education and GDP per capita has fascinated notice of researchers in diverse economies for a long time. The novel theories of neo-classical economic growth, with the involvement of Romer (1986) and Lucas (1988), point out the economic growth, with specific different ideas on the optimistic part and the important effect of education on economic growth. In spite of theoretical and experimental move forwards and the extensively supposed faith that education supports economic growth directly by its influences on production. Education has enhanced GDP per capita indirectly by improving research and development activity. Consequently, a number of models from endogenous growth theories almost do not think of education as a feature of manufacturing other than as a feature of novelty (Lucas, 1988). For that reason, research and development produce knowledge, but to make better usage and capitalization of current knowledge and on the whole well-organized technologies are adopted and put into practice quicker by the nations by means of the richest highly developed human skill and talent (Nelson and Phelps, 1996; Cohen and Levinthal, 1990).

Empirical work on aid out of the country, investment, unemployment, price increases, and industrialization in recuperating growth has been noticed in many studies in developing and developed countries. However, our research work has highlighted the effect of digitalization and education with other variables on the economic growth of a few selected developing nations. By using panel data, Castelló (2004) tried to find the relationship between income inequality and economic growth. It was found that inequality resulted in increased economic growth. Technology also affects the economic growth of nations indicated by Heeks and Mola (2009). Their result revealed that more usage of technology led to increased economic growth. The study suggested more investments in digitalization. Taking into consideration, the contribution of ICT to growth, Fukao and Miyagawa (2007) examined how information communication and

technology influenced the growth of Japan. It was found that more utilization of digitalization enhanced the growth of Japan.

Similarly, focusing on information communication and technology, Hausmann et al. (2007) concluded that the economies with more usage of ICT exported more resulted in higher growth rates. Again, Qiang et al. (2009) used data from 120 countries and found that more implementing technology resulted in more economic growth and economies experienced development. By using data from 14 OECD nations, Ceccobelli et al. (2012) also used data from 14 OECD countries to check the effect of ICT on growth. The study result pointed out that ICT led to improved economic growth of the economies. Moreover, Ortiz et al. (2015) also checked the effect of telecommunication services on education on economic growth. The regression results pointed out that telecommunications and educational factors contributed much to economic growth. On the basis of data from 1990 to 2015, Saidi and Mongi (2018) also focused on the link of growth and ICT with education in rich nations. The result showed a bidirectional association linking education and ICT. Furthermore, a unidirectional relationship was also observed from ICT and research and development to economic growth in the long run.

Again Habibi et al. (2020) examined the effect of ICT and education on economic growth in Middle Eastern nations and OECD economies. The authors have used data from 20000 to 2017. The fixed effect and GMM results pointed out that digitalization enhanced economic growth. The study recommended that the Middle East governments must focus more on the usage of information communication and technology to have a worthy economic growth. Erakhtina (2022) examined the role of mortality, healthcare investments, and life expectancy at birth on growth and development. The result showed that investment performance and the opening of inventive know-how into the healthcare system improved economic growth. Tartiyus et al. (2015) analyzed how population growth affected economic growth in Nigeria. The authors have used data from 1980 to 2010. The results pointed out that population and fertility led to increased growth. However, life expectancy and crude birth rate resulted in reduced economic growth. Rehman et al. (2022) also analyzed how foreign direct investment and ICT affected growth. The result showed that foreign investment and technology-enhanced growth in Pakistan.

Moreover, Ali et al. (2022) found how trade openness, education, and Government spending affected growth in OIC countries. Findings pointed out that trade openness, human capital and Government spending, and institutional quality caused high growth in OIC countries. Stanley et al. (2018) conducted a primary study and checked how ICT (both landline and cell technologies) affects economic growth in poor and rich nations. The rich nations gained more benefits from using technology as compared to underdeveloped countries. Ajmani et al. (2022) used data from 1917 to 2020 to find the influence of spending on education on the growth of nations. Education was a very important factor for sustainable economic growth. The result showed that a one-point increase in public expenditures will result in increased growth. Moreover, one-point increased employment and unemployment will cause increased economic growth. Abu Alfoul et al. (2024) examined the role of information communication and technology on growth in the Middle East and North African regions by using data from 2000 to 2020. ARDL results found that education fostered information communication technology and growth in both regions.

Current research has highlighted how digitalization with education affected the economic growth of developing countries. Moreover, we have also checked the effect of health-related variables like health index and life expectancy on economic growth. Existing work will also offer a policy for further improvement and a course of action.

Research Questions

1. How does digitalization affect the economic growth of developing economies?
2. To what extent, does the health index affect growth?
3. What is the effect of foreign direct investment on economic growth?
4. How does education affect the growth potential of developing economies?
5. What is the role of life expectancy in increasing the growth of developing nations?

Research Hypothesis

The study hypotheses are given as:

H1: Much usage of digitalization will increase economic growth.

H 2: Health index is linked positively with economic growth.

H3: The higher the foreign direct investment, the higher the growth of nations.

H 4: A positive relationship exists between education and economic growth.

H 5: Life expectancy is positively linked with economic growth.

METHODOLOGY

This research has used data from 2002 to 2020 to find out the impact of digitalization with education on the economic growth of developing countries. The study has selected 12 developing economies such as Bangladesh, India, Indonesia, Iran, Jordan, Nepal, Bhutan, Malaysia, Pakistan, the Philippines, China and Sri Lanka. Data for all major factors have been collected from WDI. We have used the dependent variable as GDP per capita. The independent variables are information communication and technology controlling for education (secondary school enrolment % gross), health index, foreign direct investment (% of GDP), and life expectancy at birth per 100 adults.

Model Specifications

The econometric model is shown as:

$$LGDPPC = \beta_0 + \beta_1 ICTINDit + \beta_2 HLTHINDit + \beta_3 FDINVit + \beta_4 SSENRLit + LIFEXPit + uit \quad (1)$$

LGDPPC= Log Economic growth (GDP per capita)

ICTIND= Index of (Fixed telephone subscription per 100 people plus Mobile cellular subscriptions (per 100 people)

HLTHIND= Number of doctors per 1,000 people and Number of hospital beds per 1,000 people

FDINV= Foreign direct investment % of GDP

SSENRL= Secondary school enrolment (% gross)

LIFEXP= Life expectancy at birth

$_{it}$ = (time trend)

ui_t= (error term)

RESULTS AND DISCUSSION

Stationarity Tests

Table 1 highlights the unit root in panel data. Test statistics for HLTHIND and SSENRL at level form seem insignificant showing data as non-stationary at level form. Even if, these are significant at 1st difference. In addition, factors such as LGDPPC, FDINV, and LIFEXP are stationary at level.

Table 1. Results of Panel unit methods.

Variables	probability	Levin, Lin & Chu t*	IP & Shin W-stat	ADF - Fisher Chi-square	PP - Fisher Chi-square
LGDPPC	At level	0.0000	0.0000	0.0000	0.0000
ICTIND	At level	0.0000	0.0000	0.0000	0.0000
HLTHIND	At level	0.4420	0.9930	0.9950	0.2882
	At Ist difference	0.0000	0.0000	0.0000	0.0000
FDINV	At level	0.0000	0.0000	0.0000	0.0000
SSENRL	At level	0.0152	0.9343	0.9513	0.8688
	At 1st difference	0.0000	0.0000	0.0000	0.0000
LIFEXP	At level	0.0000	0.0000	0.0000	0.0000

Table 2. Descriptive statistics of variables.

Variables	Observations	Mean	Standard deviation	Minimum	Maximum
LGDPPC	216	3.70592	0.3581554	2.665155	4.096447
ICTIND	216	4.73e-09	1.000015	-1.613019	2.243605
HLTHIND	216	1.03e-08	1	-1.436155	3.299421
FDINV	216	3.061532	4.536019	-0.2542563	28.59812
SSENRL	216	71.1412	18.72544	22.51146	100.3352
LIFEXP	216	70.73698	3.756608	62.728	76.978

We have highlighted the descriptive statistics of the major factors affecting economic growth. Findings highlight that on average, LGDPPC is 3.70592 percent. However, the range of ICTNDX has been observed from -1.6130 to 2.2436 percent in these developing economies. On average, FNINV across selected developing economies is 3.0615 percent from the time span of 2002 - 2019. Correspondingly, varying trends have been observed in HLTHIND from -1.4362 to 3.2994 percent along with factors. On average, SSENVR is 71.1412 percent in the sample economies. Table 3 highlights the random effect technique. Here, the value of Chi2 is 4.25, and the probability value is 0.51 which supports the random effect technique. Table 3 reveals the results. Health can be considered as the major factor affecting the economic growth of the nations. It has been observed that educated and healthy people can contribute part of growth directly and indirectly. Good health increases the working efficiency and it enhances more growth. The study findings indicated that a unit increase in the health index led to an increase the growth of 0.0211 percent in developing nations.

Table 3 shows random effect results and the dependent variable is GDP per capita.

Variables	Coefficients, Standard Errors and Z-values
ICTIND	0.0309 *
	0.0073
	(4.21)
HLTHIND	0.0211**
	0.0111
	(189)
FDINV	0.0023**
	0.0009
	(2.55)
SSENVR	0.0028 *
	0.0006
	(4.47)
LIFEXP	0.0243 *
	0.0053
	(4.60)
C	1.4495
	0.3506
	(4.13)
Wald chi2	882.72
Probability	0.0000
R2 Within	0.81
R2 Between	0.64
R2 Overall	0.61

Our finding is favored by Erakhtina (2022). Information communication technology also seemed to affect the economic growth of developing economies. Increased usage of the internet and net services would cause high employment, growth, and development among developing countries. It is found that one unit increase in the ICT index resulted in enhanced growth by 0.0309 percent. The result is inconsistent with Abu Alfoul et al. (2024). Foreign direct investment also improves the economic growth of the concerned nations. The finding reveals that a one percent increase in foreign direct investment will result in 0.0023 percent increased growth in developing countries. The reason may be that administrations in developing economies have been attracting more investment chances from the rich and donor countries. This will result in more employment creation and income generation and more growth in these economies. The result is favored by Rehman et al. (2022). It has been noticed that education is the key to economic growth. Highly educated and skilled people will get more job and business chances and will enhance the growth potential of the economies. The study findings revealed that one one-unit increase in secondary school enrolment will cause increased growth by 0.0028 percent in the developing nations. The finding is favored by Habibi et al. (2020). Finally, life expectancy at birth also affects the economic growth of the nations. Much of the healthy urban population is involved and working in the industrial sector with other sectors of the economies in these nations. In this way, growth potential seems improving. The result pointed out that one one-unit increase in life expectancy at birth will cause high economic growth by 0.0243 percent. The result is inconsistent with Erakhtina (2022).

CONCLUSIONS

Existing work highlights the impact of digitalization and education on economic growth in some developing economies. The study has tried to highlight the contributing factors like foreign direct investment, health, and life expectancy at birth. We have used the random effect technique for the analysis. Our dependent variable was GDP per capita and independent variables were the ICT index, health index, education, foreign direct investment, and life expectancy at birth. The result pointed out that digitalization and education along with foreign direct investment affected positively economic growth and this contribution has been noticed much. Additionally, health-related factors such as health index and life expectancy also contributed much to the economic growth of the nations. It has been concluded that digitalization and education along with other factors have enhanced the growth potential of these economies. The existing research recommended that the Government must make more possible and enhance the ICT usage in departments for high growth and development. There is also a need to improve the educational system and political environment to attract more foreign direct investment in developing economies. Finally, there is a dire need to allocate more budget towards education and health to improve the efficiency of the general public in these developing economies. Focus should be given to more investments in human capital.

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