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## The influence of the digitalization factor on the formation and development of human capital in developing countries

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**Abstract.** As developing countries especially in Africa continues to lag behind in their human capital development pursuit in this era of digitalisation, it is necessary to look at the level of influence on digitalisation factors for the formation and development of human capital. Part of this is to look at the critical involvement of digitalisation access in developing countries in Africa. At the end it is necessary to envisage recommendation that can bolster their abilities to succeed due to high investment in these key factors. The research objectives aim at a broad analysis of the influence of the digitalization factor on the formation and development of human capital in developing looking at the relationship between digitalisation and skill development in the context of 14 developing countries. We have used the Kendall's correlation coefficient ( $\tau$ -b) to test the association of the variables relating to EDI ranking and Human Capital Development in other to analyse the relationship between variables. The research result shows that Human Capital Index (HCI) and EDI ranking have negative correlation. In any case if the Human Capital of the fourteen (14) developing countries are reached the Electronic Data Interchange ranking will still decrease. The article is concluded with recommendation that developing countries should invest in human capital especially in digital skills and create the atmosphere required for digital access to their citizen in a bid to adopt digital transformation whilst building the human capital development of the people.

**Keywords:** digitalisation, human capital index, electronic data interchange, skills development, digital economy, mobile network, developing country

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## Влияние фактора цифровизации на формирование и развитие человеческого капитала в развивающихся странах

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**Аннотация.** Развивающиеся страны, особенно африканские, продолжают отставать в своем стремлении к развитию человеческого капитала в эпоху цифровизации, в связи с этим необходимо изучить уровень влияния факторов цифровизации на формирование и развитие человеческого капитала. В том числе следует оценить значение доступа к результатам цифровизации в развивающихся странах Африки. Также необходимо разработать рекомендации, которые могут способствовать успеху благодаря высоким инвестициям в эти ключевые факторы. Цель исследования заключается в анализе влияния факторов цифровизации на формирование и развитие человеческого капитала в контексте 14 развивающихся стран. Авторы использовали коэффициент корреляции Кендалла ( $\tau$ -b) для проверки взаимосвязи переменных, относящихся к ранжированию EDI и развитию человеческого капитала. Результаты исследования показали, что Индекс человеческого капитала (HCI) и рейтинг EDI имеют отрицательную корреляцию. Приведены рекомендации, как развивающимся странам следует инвестировать в человеческий капитал и цифровые технологии, поскольку создание инфраструктуры, необходимой для доступа к цифровым технологиям, способствует развитию человеческого капитала.

**Ключевые слова:** цифровизация, индекс человеческого капитала, электронный обмен данными, развитие навыков, цифровая экономика, мобильная сеть, развивающаяся страна, процесс внедрения

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## Introduction

The rise of the digital connectivity has created opportunities that have particularly impacted human lifestyle, and every aspect of modern Economic activities. At a global level the growing digitalisation has influence every regions of the world including the continent of Africa. The digital economy involves a host of technologies with the potentials to affect and support the day-to-day systems of individuals, firms, businesses and states. These digital tools may include Machine learning, mobile network, cloud computing, artificial intelligence, Internet of things, big data etc. Be as it may (Usually), all of these digital tools have the abilities to influenced economic activities and improve the social life of people in both developed and the developing world whilst at the same time solving some of the most difficult challenges in institutions, government, agencies etc.

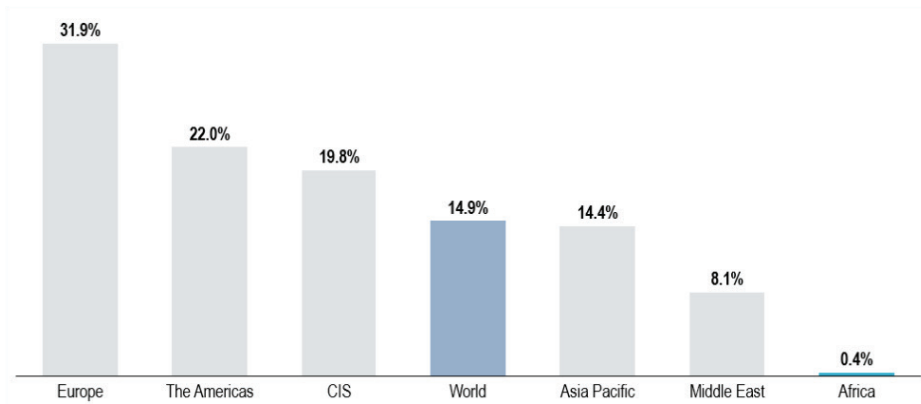
However, the digital technologies work only where there is physical ICT infrastructure (Luneborg & Nielsen, 2003). The combination of these ICT infrastructure and the digital technologies allows companies, individuals, and states to go digital and as a result create economic activities that relies on digital accomplishments such as smart machines, platforms, applications and digital products. To achieve such significant infrastructure and digital transformation, developing countries, in African are now asking questions about how the digital process can be adopted especially amongst countries with low level of education and skills.

This seems to encourage solutions against the obstacles for the adoption process. However, there are still many gaps for developing countries to match up with develop countries in the areas of very high technologies especially for Mobile network, big data and cloud computing (Tanriverdi & Venkatraman, 2005). According to the World Economic Forum 2015 digital economy in developing countries grew by 15-20% whilst G20 countries grew at 10% a year. The percentage of growth in Africa do not indicate that there are more adoptions in Africa than G20 countries. Africa and most developing countries however do not match in top five digital economies.

## Literature background

The continent of Africa is on the rise but by far it is one of the least developing regions in the trajectory that are related to digitalisation. As such the digitalisation process is has not been able to yield immense contribution to the human capital development process either in the field of education, health Care, skills development, work experience and even the labour market efficiency.

In comparison with developed and other developing countries the graph below shows the position of Africa in the digital space for mobile technology relating to fix broad band subscriptions (Figure 1).



**Figure 1.** Fixed-broadband subscriptions per 100 inhabitants, 2019, %

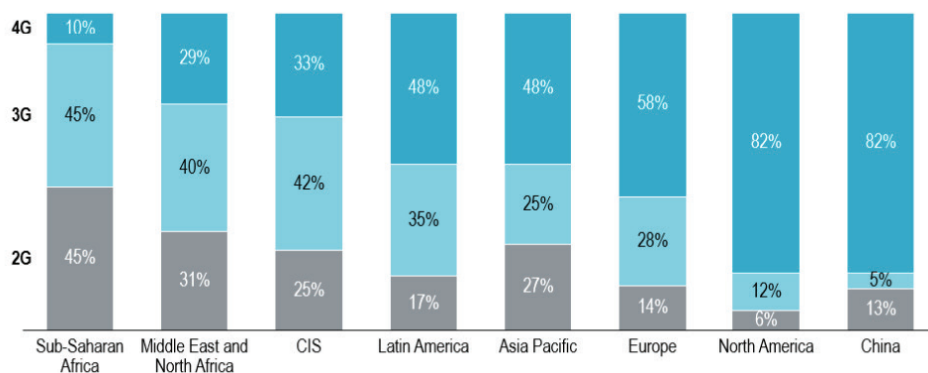
Source: ITU World Telecommunication /ICT Indicators. Retrieved December 10, 2021, from <https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx>

The technological success of developed countries is however linked or associated with the pervasive use of big data and cloud computing which ease the e-commerce process especially for the business to consumer segments as well individuals and states (Tippens & Sohi, 2003). However, various channels have been adopted by developing countries in order to match the transformation process. In few developing countries such as China, Nigeria, South Africa, Namibia etc. companies are deploying artificial intelligence, the “Internet of things”, robotic technology, 3D printers<sup>1</sup> and many other digital methods in order to create real impact and as such reduce many obstacles for the digital technology adoption process. The influence of the digitalization factor on the formation and development of human capital in many developing countries has triggered the adoption strategy of new methods in education, healthcare, skills development, recruitment and training and the creation of a framework to evolve and access new technologies used in modern times. This suggested that the formation and development of human capital in developing countries is linked with nations moving through different or several hierarchies in their technological development stages. These stages could help to match knowledge and can be very useful for understanding the digital process.

The technological driven stages could also serve as a driver of the structural change in the development process of the human capital. It enforces relevant changes in the outcome of sectorial prices and other regulations for the access of technology. This subsequently results in the use of technology and technical progress for the use of digital tools in developing countries whilst at the same time enhances drastic changes in the sectorial productivity. The higher the relative sectorial accessibility and productivity, the lower the relative sectorial prices (Baumöl, 2017). The development of technological stages in the human capital development process

<sup>1</sup> World Bank. (2018). World development report 2019: The changing nature of work. Washington, DC.

for developing countries could create large service sector that are able to absorb employment growth for developing countries. This stage would underpin the structural changes and technological progress that will help to develop the growth process. However, Africa still lacks the notable infrastructures and is currently undergoing reforms or wireless revolution that could impact digital technologies (Minges et al., 2008). Below is how Africa is compared to other regions of the world for mobile technology mix per region (Figure 2).



**Figure 2.** Mobile technology mix per region, 2019; % of mobile connections

Source: GSMA, The Mobile Economy Report 2022. Retrieved February 10, 2022, from <https://www.gsma.com/mobileeconomy/wp-content/uploads/2022/02/280222-The-Mobile-Economy-2022.pdf>

Developing countries especially in the African region are required to analyse the digital factors and the different conditions for skills needed through human capital development for the establishment of a well-designed digital economy resource. This can be achieved through basic factor conditions with a focus on the establishment of ICT infrastructure that could create many platforms for labour and even monitor natural resources. This could help in the production of local commodities in many developing countries. This strategy also will be able to reduce cost of importation from developed countries and encourage more exportation leading to currency stabilization amongst developing nation. More appropriate capacities can be achieved with the efficiency in advanced undifferentiated products with a huge development in the digital space. This will eventually reduce the shock in the digital market and encourage more efficiency in production of advance products through education and skills development incentives for real productivity.

The trend of technological investment from abroad will reduce with the growing urge to design and improve more capacities for production purposes.

As innovation plays key roles as a driver for more market ability to innovate useful product and services becomes very advanced with support systems design for industries. The services of distinguish product will become very competitive due to knowledge base adoptions and a clear support system for both digitalisation and

human capital. In the end developing economies can bolster their abilities to succeed due to high investment in these key factors.

Traditionally, developing countries are associated with simple commodity production leading to no digital consciousness. Most of the productions occurred in small scales and many materials were supplied by buyers with specific demands. In the digital economy producers are encouraged to take advantage on a wider range of manufacturing options by improving skills and relevant knowledge in other to function in areas included but not limited to manufacturing functions, logistics, marketing etc.

Having achieved original design, manufacturers in developing countries can curtain the stage of securing a pathway to controlling the normal value chain just like the case for developed countries.

Below is a schematic digitalisation factors on human capital. The digitalization factors for human capital.

The impact of these digital factors on human capital can be directly translated into the economic success of a country. In 2020 e-commerce for example accounted for about 41 % of China's retail. Other developing countries in South Asia such as India represented 5 % of retail sectors (Government of India, 2018) and possibly less than 1 % of the Philippines. However, Africa lacks the available data but managed to represent a small retail share. Despite that South Africa is one of the most advanced technological country in Africa digital economy that account for ecommerce only represented 1.4% of total retail sales in 2018 in Latin America ecommerce represented only 4 % if sales. Below is the size of digital ecosystems in Africa, Asia and Latin America (Table 1).

Table 1

**Size of the 'mobile ecosystem' in Africa, Asia Pacific and Latin America**

Region	GVA, \$	Contribution to GDP, %
Africa	155 Billion	9
Asia Pacific's	1.6 trillion	5
Latin America	216 billion	5

Source: GSMA (2019; 2020). GSM Association 1999–2019. Retrieved February 10, 2022, from <https://www.gsma.com/r/wp-content/uploads/2021/09/The-State-of-Mobile-Internet-Connectivity-Report-2021.pdf/>

The size of the internet economy in Africa shows the Africa potential to compete with another region especially Latin America. Amongst other developing countries in African Kenya represent highest performance Google and IFC (2020) iGDP accounting for about 7.7 % of total GDP. Ethiopia account for the lower iGPA and many other countries in the region have smaller iGPA economies. Below is the iGDP forecast for developing countries in Africa (Table 2).

**iGDP forecast for developing countries in Africa, 2020–2050**

Country	2020, \$	2020, %	2025, \$	2025, %	2050, \$	2050, %
Tanzania	2,57	3.98	4.28	4.75	17.03	7.50
Nigeria	24.59	5.68	36.53	6.86	145.28	11.27
South Africa	21.55	6.51	31.4	7.86	125.08	12.92
Ghana	3.01	4.42	5.01	5.31	19.94	8.73
Cameroon	2.06	5.39	3.27	6.19	13.00	10.16
Senegal	1.51	6.22	2.29	7.11	11.61	11.68
Rwanda	0.52	4.98	0.97	5.96	3.85	9.79
Mozambique	0.37	2.45	0.67	2.81	2.65	4.62
Keyna	7.42	7.70	12.84	92.4	51.07	15.17
Morocco	7.80	6.82	12.09	7.84	48.06	12.88
Algeria	9.02	5.60	11.92	6.16	47.39	10.12
Ethiopia	1.26	1.27	2.02	1.39	8.03	2.28
Cote d'Ivoire	3.18	5.27	5.53	6.04	21.98	9.92%
Egypt	15.41	4.98	25.97	5.99	103.29	9.83
Uganda	1.36	3.82	2.26	4.18	8.97	6.87
Angola	2.02	2.17	2.88	2.38	11.44	3.91
Ethopia	1.26	1.27	2.02	1.39	8.03	2.28
Rest of Africa	11.62	1.96	18.55	2.16	73.76	3.54

Source: Calculated by the Author based on the available data from the World Bank. Retrieved February 10, 2021, from <https://www.worldbank.org/>

## Methods

Looking at the influence of the digitalization factor on the formation and development of human capital in developing countries, this Article have therefore investigated and analysed the relationship between Human capital Index and digitalisation, and skill development using the Electronic Data Interchange ranking as a useful parameter in this analysis.

The Electronic Data Interchange (EDI) ranking has been considered as an ordinal variable and Human capital Index is a continuous variable.

These two variables have allowed us to use the Kendall's (1) correlation coefficient (tau-b) to test the association of the variables.

Below is a data set from world bank group and World development report for 2019 and 2020 used as secondary data for this study.

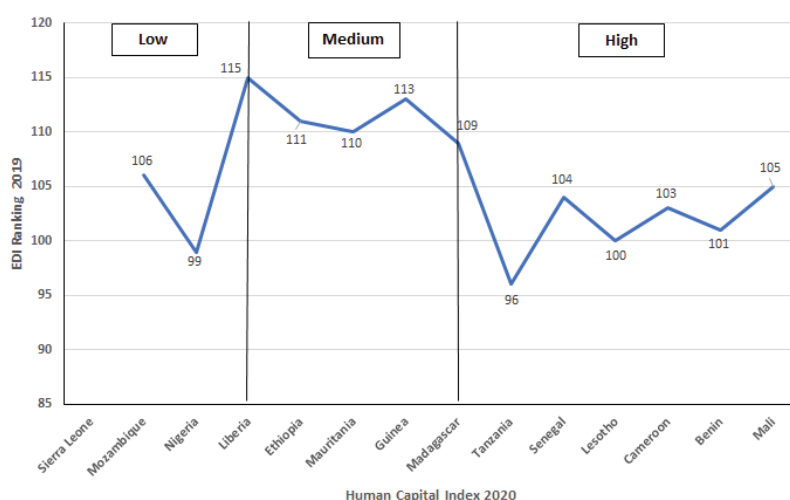
The table below shows variables for 14 different countries with Electronic Data Interchange (EDI), and Human Capital variables for 14 countries (Although the data is highly irregular due to missing observations for many countries, we can still observe a broad upward trend from the majority of countries) (Table 3).

**Interchange (EDI), and Human Capital variables, 2019–2020**

Countries with Lead digital access	EDI Ranking 2019	Human Capital Index 2020	Skills Development
Tanzania	96	0.55	Not stated
Nigeria	99	0.36	Not stated
Lesotho	100	0.40	Stated
Benin	101	0.40	Not stated
Cameroon	103	0.40	Not stated
Senegal	104	0.42	Not stated
Mali	105	0.42	Not stated
Mozambique	106	0.36	Not stated
Madagascar	109	0.39	Stated
Mauritania	110	0.38	Not stated
Guinea	113	0.37	Not stated
Ethiopia	111	0.38	Not stated
Liberia	115	0.32	Not stated
Sierra Leone	-	0.36	Not stated

Source: Calculated by the Author based on the available data from the World Bank. Retrieved February 10, 2021, from <https://www.worldbank.org/>

Human capital index calculates the contribution of health and education to worker productivity. The final index score ranges from zero to one and measures the productivity as a future worker of a child born today relative to the benchmark of full health and complete education (Figure 3).



**Figure 3.** Graphical representation of Human Capital and EDI ranking, 2019–2020

Source: calculated by the authors based on the available data from the World Bank. Retrieved February 10, 2021, from <https://www.worldbank.org/>



Refers to as Electronic data interchange; Normally it shows the ranking of digital access in different countries. There are no adequate skill development results for countries in the world.

## Results

The result shows correlation coefficient (tau-b) test showing the association of the variables which was  $-0.4537$ . This means that Human Capital Index (HCI) and EDI ranking have negative correlation. In any case so if the Human Capital of these countries are reached the Electronic Data Interchange ranking will still decrease. This result shows that these developing countries' investment in human capital in 2020 was not enough for these countries to reach the high level of digital access based on our dataset. The result also shows that two of the variables have statistically significant correlation at 95% confidence interval, considering Bonferroni correction for p-value.

Table 4

**Influence of the digitalization factor on the formation and development of human capital**

National level impact on African countries	Pathways of impact	Likely labour market impact
Opportunities	Increase productivity	Increase in jobs
	Increases in demand for new and existing products	Increase in jobs
	Reduction in cost of production enabling new entrants and SMEs to enter the export market	Creation of new jobs
	Reduction in cost of training leading to GVC participation	Increase in jobs
Challenges	Substitution of labour with automations	Decrease in jobs, unskilled workers are likely to be more affected
	Cognitive robot can be used to replace skilled labour	Decrease in skilled job; skill labours moves to less skilled jobs increasing skill mismatching
	Increase in precious work on digital platforms	Reductions in good jobs
International level impact on African Countries	Pathways of impact	Fall in wages of labour
Challenges	Reshoring of manufacturing Automation can have a back-stopping effect; Robot deployment in developed countries can pressure developing countries to become more competitive Exclusions from GVC and concentration of future production of digitally advanced goods in developed countries	Loss of potential jobs

Source: (Karishama Banga et al., 2018).

In other to summarise the whole idea we have taken a close look at the influence of the digitalization factor on the formation and development of Human capital in a tabular analysis with the aim to ease the complexity of the discussion Furthermore, even today the electronics industry in Russia is still viewed as an IDM when it does not produce most devices inhouse. This shows that proper understanding of modern production chain of electronics (in the form of end product) is required.

The national level impact of digitalisation has created opportunities despite numerous challenges in the case of developing countries. From a broader perspective the digital influence on the development of human capital has the tendency to increase productivity and expand knowledge base which in turn has a positive relationship in the development process of creating new market and improving job opportunities. The human capital development through technological effort has become competitive. The creation of unique and modern high-tech industries in the developed world has been a huge source for the ongoing digital process for many developing countries. The establishment of these digital infrastructure will help to support education, development of public services, research institutes and the formation of new industries for the establishment of skills development through on the job training and other mechanisms.

### **Discussion and conclusion**

This article examines the influence of digitalisation factors on the formation and development of human capital development in developing countries.

The article introduces digital economy and digital connectivity with their effect on individuals' businesses and firms. The size of the digital economy as well as the fixed broadband for Digital economies especially for developing countries in the different region were compared in other to look at Africa's position in the development process of digital adoption. Africa scoring 0.4% in the Fixed-broadband subscriptions per 100 inhabitants (2019) and lagging behind middle east and Asia shows that the developing countries in Africa needs to develop required infrastructure that could support the digital transition and the adoption process. Europe, America and CIS countries however proved to have an excellent standing and double the progress that have been made in Asia and the middle east, that also consist of many developing countries. Furthermore, mobile technology plays a huge role in the digital adoption process looking at the emergence of social media and other daily electronic usages. The use of 4G technology in both sub-Saharan and North Africa is relatively low compared to other developing regions. China, North America and Europe however shows tremendous progress. The sub-Saharan Africa region consist of most of the countries for this research and the region proves to be weak in its capacity to compete with the rest of the world.

The chapter also investigated secondary data from world bank group and World development report for 2019 and 2020 for 14 developing countries and analyse the relationship between Human capital Index and digitalisation using the EDI ranking. The investigation resulted into a negative correlation showing a correlation coefficient

of  $-0.4537$ . It is recommended that developing countries should invest in human capital especially in digital skills and create the required of digital access to their citizen in a bid to adopt digital transformation whilst building the human capital development of the people.

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### Сведения об авторах / Bio notes

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