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PRELIMINARY REPORT

Is There a Relationship Between Country Development and Citizens' Level of Digital Skills?

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ABSTRACT
This paper examines the relationship between citizens' level of digital skills and country development. Country development is measured by Gross National Income per capita (GNI p.c.), while digital skills are measured by the World Economic Forum. Data were gathered from the World Bank databases for 2019 from 135 countries worldwide. Correlation analysis was used for the analysis. The results of the correlation analysis show a significant strong positive linear relationship between digital skills and GNI p.c., indicating the importance of country development in developing adequate levels of the crucial skills of the 21st century – digital skills and vice versa

Keywords: digital skills, development, gross national income per capita, correlation analysis

JEL Classification: F63, J24

INTRODUCTION

Globalization and technological innovations have contributed to a change in the way how individuals and the economy function. James (2021) states that most innovations are created in developed countries. The same author notes that digital technologies are primarily developed in and for the usage of affluent countries concerning their socio-economic conditions, including attitudes, skills, income, and infrastructure. Regarding this, citizens in developing countries, especially rural areas, lack digital skills. Developed countries are usually the setters in innovations, so developing countries lag in their adoption (Bara, 2016). In this regard, Comin & Mestieri (2018) state that despite reducing lag, developed countries are ahead in the diffusion of technology. According to Baliamoune-Lutz (2003), time lag and diffusion of innovation depend on the level of the country's income. Regarding this, in developing countries, income per capita constraints ICT diffusion. Also, Karjaluoto et al. (2002) and Lee et al. (2002) state that an increase in income is positively related to the adoption of innovation. Kolaković et al. (2009) indicate that success in using digital resources depends on the level of development. Bradić-Martinović & Banović (2018) confirm differences between developed and developing countries regarding accessing ideas, knowledge, and modern ICT.

OECD points out that in developing the digital economy in countries, the crucial roles play the following elements: ICT infrastructure, ICT skills, finance, and regulation, as well as the interplay

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between them (Dahlman et al., 2016). The coronavirus accelerated the adoption of digital products/services and highlighted the importance of digital channels and, consequently, the possession of required digital skills. The Committee for the Coordination of Statistical Activities (2020) states that developing countries are less equipped to use information and communication technologies to minimize the disruption due to coronavirus. Regarding this, it can be concluded that developing countries should improve their position since there is a possibility that another similar event will occur in the future.

In the fourth industrial revolution era, it is crucial to understand how to use digital tools and communicate through digital channels. Regarding this, it is significant to possess the appropriate level of digital skills in the digital world when performing everyday activities. Thus, digital skills are needed for daily digital communication, doing a job, executing digital banking transactions, etc. European Parliament & Council also highlights the importance of digital competencies, considering they represent lifelong learning competencies (European Parliament & Council, 2006). Individuals can acquire the required skills in this digital world by learning and experiencing them in practice (Ivanović & Simović, 2020). Also, all individuals should continuously develop digital skills in every stage of life (Ivanović & Antonijević, 2022), so it is a never-ending process. Those who are digitally skilled have more success in finding a job. Also, the International Telecommunication Union - ITU (n.d.a) points out that digital skills are required for the future since nine out of ten jobs need these skills in Europe. Therefore, digital skills have become essential for individuals who want to be a part of the labor market, considering that around 90% of jobs require an appropriate level of digital skills. Lazić et al. (2023) emphasized the significance of digital competencies, especially for people with disabilities, considering the opportunities for their employment through freelance platforms. Possessing proper digital skills is significant, especially in developing countries, since billions of the young will participate in the labor market (UNCTAD, 2018). Individuals who lack digital skills are threatened to lose their job due to their lower competitiveness in the labor market (Banović & Pavlović, 2021). According to Domazet et al. (2018), developing cooperation between three sectors—ICT, education, and private—can help generate a synergy effect and be advantageous to all parties.

No recent literature explores the relationship between the level of digital skills and development. Given that developed and developing countries differ in terms of digital infrastructure (Center for Strategic and International Studies CSIS, 2022; James, 2021) and education (Wiley, 2021; OECD et al., 2020), authors expect that there is a relationship between development, measured by Gross National Income per capita, and citizens' level of digital skills, measured by a 7-point Likert scale determined by the World Economic Forum.

This paper is structured as follows. After analyzing the relevant literature, the authors examined the association between the level of digital skills and GNI per capita. The results of the correlation analysis indicate that the country's development plays a vital role in the citizens' digital skills and vice versa, considering that the authors found a strong positive relationship between the level of digital skills and the GNI p.c. The last part of this paper includes suggestions and directions for further research.

LITERATURE REVIEW AND HYPOTHESES

Eshet (2004) indicated the crucial role of digital skills in the twenty-first century. All industries have been exposed to changes under the influence of digital technologies, which consequently underlines the need for possessing the appropriate level of digital skills. Thus, digital skills have become essential in an individual's everyday activities.

Different terms correspond to skills related to ICT and digital technologies, such as ICT skills, IT skills, digital literacy, information literacy, technology skills, 21st-century skills, and digital skills, so all mentioned terms are synonyms (Bejaković & Mrnjavac, 2020). UNESCO defined digital skills as "a range of abilities to use digital devices, communication applications, and networks to

access and manage information. They enable people to create and share digital content, communicate and collaborate, and solve problems for effective and creative self-fulfillment in life, learning, work, and social activities at large" (UNESCO, 2018). According to Eurostat, there are four levels of digital skills. These levels are based on the European Digital Competence Framework (DigComp) and individuals' digital activity in the last three months. Regarding this, the following individuals' levels of digital skills are identified by Braun et al. (2020):

1. *Individuals with above-basic digital skills* - "individuals who have performed all of the following activities: sending/receiving emails, participating in social networks, installing software and applications, using online banking, using word processing software, using advanced spreadsheet functions to organize and analyze data such as sorting and filtering".
2. *Individuals with basic digital skills* - "individuals who have sent/received emails, installed software and applications, and used spreadsheet software (without advanced functions such as sorting and filtering)".
3. *Individuals with low digital skills* - "individuals who have sent/received emails, installed software and applications, but have neither used word processing, nor spreadsheet software nor have used software to edit photos, videos or audio files".
4. *Individuals with no digital skills* - individuals who "have not performed any relevant activities, despite declaring having used the internet at least once during the past three months".

International Telecommunication Union - ITU (2018a) identifies three types of digital skills: basic, intermediate, and advanced. An explanation of all these types is given in detail below in Table 1.

Table 1. Types of digital skills

Type	Explanation
Basic	"Elementary skills for executing basic tasks. Include "hardware (for example, using a keyboard and operating touch-screen technology), software (for example, word processing, managing files on laptops, managing privacy settings on mobile phones), and basic online operations (for example, email, search, or completing an online form)".
Intermediate	"Enable us to use digital technologies in even more meaningful and beneficial ways, including the ability to critically evaluate technology or create content. These are effectively job-ready skills since they encompass those skills needed to perform work-related functions such as desktop publishing, digital graphic design and digital marketing".
Advanced	"Those needed by specialists in ICT professions such as computer programming and network management. These include artificial intelligence (AI), big data, coding, cybersecurity, Internet of Things (IoT), and mobile app development".

Source: International Telecommunication Union - ITU. (2018a). Digital Skills Toolkit. Available on https://www.itu.int/en/ITU-D/Digital-Inclusion/Documents/ITU%20Digital%20Skills%20Toolkit.pdf. Accessed September 25, 2022.

OECD (2004) differs the following three categories: basic users, advanced users, and ICT specialists, while Cedefop (2015) points out basic, moderate, and advanced ICT skills.

International Telecommunication Union - ITU (2021) differs three types of digital skills:

1. Basic: "copying or moving a file or folder, using copy and paste tools to duplicate or move information within a document, sending emails with attached files, and transferring files between a computer and other devices";

2. Standard: “using the arithmetic formula in a spreadsheet, connecting and installing new devices, creating electronic presentations with presentation software, and finding, downloading, installing and configuring software”;
3. Advanced: “writing a computer program using a specialized programming language”.

Paset et al. (2021) identify the following digital skills levels: Basic/Foundational, Intermediate, Advanced, and Highly specialized.

Digital skills are becoming central for developing and developed countries (International Telecommunication Union - ITU, 2018a). The results of the International Telecommunication Union - ITU (2018b) research showed that the digital skills divide existed between developing and developed countries since the average percentage of individuals with basic digital skills amounted to 46% and 65%, respectively. Furthermore, the gap was higher in terms of standard skills (20% in developing countries and 49% in developed countries). The least developed countries characterized the highest gap between access to the Internet and the actual use of the Internet. The vast digital skills gaps are often associated with less wealthy economies due to inappropriate digital education and training (Wiley, 2021). Insufficient skills were identified in developing countries, especially in the case of the poor (International Telecommunication Union - ITU, 2021). According to OECD et al. (2020), there was a digital divide between the more vulnerable and less educated on one side and the rich and more educated on the other. Additionally, the same authors indicated that new technologies must be incorporated into education to develop digital skills. Therefore, teachers have a crucial role in digital transformation by including ICT in teaching.

Information Telecommunication Union - ITU (n.d.b.) data showed that overall digital skill levels should be enhanced in numerous countries. This conclusion is based on the fact that less than 40% of respondents worldwide reported engaging in basic digital skills activities in 76 countries for which data were available in 2021. Also, less than 40% of respondents reported performing some of the activities comprising standard digital skills in 70% of countries. Additionally, more than 10% of respondents reported carrying out activities involving advanced digital skills in 15% of observed countries' Information Telecommunication Union - ITU (n.d.c). According to Eurostat data, 54% of the EU population (age range 16 – 74) had at least basic digital skills in 2021. The top 3 countries with the highest scores were the Netherlands, Finland, and Ireland, while the lowest had Romania, Bulgaria, and Poland (Digital Skills & Jobs Platform, 2022). In Serbia, Bradić-Martinović & Banović (2018) found that slightly lower than 50% of respondents had no or had a low level of digital skills in 2017. However, the study's results did not differ significantly from the EU average (42.8%), i.e., more precisely, 17.3% had no digital skills, while 25.5% had a low level of digital skills.

One key factor determining ICT access is income level (Dewan et al., 2005). Thus, the authors indicated that ICT's affordability increases with income. Nipo et al. (2014) also supported these findings. Vicente & Lopez (2008) stated that countries with higher education and income levels express better ICT access. Maji & Laha (2021) also highlighted the crucial roles of income, education, economic openness, and urbanization in overcoming the digital divide. Results of recent studies showed that the digital divide was determined primarily by income level, educational level, Internet affordability, freedom of the economy, citizens’ gender and age, urbanization, and foreign direct investments (Aikins, 2019; Cruz-Jesus et al., 2018; Fang et al., 2019; Huxhold et al., 2020; Otioma et al., 2019; Pachis, 2018; Song et al., 2020).

In 2021, there was still a digital divide between developing and developed countries, considering that 96% of 2.9 billion offline people lived in developing countries (International Telecommunication Union - ITU, 2021). According to the latest data from the International Telecommunication Union- ITU (n.d.b), around 4.9 billion individuals worldwide used the Internet in 2021. When the pandemic started, the number of Internet users in developing countries increased by 13.3% (International Telecommunication Union - ITU, 2021), indicating the importance of being online. Regarding country development, 90% of people used the Internet

in developed countries and 57.1% in developing countries (International Telecommunication Union- ITU, 2021). Regarding this, those who are unconnected need to develop appropriate skills to become connected.

Wiley (2021) stated that those economies that lead to digital skills development were considered the most resistant. Moustakas et al. (2018) also highlighted the importance of a skilled labor force for improving economic productivity and growth. Due to the pandemic, the demand for workers with digital skills is still increasing. The pandemic indicates the significance of reducing the digital skills gap. Also, it has underlined the critical role of an adequate level of digital skills (EU4Digital, 2021). Additionally, the pandemic has disclosed the gaps between developed and developing countries in adopting digital technologies (Misra, 2022). Misra (2022) has pointed out that the main obstacles to achieving digital inclusion in developing countries are ineffective implementation and investment approaches related to digital skills.

Olczyk & Kuc-Czarnecka (2022) revealed that the Digital Economy and Society Index (DESI), which measures the EU's digital performance, was an important predictor of changes in GDP per capita in EU countries. Furthermore, Rozite et al. (2019) found that digital skills statistically impact GDP per capita in the EU. Additionally, Aniela et al. (2019) stated that in 2015, EU countries can be classified into four clusters (very high level, high level, medium level, and low level) based on their GDP and the percentage of individuals who have basic or above-level digital skills, indicating similarities within groups and dissimilarities among groups.

By analyzing the literature, the authors have identified a lack of studies that examine the association between digital skills and development, especially on a global level.

Based on all the above, two hypotheses were formulated:

H1: There is a significant positive relationship between the level of digital skills and GNI p.c.

The following section presents a detailed insight into the characteristics of the sample and the statistical tools the authors used to test the defined hypothesis.

METHODOLOGY

World Bank databases were used to examine the presence of a linear relationship between the level of digital skills and development. Since the most recent digital skills data available was from 2019, the authors conducted the analysis using data from that year. The study included 135 countries worldwide, 52 developed (38.52%) and 83 developing countries (61.48%). Data for some African and Asian countries were missing, and they were excluded from the analysis.

Table 2 presents the summary of the variables used in the analysis.

Table 2. Summary of the variables

Variable	Explanation	Data source
Digital skills	In your country, to what extent does the active population possess sufficient digital skills (e.g., computer skills, basic coding, digital reading)? [1 = not all; 7 = to a great extent]	https://govdata360.worldbank.org
GNI per capita	GNI per capita, Atlas method (current US$)	https://data.worldbank.org

The World Bank classification for 2019 was used, which classifies countries into four income groups (low, lower-middle, upper-middle, and high-income) based on the thresholds determined by the amount of GNI p.c. in USD. It is important to note that on July 1 each year, the World Bank updates the classification of countries, considering that changes in population, inflation, income

growth, and exchange rates influence GNI p.c. and that the thresholds must be adjusted for inflation (World Bank, 2019). According to Nielsen (2011), high-income countries are considered developed, while low, lower-middle, and upper-middle countries are considered developing countries. GNI per capita in U.S. dollars was used to express the level of development as proposed by Paulozzi et al. (2007).

Table 3. presents the summary of income groups, countries' classification by development level, and the codes used in the analysis.

Table 3. Classification of countries by income group and development

Income group	GNI per capita (USD)	The codes of the income group	Level of development
Low income	< 1,026	1	Developing
Lower-middle income	1,026 - 3,995	2	
Upper-middle income	3,996 - 12,375	3	
High income	> 12,375	4	Developed

Source: World Bank, available on https://blogs.worldbank.org/opendata/new-country-classifications-income-level-2019-2020 16.9.2022 and Nielsen, L. (2011). IMF working paper–classifications of countries based on their level of development: how it is done and how it could be done. International Monetary Fund.

The level of digital skills was measured using publicly available 7-point Likert scale data from the World Economic Forum, which were based on assessments made by research teams from each country's institute on a scale ranging from 1 to 7. Based on the available data, the authors calculated the global average digital skills score to be 4.22. Considering that the maximum score is 7, it can be concluded that there is a space for improving the level of digital skills globally. From the aspect of development, developed countries had, on average, a higher level of digital skills (4.81) compared to developing ones (3.86).

Table 4. Descriptive statistics – Digital skills

Income group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
1	13	3.33	.42933	.11908	3.0752	3.5941	2.74	4.03
2	33	3.84	.54702	.09522	3.6433	4.0312	2.45	5.06
3	37	4.07	.62451	.10267	3.8602	4.2766	2.91	5.37
4	52	4.81	.55497	.07696	4.6557	4.9647	3.52	5.83
Total	135	4.22	.75070	.06461	4.0992	4.3548	2.45	5.83

Source: Authors' calculation

In income group 1, Mozambique had the lowest score for digital skills, while the Gambia had the highest score. In income group 2, the lowest score was recorded in Angola, while the Philippines had the highest score. The lowest and the highest values in income group 3 had Paraguay and Malaysia, respectively. In income group 4, Panama had the lowest, while Finland had the highest digital skills score. In Serbia, the score for digital skills was 4.09. This score is slightly above the average of Serbia's income group (upper-middle income).

The descriptive statistics for GNI per capita are presented in Table 5.

Table 5. Descriptive statistics – GNI per capita in USD

Income group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
1	13	701.54	196.505	54.501	582.79	820.29	240	950
2	33	2223.03	947.841	164.998	1886.94	2559.12	1070	3980
3	37	7007.03	2414.146	396.883	6202.11	7811.94	4010	12120
4	52	37003.46	20030.484	2777.728	31426.94	42579.98	12620	84260
Total	135	16784.59	20416.586	1757.180	13309.20	20259.99	240	84260

Source: Authors' calculation

In income group 1, Burundi had the lowest GNI p.c., while Guinea had the highest. In income group 2, the lowest GNI p.c. was recorded in Angola, while the Philippines had the highest value. The lowest and the highest GNI per capita income group 3 had Sri Lanka and Costa Rica, respectively. Finally, in income group 4, Romania had the lowest, while Switzerland had the highest GNI p.c. GNI per capita in Serbia was 7040 USD in 2019. This amount was slightly above the average of the upper-middle income group Serbia belongs to.

Correlation analysis was used to test the defined hypothesis and examine the relationship between two variables, i.e., development (measured by GNI per capita) and the level of digital skills (measured by a seven-point Likert scale). Considering the presence of the outliers, we applied Spearman correlation analysis.

RESULTS

Analysis of the association between the level of digital skills and GNI p.c. shows that a higher level of digital skills corresponds to a higher GNI p.c. Dots on the graph (Figure 1) represent pairs of digital skills and the income level with the belonging code of the income group above the dot.

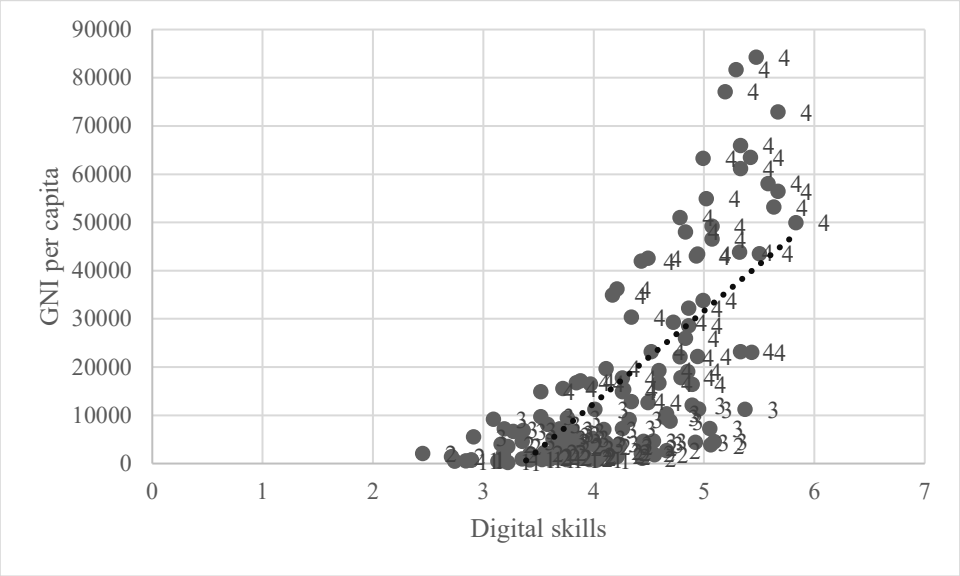

Figure 1. Scatter plot for the level of digital skills and GNI p.c. (US$)

Source: Authors based on World Bank data

Even though a positive relationship between these two variables is identified, it should be pointed out that there is an influence of some other factors, such as the development of digital infrastructure, quality of the educational system, availability of the latest technology, etc.

A correlation analysis was applied using the Spearman coefficient to examine the presence of a statistically significant association between digital skills and GNI p.c. Considering the presence of outliers, the authors used Spearman's correlation. A statistically significant ($p<0.01$) strong positive linear relationship was found between the level of digital skills and GNI per capita, i.e., development, considering that the value of the correlation coefficient is 0.72 (Table 6). Therefore, the null hypothesis that there is no linear relationship between the level of digital skills and GNI per capita was rejected.

Table 6. Results of the Spearman's correlation

	Total sample	
	Digital skills	**GNI per capita**
Digital skills	1	**.720****
Sig. (2-tailed)	0	0
GNI per capita	**.720****	1
Sig. (2-tailed)	0	0
N	135	135

*** - Correlation is significant at the 0.01 level (2-tailed)*

Source: Authors' calculation

This result shows a strong link between development and digital skills, i.e., the higher level of GNI per capita corresponds to a higher level of digital skills, and vice versa. Due to the lack of literature examining the relationship between digital skills and development, particularly globally, there was a limitation in comparing research results. Our findings support the previous studies conducted in the EU by Rozite et al. (2019) and Aniela et al. (2019). Therefore, the results of our analysis highlight the significant role of income in developing citizens' appropriate level of digital skills. Furthermore, digital skills play an important part in driving economic development.

This study contributes to the expansion of the literature in this scientific field, given that it provides for the first time an insight into the relationship between the development and the level of digital skills on a global level.

CONCLUSION

Digital transformation is rapidly changing the way how society and the economy function. In the 21st century, all individuals need digital skills to interact, study, work, access online services, and find necessary information (European Commission, n.d.). The development of digital skills significantly contributes to overcoming poverty and empowering the poor (Urvashi et al., 2017). Since there are differences between developing and developed countries, it is significant to explore the relationship between country development and the citizens' level of digital skills. In this regard, this paper aims to examine a positive linear relationship between the level of digital skills and country development measured by Gross National Income per capita (GNI p.c.). The analysis covered 135 countries worldwide, considering that the data for predominantly African and Asian countries were unavailable. The data were collected from the World Bank databases for 2019. To test the formulated hypothesis, correlation analysis was used. A strong positive relationship was found between the level of digital skills and GNI p.c. considering that the correlation coefficient amounts to 0.720. This result indicates a higher level of GNI per capita. i.e., country development corresponds to a higher level of digital skills, and vice versa. Thus, the results of our analysis highlight the important role of country development in enhancing citizens'

level of digital skills, and the significance of citizens' level of digital skills in improving country development.

Based on the findings of the study, there are several implications and policy recommendations.

Firstly, the study highlights the importance of increasing access to digital technologies and infrastructure in promoting country development. Governments should invest in expanding access to high-speed internet, computer hardware, and software, especially in rural and underdeveloped areas, to ensure citizens can access the digital resources necessary to develop their digital skills. Secondly, the study suggests that digital skills education and training investments can effectively enhance the development of the country. Thus, governments should prioritize the higher incorporation of digital skills in their education systems and provide training programs to the workforce to ensure that citizens have the necessary skills to thrive in the digital economy. Finally, policymakers should consider the findings of this study in their efforts to close the digital divide and promote digital inclusion.

Even though this study contributes to expanding the scope of the literature related to this scientific field, this research has some limitations. Firstly, the data for predominantly African and Asian countries were unavailable, which could limit the generalizability of the study's findings. Secondly, the study only examined the correlation between the level of digital skills and country development, which does not imply causality. Thirdly, other factors that may affect a country's development and the level of digital skills were not considered.

The above limitations suggest the need for further research to better understand the complex interplay between digital skills and country development. Future studies should aim to expand research by incorporating more countries into the analysis. Furthermore, researchers should include other relevant variables, such as the development of digital infrastructure, availability of the latest technology, quality of the educational system, etc. Additionally, they should consider using more precise and reliable measurements of digital skills, such as observing the percentage of the population with the respective level of digital skills (e.g., above-basic, basic, low, and no digital skills). Moreover, further research should focus on examining causality and developing more sophisticated statistical models and techniques to analyze and identify causal relationships.

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