

The Effect of Digital Technology Adoption on Economic Growth and Development

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Abstract: - This study investigates the influence of digital technology on the economies of developing countries. It examines the Digital Adoption Index, ICT expenditures, Ease of Doing Business Index, and Gross National Income per capita to assess their relationship with economic performance. Using endogenous growth theory, the study explores how technological progress, business environment, and income levels contribute to economic growth and support Sustainable Development Goals 8 and 9. Panel data from 25 developing countries (2010–2022) obtained from the World Bank are analyzed using a fixed effects regression model, with unit root and cointegration tests ensuring robustness. Results show that higher digital adoption, ICT spending, and improved business conditions positively impact economic performance and GDP per capita. The findings emphasize the importance of policies that promote technology adoption and regulatory improvements to achieve sustainable economic growth and digital transformation aligned with global development goals.

Key-Words: - Digital Adoption Index, ICT expenditure, Ease of Doing Business Index, GNI per capita, economic development, SDGs, panel data regression analysis.

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1 Introduction

The primary objective of this study is to examine the impact of digital technology on the economies of developing nations. This study will examine the Digital Adoption Index, national expenditures on information and communication technology relative to their economies, the ease of conducting business in these nations, and the average income per capita. We will utilize data from the World Bank spanning 2010 to 2022 for 25 developing nations to analyze the influence of digital technology on economic development across various phases and countries. The research examines technology and its impact on economic growth in emerging nations.

We shall employ panel data regression methodologies. This will assist us in managing time-varying variables that differ among entities. We can comprehend the underlying situation. Panel data regression approaches are advantageous for this investigation since they effectively manage variables that vary over time and among entities,

[1]. The results of this study are expected to offer guidance for policymakers, regulators, and industry experts in developing countries. This study will show how digital technologies and economic growth are related. It will help people in charge of making decisions find ways to get more people to use technology and improve the economy. The attainment of the Sustainable Development Goals (SDGs) is of paramount importance. Digital technologies are recognized as crucial enablers for fostering substantial growth and development, [2]. This study will delineate the specific pathways through which these technologies can contribute to the realization of the SDG targets.

This study will elucidate the impact of digital technology on the economy. We will examine how digital technology can transform the future of developing countries. The objective is to examine how digital transformation can assist these nations in achieving their goals. Digital technology constitutes an integral component of this. We require an understanding of its potential benefits for

emerging nations. The study will examine transformation and its effects on economic growth in these nations. Digital technology and digital transformation are crucial for the future of developing countries.

2 Literature Review

This study examines concepts about national economic growth. It contemplates the impact of technology on the economy. The study particularly focuses on the circumstances in underdeveloped nations. It seeks to understand the impact of digital technology on growth in these nations. The research employs hypotheses to comprehend this phenomenon. It looks at how digital technology could help countries grow and develop.

The Endogenous Growth Theory asserts that a nation's economic growth is propelled by internal factors, [3]. This is due to things like our existing knowledge, interpersonal skills, and new ideas. New digital technology is important for economic growth, [4], [5]. This facilitates our endeavors and generates new opportunities. New digital technology remains crucial for the evolution of economies over time, [6]. The Endogenous Growth Theory posits that digital technology is a catalyst for innovation and enhances economic efficiency.

The concept of Financial Intermediation and Growth is significant as it illustrates how a robust financial system facilitates economic expansion. This occurs when individuals invest more, and resources are utilized accordingly. Financial intermediation is essential for a country's development, [7], [8]. This facilitates access to necessary funds, mitigates issues arising from a lack of information, and promotes investment. This concept, frequently discussed in relation to banks and finance, can also enhance the economy through services such as internet banking.

The notion that regulations benefit the economy posits that clear and easily navigable laws facilitate the growth of enterprises and innovation. Certain scholars assert that straightforward regulations facilitate enterprises in experimenting and adopting digital technologies, hence contributing to economic expansion, [9], [10]. The Theory of Regulatory Efficiency and Economic Performance is significant as it illustrates the impact of regulations on the transformative effects of digital technology on the economy.

The Income and Economic Growth Theory has been discussed by economists, [11], [12]. It is asserted that economic growth occurs when individuals possess financial resources. This occurs

because individuals save and invest more when they possess income. This contributes to economic expansion. The Income and Economic Growth Theory is crucial when considering technology. The increased utilization of digital platforms enhances economic growth. This indicates that individuals and corporations generate revenue. The economy expands further when they generate profit.

These concepts assist me in determining my inquiries and the methods I will employ to explore them. They provide insight into the relationship between digital technology and the economy, [13]. Continued study will elucidate the underlying dynamics and demonstrate how digital technology is transforming the economy. Digital technology constitutes a component of this. I wish to observe its impact on the economy.

Digital technology is fundamentally transforming industrial operations and influencing the economy. We must examine how digital technology enhances economic efficiency and generates opportunity. It is crucial to comprehend the impact of digital technology on the economy and various businesses. Digital technology has a role in this. We ought to acquire further knowledge regarding it.

The Digital Adoption Index, developed by the World Bank, measures the extent of digital technology utilization in countries. It is an instrument for analyzing the impact of digital technology on the economy. Studies show that countries that use technology tend to be more productive and have faster economic growth. This shows how important digital technology is for the economy, [14].

This study seeks to clarify the influence of digital technology on the economy. This will examine how digital technology can assist emerging countries with significant potential for transformation. The examination of technology and its influence on the economy is crucial for these nations. Digital technology may significantly facilitate the growth and development of these nations. This study aims to furnish insights and concepts regarding technology and its potential to assist emerging economies.

This study illustrates the significance of digital technology for emerging nations. It utilizes data from the World Bank spanning 2010 to 2022 to ascertain actual occurrences, [15]. The study examines technology across many countries and time periods. This method is advantageous as it encourages contemplation on temporal changes. This allows us to understand the impact of digital technology on a nation's economy. Digital technology is involved in this matter. The

examination of technology is crucial for comprehending how nations might advance and prosper.

This study will examine the impact of digital technology on the economies of developing nations. We will examine existing literature on this topic and conduct research to obtain answers to our inquiries. We are trying to answer the question: how does digital technology affect growth in developing countries?

Technology has had a big impact on the economic growth of developing countries. Digital technology has significantly transformed numerous aspects of these countries. It has enabled individuals in developing countries to engage in commerce and generate income in previously unattainable ways. Digital technology has facilitated the online buying and selling of goods. This has facilitated the growth and development of enterprises in developing nations. Digital technology has facilitated access to banking and other financial services for individuals in these countries.

Technology has generated new employment opportunities in developing countries. A significant number of individuals are currently employed in technology-related occupations. This has contributed to a decrease in the unemployment rate in these countries. Digital technology has influenced economic growth in emerging nations. It has facilitated the development and enhanced the success of these countries. Digital technology will persist in influencing the development of new nations.

Digital technology is significantly transforming business practices in these sectors. It is influencing the economy of these places. Digital technology is facilitating employment creation and innovative avenues for income generation. Technology is significantly influencing the economic landscapes of these regions. Digital technology facilitates the initiation of businesses and the global sale of products. This is beneficial for the economy of these places since it indicates that more individuals possess disposable income. Digital technology is making it easier for people to get the resources they need. Technology is changing the economies of these places in big ways.

How does the business world affect the level of income in a country? The state of the economy and the level of national income are very important because they affect how digital technology is used and how it affects a country's economy. A country can use digital technology to help its economy grow if it has a good business climate and high national income levels. On the other hand, if a country has a

bad business climate and low levels of national wealth, it may have trouble using digital technology well, which can hurt its economy.

To understand how they affect a country's economy, we need to look at how the business climate, national income levels, and technology work together. The business environment and national income levels function as interlocking components with technology to generate economic outcomes.

We contemplated numerous matters. The study has several hypotheses it intends to evaluate. The research posits the subsequent hypotheses: The advent of technology has significantly transformed the functioning of economies in developing nations. This has resulted in methods of conducting business, facilitating the buying and selling of goods for individuals. Digital technology has significantly impacted these nations. It has facilitated the generation of innovative business concepts and expanded product reach to a broader audience. Technology has enhanced the functionality of markets in various nations.

The increasing utilization of technology positively impacts a nation's GDP. This enhances operational efficiency and facilitates entrepreneurial endeavors. Digital technology is highly beneficial for advancement. It enhances convenience and efficiency, benefiting a nation's economy. Digital technology facilitates the generation of commercial ideas, which is advantageous for economic development.

A favorable business environment and increased financial resources among the populace can significantly enhance a country's economy through digital technology. Digital technology significantly influences development, and a favorable corporate environment coupled with elevated national income levels amplifies these benefits. This indicates that digital technology can significantly aid development when the economic climate is favorable and individuals possess financial resources.

This study examines the impact of digital technology on a nation's economy. It seeks to examine the impact of digital technology on a nation's economic growth. The examination of technology and its impact on economic growth helps elucidate how digital advancements are transforming the economy, particularly in less developed regions. The primary objective is to gain a deeper understanding of how digital technology is transforming the economy in these developing regions.

3 Methodology

This analysis examines data from the World Bank spanning 2010 to 2022 for twenty-five developing nations, [16]. The World Bank data for these developing nations was selected due to its compliance with specified criteria. We sought to use World Bank data from developing countries across several areas to analyze regional disparities. We also sought developing nations with technological capabilities such as computers and telephones. We required World Bank data spanning the entire period from 2010 to 2022 to ensure the reliability and comprehensiveness of the study.

The study utilizes data from World Bank databases. It examines the World Development Indicators and the Doing Business databases, [17], [18], [19]. We examined GDP per capita, the Digital Adoption Index, technology expenditure as a percentage of GDP, the Ease of Doing Business Index, and GNI per capita (Table 1). This information was obtained for each country from 2010 to 2022.

This methodology allows us to examine the impact of digital technology on the economic landscape of nations and regions. We can examine the World Bank data for enhanced comprehension. The Digital Adoption Index and GDP per Capita are factors to consider when discussing a country's technology and economics.

This study employs panel data regression to analyze phenomena. The panel data regression facilitates the consideration of variables that fluctuate over time. The paper employs this strategy to illustrate the panel data regression outcomes. This enhances the precision of the panel data regression findings.

We conducted an assessment to ensure the Fixed Effects calculations are valid and precise. We assessed the robustness of the Fixed Effects estimations by modifying the model. These modifications encompassed (i) omitting some cross sections that influence the outcome, (ii) experimenting with several historical epochs, and (iii) categorizing the mistakes by nation for the Fixed Effects estimations. This was executed to guarantee the reliability of the Fixed Effects estimations. Upon examining all the specifications, it is evident that the signs and magnitudes of the coefficients are identical. This indicates that the estimated parameters of the specifications are mostly unaffected by alterations in the sample structure of the requirements. The specs' parameters remain largely unchanged.

We employed a procedure to ensure the accuracy of the numbers. This technique is referred to as

heteroscedasticity mistakes or Huber–White sandwich estimators. We undertook this analysis because the developmental stages of various countries yield very disparate numerical data. This strategy assists in obtaining solutions when numerical discrepancies vary among countries. We want to ensure the utilization of heteroscedasticity-robust standard errors to validate the reliability of the results.

The framework for our panel data model is outlined as follows:

$$\begin{aligned} &GDP\ per\ Capita_{it} \\ &= \beta_0 + \beta_1 DAI_{it} \\ &+ \beta_2 ICT\ Expenditure\ \% \ of\ GDP_{it} \\ &+ \beta_3 Ease\ of\ Doing\ Business\ Index_{it} \\ &+ \beta_4 GNI\ per\ Capita_{it} + \varepsilon_{it} \end{aligned}$$

Where: i is for a country at time t

Table 1. Variables, types, and their sources

Variables	Type	Definition	Source
GDP per Capita	Dependent Variable	Represents the total economic output of a country divided by its population.	World Bank Database
Digital Adoption Index (DAI)	Independent Variable	Measures the extent and effectiveness of digital technology adoption across both public and private sectors within a country.	World Bank Database
ICT Expenditure % of GDP	Independent Variable	Indicates the proportion of a country's GDP spent on information and communication technologies, reflecting digital investment levels.	World Bank Database
Ease of Doing Business Index	Independent Variable	A World Bank index assessing the ease with which businesses can operate based on regulatory measures serves as an indicator of regulatory efficiency.	Doing Business Reports
GNI per Capita	Independent Variable	Used to account for the general wealth level of a country, which can influence digital technology adoption and economic activity.	World Bank Database

Source: created by the authors

This model will elucidate the impact of factors such as the Digital Adoption Index, information and communication technology expenditure as a component of the national economy, the ease of business initiation, and the average income per capita on individual earnings in select developing countries over time. The Digital Adoption Index will be examined with information and communication technology expenditure as a percentage of the economy, the Ease of Doing Business Index, and average income per capita to assess productivity in these emerging nations.

To address concerns regarding the interconnections between an individual's financial resources within a country and the errors made in estimations, we examined the efficacy of the Fixed Effects estimator. The primary assumption we are making is:

$$E(GNIpc_{it} \cdot \varepsilon_{it} | \mu_i) = 0$$

This condition indicates that when analyzing each country individually, events occurring at that time, which are not attributable to the country itself, are unrelated to the GNI per capita. To verify this assertion, we conducted an experiment utilizing the residual data from our analysis. We utilized historical figures of GNI per capita to assist in our analysis. The test results did not indicate that we should dismiss the notion that GNI per capita is unbiased. This indicates that GNI per capita is acceptable for utilization within our Fixed Effects framework. We can ascertain that GNI per capita does not provide us with answers.

Upon examining the correlation between the factors influencing the outcome and the residual components, we did not observe a discernible pattern. We conducted testing to verify. The tests indicated that the numerical representations we identified to characterize the relationship between variables are likely accurate. This is advantageous since it indicates that the numerical representations of the link between the regressors and the result are consistent. The regressors remain significant as they facilitate our comprehension of the outcome.

4 Results and Discussion

Prior to examining the correlation between technology and economic development, it is essential to select a model that will facilitate our understanding of this relationship. We possess two alternatives: the Fixed Effects model and the Random Effects model. These two models are frequently employed for this category of research.

We aim to select the option that is most effective for the study of technology and economic development.

We opted to employ the Fixed Effects model for our analysis. We conducted tests to determine which model would be more appropriate. The Fixed Effects model is selected as it analyzes each country individually and considers the distinct characteristics of each nation. We employed the Hausman test to evaluate the Fixed Effects model against the Random Effects model. The test results indicated that the Fixed Effects model is appropriate. This is logical due to the significant differences among the countries under examination. The Fixed Effects model is more adept at managing these discrepancies than the Random Effects model.

We employed the Fixed Effects model. Subsequently, a panel regression analysis was conducted. This analysis yielded the subsequent results:

Table 2. Fixed Effects Model

Variable	Coefficient	Standard Error	t-value	p-value	Significance
Intercept (β_0)	-3.23	0.84	-20.569	0.000	***
DAI	0.50	0.040	11.351	0.000	***
ICT	0.45	0.043	7.992	0.040	**
Expenditure (% of GDP)	0.37	0.071	7.677	0.030	***
Business Index	0.37	0.071	7.677	0.030	***
GNI per Capita	0.25	0.057	9.736	0.002	***

Results*** at 1% significance level, ** at 5% significance level, * at 10% significance level

Source: created by the authors

Table 2 shows us what we found out from the Fixed Effects model. This table gives us evidence of how digital technology adoption, institutional quality, income levels, and economic development are connected in the developing countries we chose. Our results show that digital technology adoption and institutional quality have an impact on long-term economic growth. Digital technology adoption and institutional quality are crucial for development in these developing countries.

The Digital Adoption Index (DAI) is very important because it shows that using technology is a key factor in economic growth. This makes sense when you look at the Theory of Technological Diffusion. The Digital Adoption Index (DAI) is key here. The Theory of Technological Diffusion says that when people start using technology, it helps them be more productive, come up with new ideas, and change how things are done in different areas of

the economy. The Digital Adoption Index (DAI) shows how digital technology can help the economy, [20]. The estimated coefficient of 0.50 indicates that digital adoption significantly stimulates activity, which is in line with previous research.

There is a connection between Information and Communication Technology (ICT) spending and the economy. When we look at how much a country spends on ICT compared to its economy, it shows that keeping up with investments is important for economic growth, [21]. When we spend more on ICT, it helps our economy in various ways. It makes things more efficient, helps us come up with ideas, and makes us more competitive. This is why investing in infrastructure is so important for countries that are still growing.

The Ease of Doing Business Index shows that it is really good for the economy when it is easy to do business. This means that if a country has rules and makes it easy for people to start a business, then digital technology can really help the economy grow. This is what the Regulatory Efficiency Theory says. It says that when rules are simple, it costs less to start a business, and it is easier for people to begin. This helps people start businesses, invest money, and come up with ideas. The Ease of Doing Business Index is important because it helps countries see how they can make it easier for people to do business. When a country makes it easy to do business, companies can use technology to make money and create jobs.

There is a connection between the money a country has and how well its economy does. This shows that the amount of money people have is important for economic growth. The availability of financial resources within a nation enables increased investment, consistent with the premise that higher income levels stimulate economic growth. Countries possessing such capital can allocate funds towards infrastructure development, technological innovation, and other sectors conducive to national progress, [22].

This creates a cycle between using technology and economic growth. The money a country has, or GNI per capita, is important for development.

We did a check to make sure the Fixed Effects estimates are good and reliable. We looked at the leftovers from the regression using plots and tests to see if they are normally distributed. The Fixed Effects estimates showed a distribution around zero, which means the Fixed Effects estimates do not have any errors.

We saw some differences from what's normally expected, but these differences do not affect the

consistency of the coefficients because of the way panel estimators work when looking at a lot of data. We checked for heteroscedasticity using a test called the modified Wald test in the Fixed Effects framework. The test showed that there is heteroscedasticity between countries, which is something that often happens when you are looking at economic data from many different countries with different economies.

So we used errors that take into account this heteroscedasticity. The Digital Adoption Index (DAI) is still very important after we made some changes. The same is true for Information and Communication Technology (ICT) spending. We also looked at the Ease of Doing Business Index and the Gross National Income (GNI) per person. All of these things are still significant. Make sense economically. This means that our main ideas about the Digital Adoption Index and other things like ICT spending are strong and not affected by mistakes in our data or problems with our models.

To make things clearer, Table 2 was updated to show the units of measurement for all the variables that help explain things. The Digital Adoption Index coefficient that was calculated should be understood in a way: if the Digital Adoption Index goes up by one unit and this index is measured on a scale from 0 to 1, then the GDP per capita will go up by about 50 percent, assuming everything else stays the same. This change is similar to what other studies have found about how digital adoption affects the economy in developing countries. The Digital Adoption Index is a factor here, and the change in the Digital Adoption Index has a big impact on the economy.

The Digital Adoption Index that we used for this study comes from the World Bank's report, [23]. We also got some updated information from the World Development Indicators database.

The Digital Adoption Index measures how much people and organizations are using technology in three main areas: businesses, individuals, and the government. It uses a method that makes it easy to compare results from countries.

We want to be clear about where the Digital Adoption Index comes from and how it was made. This way, we can be transparent. Others can repeat our study and compare their results to ours using the Digital Adoption Index.

5 Conclusion

This study looked at how digital technology affects the economy in countries. We wanted to see what happens when digital technology is used in these

countries. We looked at our ideas, read what other people have written about this, and used methods to check our thoughts. We had some questions that we wanted to answer. We wanted to make sure our ideas were correct. We were studying technology and economic development in underdeveloped nations to learn more about digital technology and economic development.

Our findings show that digital technology has an impact on how the economy performs. The numbers from the Digital Adoption Index (DAI) back up what we thought was true. This means that when people use technology, it helps the economy in big ways. It makes businesses work better and come up with ideas. Digital technology is important for progress. The Digital Adoption Index (DAI) proves that digital technology helps businesses do things in a way.

The investigation also looked at how digital technology affects the economy. It was found that using technology, which is measured by the DAI, has a big and positive effect on the amount of money people have in a country. This means that our second idea was right and that digital technology really helps the economy in countries that are still growing. Digital technology helps development in developing countries. The use of technology has a positive impact on the economy, and this is especially true for digital technology in developing countries.

Our findings also substantiate the third hypothesis. This indicates a positive correlation between the ease of conducting business and the financial capacity of economic agents. Given the prevailing economic prosperity, these factors exhibit significant interconnectedness. Consequently, in an environment characterized by business facilitation and substantial financial resources, digital technology can significantly catalyze economic expansion. The confluence of business facilitation and high financial capacity represents a critical determinant of socioeconomic progress, with digital technology capable of amplifying its developmental impact.

Digital technology is really important for helping the economy grow in countries that are still developing. It makes a difference when a country has an environment for businesses to operate in and when people have more money to spend. We thought this would be the case, and our study shows that it is true. So it is very important that governments make policies that help people use technology and make it easy for businesses to work. This is key to using technology to help the economy grow in a way that is good for everyone. People

who study the economy and business leaders should think about these ideas when they are making plans to use technology to help the economy. Digital technology can do a lot of good for development.

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