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Analysis of the impact of digital development on a country's economic growth

Abstract. Examining the impact of digital technologies on advanced economies is crucial. The COVID-19 pandemic underscores their role in economic stability, emphasising the need to assess digitization's relationship with economic growth using regression models, which was the aim of this study. Analytical and inductive methods were utilised to determine the basic set of digitalization indicators. Through expert evaluation, a basis of five key indicators was formed: internet coverage level, level of financial activity online, level of digital skills development among the population, degree of integration of digital technologies into government processes, and volume of online purchases. To isolate the most influential factors, an experimental approach involving the construction of a linear regression model and the partial use of data augmentation statistical methods based on autoregression was employed. The results indicate that the most significant factor is the level of financial activity online. However, negative effects are observed in certain aspects

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of digitalization, such as online purchases, which require further analysis. The inclusion of state factors in the model proved to be crucial for accurately assessing the impact of digitalization on the economy. This underscores the need for further research in this area to gain a deeper understanding of the mechanisms by which digital technologies influence economic development and to develop development strategies. The overall results confirm theoretical concepts regarding the positive correlation between digitalization and economic development but also indicate the need for refinement and additional research into the specific mechanisms of this impact. This opens the way for further detailed evaluation of potential sub-indicators of this metric and a comprehensive understanding of the relationship between digitalization and the economy. In the public sector, these data can serve as a practical basis for policy adjustments related to the implementation of new technologies aimed at improving the economic situation

Keywords: transformation; digital economy; digitization; macroeconomic indicators; coefficient of determination

INTRODUCTION

Digitization is one of the key drivers of the global economy, necessitating a thorough analysis of its impact on the economic growth of nations. Digital development contributes to increased labour productivity through process automation and resource management optimisation. Digital technologies enable enterprises to reduce costs and enhance efficiency, thereby positively impacting the economic growth of the country. The integration of digital technologies into education and scientific activities opens up new opportunities for human capital development. With access to global information and resources, educational institutions can enhance the skills of their workforce, which is a fundamental factor in supporting sustainable economic growth. Digitization opens up new avenues for countries to engage in international trade and the global market. E-commerce, digital payment systems, and digital logistics significantly streamline international operations, providing faster and more efficient service to customers from around the world. It can be noted that digital development also contributes to the democratisation of the economy by providing broader access to market opportunities for small and medium-sized businesses. This stimulates innovative activity, entrepreneurial initiative, and competition, which are important for healthy economic development.

The process of digitization and its impact on economic development has been the subject of numerous academic works by foreign and Ukrainian scholars. L. Török (2024), in his article, explored the relationship between digital development and economic growth in European Union member states. The study confirmed a positive impact of digital development on the gross domestic product (GDP) of EU member countries. However, it was noted that this correlation did not apply to the year 2020 due to the influence of the COVID-19 pandemic. The research also revealed that more digitally advanced countries experienced a more dynamic development in digitization and GDP compared to less developed EU member states, indicating an increase in the gap between them. A.A. Oloyede *et al*. (2023) conducted research on defining and measuring the impact of the digital economy on the development of countries, utilising a systematic literature review and the PRISMA model. The results indicated that the lack of awareness of relevant datasets and the diversity of country-specific definitions complicated the harmonisation of concepts and metrics in the digital economy. It was suggested to create a tool that would facilitate comprehensive measurement, aiding in accurately determining the contribution of the digital economy to the GDP of developing countries. J. Zhang *et al*. (2022b) researched the impact of the digital economy on the development of countries along the "belt and road" and the consequences of the COVID-19 pandemic on their digital sectors. The results demonstrated a positive influence of the digital economy on economic development, as well as an increased demand for digital industries during the pandemic, particularly in Armenia, Israel, Latvia, and Estonia. The proposed recommendations include the necessity of infrastructure development, creating a favourable environment for the growth of digital enterprises, and expanding cooperation in digital trade.

S. Gomes *et al*. (2022) investigated the impact of the digital economy on the development of OECD countries, categorising them into groups based on their level of development. The results indicated that information and communication technology (ICT) positively influences the economic development of OECD countries, but the impact varies depending on the country's level of development. The authors also proposed recommendations for policymakers to reduce the digital divide and promote the development of the digital economy. I. Tiutiunyk *et al*. (2021) examined the role of digital transformation in achieving competitive advantages in the economy and identified a correlation between the level of macroeconomic stability and the digital transformation index for most EU countries. The obtained results demonstrated a bidirectional cause-and-effect relationship between the digital transformation of the economy and indicators of its macroeconomic stability. For further research, the importance of determining the intensity and nature of the relationship between the level of business competitive advantages and the digital transformation index was identified. A.I. Magoutas *et al*. (2024) investigated the relationship between the economic growth of the European Union and rapid advancements in ICT, using data from three global sources. The results demonstrated a positive correlation between ICT development and the GDP index, while also highlighting the crucial role of new artificial intelligence technologies in the business sector. The study underscores the necessity of enhancing human capital and accelerating the growth of e-government technologies to support the economic resilience of European countries.

Taking the above into account, researching the impact of digital development on a country's economic growth is extremely relevant and important for shaping digital transformation strategies at the national level, ensuring sustainable development, and improving the standard of living for the population. This article aimed to investigate the impact of digitization on the economic development of countries and enterprises and to identify key factors determining this impact. Specifically, the goal was to analyse the coefficients of linear regression for countries with developed economies and technologies. To achieve the stated objective, the following tasks were set: to conduct an analysis of the coefficients of linear regression for a range of countries and determine their impact on economic development; to identify the key factors of digitization that have the greatest influence on GDP and other economic indicators.

MATERIALS AND METHODS

It was decided to utilise a family of regression models for further investigation. Their relative simplicity, while limiting the applicability of results for forecasting economic trends, allows for comparing the extent to which the target indicators are influential. At the same time, the selection of appropriate regularisation and normalisation algorithms prevented the obtaining of unbalanced coefficients, which might have arisen due to different measurement scales of digitization indicators. The first step in building the model was data selection. To identify the factors that best describe the digitization process, it was decided to conduct expert assessments among 200 IT specialists, smart city project managers, and innovation implementation managers from Kharkiv, Kyiv, Lviv, Vienna, Lisbon, Prague, and Krakow in 2024. All participants were informed about the aim and task of the study, which were stated in the appropriate form. At the same time, all ethical standards for working with respondents provided for by the Declaration of Helsinki (2013) were fulfilled. The essence of the survey was to provide each respondent with a list of 10 factors, the data on which is provided by Eurostat (digital economy and society) (Database, n.d.).

The survey was conducted using Google Forms, where the user could choose the 5 most important factors. After that, the number of important points was calculated for each of the factors. The five factors with the highest number of points (total points count equal 1,000) later served as the basis for the model. In addition, the condition was considered: with an equal number of points, all relevant options are taken. The survey factors are as follows: internet coverage level; level of financial activity online; level of digital skills development among the population; degree of integration of digital technologies into government processes; volume of online purchases; level of use of the internet of things; usage of information technologies at work; usage of information technologies in the enterprise; trust level to new devices; demand level on information technology specialists. The following description of the method is based on the results of an expert survey.

After processing the experts' responses, the 5 most influential factors were determined: internet coverage level (IC); level of financial activity online (FA); level of digital skills development among the population (DS); degree of integration of digital technologies into government processes (IIP); volume of online purchases (IP). In addition to these core indicators, it was decided to consider the influence of the information environment (IE) and the state (G) as a whole. The latter indicator was intended to show to what extent the regression would depend on the selected countries and serve as a "benchmark indicator", allowing for the determination of the real influence of the selected factors. On the other hand, the information environment was a synthetic indicator that entered the model as a weighted sampling coefficient. In contrast to the previous ones, IE was formed based on the frequency analysis of the 50 most popular news articles for each year within the selected timeframe in the target countries.

The general algorithm for transforming textual information was as follows: retrieving data from the most influential sources (e.g., BBC, Euronews, etc.); cleaning the texts from elements that do not carry linguistic load; extracting main components, followed by stemming and lemmatization operations (these steps are permissible, as the language of the selected news is English, which is not polymorphic); calculating the frequency indicator (VM25) and the polarity indicator; determining the emotional tone of the text and aggregating the data; normalising the obtained results within the range of 0 to 1. The next step in model formation involves choosing the data regularisation algorithm. Considering that one of the target indicators (specifically G) is categorical, the best choice would be the group LASSO algorithm. This was because for linear regression to work with categories, they needed to be transformed into a set of Boolean values. The formation of a group of related variables necessitates their group processing. In this case, the general formula for linear regression with the selected regularisation algorithm can be presented as follows:

$$arg\,\frac{1}{n}\min_{\beta_g\in\mathbb{R}^{d_g}} ||\textstyle\sum_{g\in K}[\boldsymbol{X}_g\beta_g]-\boldsymbol{y}||_2^2+\lambda_1||\beta||_1+ \\ +\lambda_2\textstyle\sum_{g\in K}\sqrt{d_g}||\beta_g||_2, \quad (1)$$

where $X_g \in \mathbb{R}^{n\times d_g}$ – the matrix corresponding to the values of target indicators g; β_g – the regression coefficients; $\mathbf{y}\in\mathbb{R}^n$ – the target regression function; n – the number of observations; d_g – the dimensionality of the target indicator group; λ_1 – the regularisation parameter at the indicator level; λ_2 – the regularisation parameter for indicator groups; K – the set of indicator groups. It is worth noting that in the formula above, the L2 norm is not quadratic. As a result, the regularizer has a "kink" at the zero level, causing uninformative groups of target indicators to have regression coefficients equal to zero. Another step was the standardisation and enrichment of the input data. The selected indicators were available for the period from 2010 to 2023 in annual format. However, this volume of data was insufficient to create a high-quality model. To address this issue, data augmentation operations, or synthetic expansion, were performed. The vector autoregression moving average algorithm was utilised for this purpose. This choice was made to smooth out fluctuations in target indicators and due to the proven overall effectiveness of the approach (Yakovlev *et al.*, 2023). Formally, it can be presented as follows:

$$\Phi_0 y_t = \Phi_1 y_{t-1} + \ldots + \Phi_p y_{t-p} + \Theta_0 u_t + \Theta_1 u_{t-1} + \ldots + \Theta_q u_{t-q}, \quad (2)$$

where y_t – N-dimensional time series; Φ_i,Θ_i – non-degenerate coefficient matrices of autoregression with dimensions $N\times N$, $i=\overline{1,p}$, $j=\overline{1,q}$; u_t – N-dimensional white noise vector; p – number of target factors; q – number of external influence factors. It was worth noting that since the coefficient matrices were non-degenerate, they could be easily normalised within the range of 0 to 1. The model could be used to examine short-term periods, provided there was no significant external influence. Since this study focused on the medium-term perspective for augmentation (one month), it was necessary to find the delta between the given formula and the forecast for the previous period. Therefore, the following formula was presented:

$$\Phi_0 \Delta y_t = \prod y_{t-1} + \ldots + \Psi_p y_{t-p+1} + \Theta_0 u_t + \Theta_1 u_{t-1} + \ldots + \Theta_q u_{t-q}, \quad (3)$$

where $\prod = -(\Phi_0 - \Phi_1 - \ldots - \Phi_p)$; $\Psi_i = -(\Phi_{i+1} + \ldots + \Phi_p)$; $i = \overline{1, p}$, $j = \overline{1, q}$. The obtained coefficient matrices, given the total number of unknowns to be considered during generation, might have varied. As for standardisation, it was decided to use the classical method of data normalisation, which could be presented in the following form:

$$X_n = \frac{X - \mu_X}{\sigma_X}, \quad (4)$$

where X – the original vector of target variable values; X_n – the normalised value of the target variable; μ_X – the mathematical expectation of variable X; σ_X – the standard deviation of variable X. The target countries for model formation were chosen to be those with developed economies and technologies, following consultation with the aforementioned experts. The selected countries were Denmark, Germany, the Netherlands, Sweden, and Finland. The proposed model was implemented using the Python 3 programming language with relevant libraries for scientific research, including polars, celer, scikit-learn, nltk, etc. The importance of factors was determined by a simple comparison of denormalized coefficients of linear regression, with GDP per capita considered as the target variable.

RESULTS

The general distribution of survey results is as follows: internet coverage level – 200 points; level of financial activity online – 200 points; level of digital skills development among the population – 180 points; degree of integration of digital technologies into government processes – 155 points; volume of online purchases – 100 points; level of use internet of things – 65 points; usage of information technologies at work – 60; usage of information technologies in the enterprise – 30 points; trust level to new devices – 10 points; demand level on information technology specialists – 0 points. The results for each country were examined individually. Specifically, for Denmark, the following set of coefficients was observed (Table 1).

Table 1. Coefficient values for Denmark

Indicator	Coefficient	R^2
IP	0.207171	0.613561
FA	0.672529	0.613561
DS	0.103562	0.613561
IIP	–0.183898	0.613561
IC	0.004964	0.613561

Source: developed by the authors

The most influential factor was the financial activity indicator, which logically had a direct impact on the multiplier of consumer spending and, consequently, on GDP per capita. At the same time, it was noticed that the integration of digital technologies had a negative coefficient. Within this context, it was worthwhile to consider several hypotheses: calculation error resulting from the imperfection of the augmentation algorithm, and consequently, insufficient reliable data for model construction; multicollinearity – internal correlation between indicators, which biassed the coefficient values, making them erroneous; implementation of digitization at the foundational stages increased the unemployment rate, which in turn affected the purchasing power of the population, and therefore, the target GDP indicator.

Verification of the mentioned hypotheses required further research and a larger amount of original data, which would allow for mitigating the short-term negative impact of digitization. It was also worth paying attention to the coefficient of determination; overall, its value was acceptable for conducting comparative analysis. The next country chosen for examination was Germany. Below are the coefficient values for Germany (Table 2).

Table 2. Coefficient values for Germany

Indicator	Coefficient	R^2
IP	0.198209	0.876453
FA	1.167393	0.876453
DS	0.091381	0.876453
IIP	–0.055128	0.876453
IC	–0.156201	0.876453

Source: developed by the authors

The obtained results revealed a similar situation for Germany as observed for Denmark. However, the coefficient of determination is significantly higher for Germany, indicating that the model better captured the relationship in this country. A significant exception compared to the previous case was the negative coefficient for the level of internet purchases. To explain this, the following hypotheses were highlighted: a calculation issue, as in the case of the negative IP; a short-term crisis related to the inability of businesses to quickly transition to digital platforms and open up opportunities for international purchases (both within the EU and beyond its borders). For the Netherlands, the situation was similar both in terms of the determination coefficient and the signs of the coefficients (Table 3).

Table 3. Coefficient values for the Netherlands

Indicator	Coefficient	R^2
IP	0.040353	0.852356
FA	0.128875	0.852356
DS	0.443139	0.852356
IIP	−0.120588	0.852356
IC	−0.307203	0.852356

Source: developed by the authors

A notable difference was that the FA indicator was not the most influential; however, the difference between other coefficients was not significant, so this could be disregarded. In the case of Finland (Table 4), a negative impact of financial activity was observed; however, considering the accuracy of this model (based on R^2) – this could be a data error or explained by a general transformational process. The fact is that, compared to other selected countries, Finland was the least developed in the digital sphere for a long time (until 2020).

Table 4. Coefficient values for Finland

Indicator	Coefficient	R^2
IP	0.015163	0.681786
FA	−0.318534	0.681786
DS	0.32096	0.681786
IIP	−0.217509	0.681786
IC	−0.028013	0.681786

Source: developed by the authors

The final country under consideration was Sweden (Table 5). It had the highest coefficient of determination, which might have indicated model overfitting. However, the overall values obtained were consistent with the conclusions mentioned above. As an additional verification step, a general model was created for all countries, considering the factor of the country without its influence. For the second case, the following coefficients were presented (Table 6).

Table 5. Coefficient values for Sweden

Indicator	Coefficient	R^2
IP	0.208919	0.969962
FA	0.305002	0.969962
DS	0.007243	0.969962
IIP	−0.113182	0.969962
IC	−0.218243	0.969962

Source: developed by the authors

Table 6. General coefficient values without considering the influence of the country

Indicator	Coefficient	R^2
IP	0.053698	0.47955
FA	0.179769	0.47955
DS	0.288621	0.47955
IIP	−0.3723	0.47955
IC	0.219011	0.47955

Source: developed by the authors

Although the obtained values overall correspond to the hypotheses presented, the coefficient of determination indicates a significant problem in describing the dependencies. This can be explained by including country-specific factors in the model (Fig. 1). It was evident that the country factor is the most influential in terms of GDP per capita. The conclusion obtained generally corresponds to modern principles of macroeconomic theory, which consider the selected target indicator as one that can be influenced by numerous other indicators.

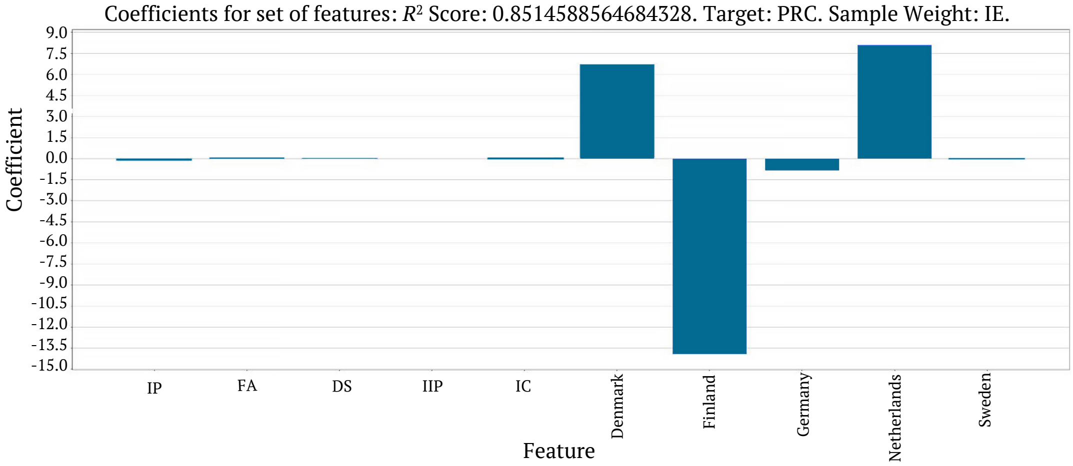

Figure 1. Overall coefficient values taking into account the influence of the country
Source: developed by the authors

In other words, when examining the relationship between digitization and economic growth, inter-country analysis requires additional adjustments, which can be expressed either by using other independent variables or by a certain data transformation algorithm. This, in turn, goes beyond the scope of the current work, thereby opening up possible avenues for further research. Thus, it can be concluded that the overall impact of digitization on the economy is positive for the country. At the same time, the most significant factors are those directly related to the consumption process, both at the individual and business levels. It is also worth mentioning the simplification of bureaucratic procedures, which are difficult to reflect using indicators but undoubtedly help reduce the costs of companies, both real and alternative.

The accuracy of the model is enhanced by the country's component, demonstrating the complexity of the interactions between the economy and digitalization. Due to its complexity, more research is required to fully understand how each digitalization aspect affects the economic development of different nations and businesses. For a precise assessment of the effects of digitalization on the economy, state elements had to be included in the model. This emphasises the necessity of developing development strategies and gaining a greater grasp of the ways in which digital technologies affect economic development. The findings support the theoretical notion that digitization and economic progress are positively correlated, but they also highlight the need for further investigation and improvement into the precise mechanisms underlying these effects. This creates opportunities for more in-depth analysis of possible metric sub-indicators as well as a thorough comprehension of the connection between the economy and digitalization.

DISCUSSION

The issue of the impact of digitalization on economic development has been repeatedly raised in both European and global practices. However, the target methods have varied, encompassing purely mathematical or econometric approaches as well as more general methods aimed at utilising comparative analysis. An example of the latter can be seen in the work of G. Myovella *et al.* (2020), dedicated to studying the dynamics of economic development and digitalization in African countries. Similar to the current research, it confirmed a significant correlation and partial dependence between indicators of technological progress and the growth of key macroeconomic indicators. Despite the descriptive nature of the presentation, such studies provide a deeper understanding of the selected indicators and have formed the basis for a set of metrics provided to the expert group during the current study.

Regarding the econometric approach, it is worth mentioning the work of Chinese scientists W. Zhang *et al.* (2021) from Chongqing University of Posts and Telecommunications dedicated to applying the Cobb-Douglas function to verify the impact of digital technology implementation on production efficiency and, consequently, economic development. In comparison with the current research, it should be noted that the set of factors considered is similar to the one chosen above. Specifically, the levels of financial activity and internet penetration are also examined. However, that study evaluates the overall impact of technological development rather than identifying what specifically holds the most significance for a country's economy. A linear model was constructed by a group of scientists from Nanjing C. Ding *et al.* (2022) with a similar purpose. Its feature is its generally conditional nature, allowing a connection between economic growth and digitalization. However, due to the construction specifics, the equation derived by the scientists is oriented towards the market conditions in China, and for European realities, it provides less accurate results (indicated by a higher aggregated value of the root mean square error).

Regarding the European scientific community, it is worth mentioning the work of a team of Spanish researchers, A. Fernández-Portillo *et al.* (2020), who, unlike their Asian counterparts, examined in more detail the impact of individual factors on information technology development. Although the results can be considered similar to those obtained using the described and constructed model above, this study employed a simpler least squares method. Similar indicator importance values were obtained by R.P. Pradhan *et al.* (2020) during an international study dedicated to the use of a vector error correction model. Similar in nature to the described approach is the use of autoregressive models, which have been applied for data augmentation. However, based on existing research by A. Khovrat *et al*. (2022), it is important to note that such algorithms require substantial volumes of information to generate accurate forecasts and, consequently, coefficients of influence for various indicators. Additionally, external influence indicators must be considered, necessitating further research, such as involving a separate expert group, similar to the one convened to determine the target indicators in the current study.

It is important to note that the computational approaches described above are relatively simple and do not require additional hardware capabilities for analysis. This simplicity allows for rapid retraining of the algorithm but may result in inaccurate outcomes. A potential solution is the use of artificial neural networks, as demonstrated by researchers I. Petkovski *et al*. (2022), or deep networks, as shown in the work of C. Cheng & H. Huang (2022). These approaches are significantly more sensitive to data compared to linear regression and require substantial volumes of information, as evidenced by the research conducted by A.B. Çolak (2021). Based on this, it can be concluded that neural networks cannot be applied to the selected indicators with quarterly reporting. However, their overall effectiveness requires further verification using a different set of target indicators.

Another group of algorithms used to determine the impact of digitalization on economic development is the family of probabilistic models, such as Markov or Bayesian networks. Although computationally similar to regression models, their overall effectiveness depends on the quality of the network construction. This also requires larger volumes of real empirical data, a problem noted by several groups of scientists from various parts of the world (Li & Qiao, 2022; Zatonatska *et al*., 2022). Another significant drawback is the general complexity of the model, which is difficult to interpret and requires more time for data processing. In the context of the current work, the latter factor is not significant, but it may become more important if these approaches are implemented in information systems.

The results obtained above confirm the existence of causal relationships between the indicators but do not determine their nature or essence. Various aspects of this issue have already been repeatedly raised in the European and global communities. Notably, studies have focused on the impact of digitalization on poverty (Kwilinski *et al*., 2020) and the energy sector (Zhang *et al*., 2022a), highlighting its mediating role in relation to economic development. Equally important are studies on the social impact of digitalization. For instance, research by scientists from Beijing X. Zhang *et al*. (2020) on the development of inclusivity, and Romanian and Spanish researchers F.-D. Tănase *et al*. (2022) and M. Núñez-Canal *et al*. (2022) who examined the impact on the education sector during the COVID-19 pandemic. Despite the specific focus, these studies emphasised the subsequent effects of targeted changes on the economy.

Considering all the above, it can be concluded that the conducted research and its results are fully consistent with the achievements of the global scientific community. Additionally, it complements these achievements in the context of limited data volumes and computational resources. The obtained research results also confirm the influence of digitization on the economic development of the country, as in the studies conducted by other researchers. However, the proposed approach allows assessing the significance of the impact of each of the considered factors, enabling the formation of a list of the most influential factors. Such an approach will further allow considering factors not only at the country level but also identifying the most influential digitization factors at the level of enterprise economic development.

CONCLUSIONS

Based on the provided information, several important conclusions can be drawn regarding the impact of digitalization on economic development. The analysis of linear regression coefficients for countries such as Denmark, Germany, the Netherlands, Finland, and Sweden demonstrates that digital technologies exert a significant influence on the economy. Specifically, financial activity emerges as one of the most influential factors, directly affecting consumer spending and, consequently, GDP per capita. However, the negative impacts of certain aspects of digitalization, such as the level of internet purchases, have also been identified. These results indicate the need for further research and increased availability of data for a more accurate model. Additionally, the analysis of coefficients for the overall model, without considering the influence of the country factor, confirms the significant impact of digitalization on economic development.

However, including the country factor significantly improves the model's accuracy, which indicates the complexity of the relationships between digitalization and the economy. This complexity underscores the necessity for further research aimed at examining the impact of each digitalization factor on the economic development of individual countries and enterprises. Such an approach will not only deepen understanding of the mechanisms of digital technology influence but also provide specific recommendations for management decisions and development strategies. Moreover, it is crucial to highlight that including country factors in the model is essential for reflecting the complexity of the relationships between digitalization and economic development. This approach opens up new opportunities for research and analysis, enabling a more nuanced understanding of how different elements of digitalization interact with economic variables in diverse national contexts.

In conclusion, the findings of this analysis emphasise the importance of continued investigation into the specific effects of digitalization on economic growth. Policymakers and business leaders can leverage these insights to formulate more effective strategies that harness the benefits of digital technologies while mitigating potential downsides. The incorporation of comprehensive data and sophisticated modelling techniques will be pivotal in advancing this field of study, ensuring that future research can offer actionable insights tailored to the unique circumstances of each country.

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CONFLICT OF INTEREST

None.

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Аналіз впливу цифрового розвитку на економічне зростання країни

Анотація. Вивчення впливу цифрових технологій на розвинені економіки має вирішальне значення. Пандемія COVID-19 підкреслює їх роль у економічній стабільності, що акцентує необхідність оцінки взаємозв'язку між цифровізацією та економічним зростанням за допомогою регресійних моделей, що і було метою цього дослідження. Використано аналітичний та індуктивний методи для визначення базового набору індикаторів цифровізації. Серед них за допомогою експертного оцінювання сформовано базис із п'яти ключових показників: рівень охоплення інтернетом; рівень фінансової активності в інтернеті; рівень розвитку цифрових навичок серед населення; ступінь інтеграції цифрових технологій у державні процеси; обсяг онлайн-покупок. Задля виокремлення найбільш впливових факторів було вирішено задіяти експериментальний підхід із побудовою моделі лінійної регресії та частковим залученням статистичних методів аугментації даних, що ґрунтуються на авторегресії. Отримані результати вказують на те, що найбільш значним є рівень фінансової активності онлайн. Однак у певних аспектах цифровізації, таких як онлайн-покупки, спостерігаються негативні наслідки, що потребують подальшого аналізу. Включення державних факторів у модель виявилося вирішальним для точного оцінювання впливу цифровізації на економіку. Це підкреслює необхідність додаткових досліджень у цій сфері для глибшого розуміння механізмів, за допомогою яких цифрові технології впливають на економічний розвиток, і для розробки відповідних стратегій розвитку. Загальні результати підтверджують теоретичні концепції щодо позитивної кореляції між цифровізацією та економічним розвитком, але також вказують на потребу в уточненні та додаткових дослідженнях конкретних механізмів цього впливу. Це відкриває шлях до подальшого детального оцінювання можливих підпоказників цього індикатора і загального розуміння взаємозв'язку між цифровізацією та економікою. У випадку державного сектору ці дані можуть слугувати практичною основою для корекції політики щодо впровадження нових технологій орієнтованих на поліпшення економічного становищах

Ключові слова: трансформація; цифрова економіка; цифровізація; макроекономічні показники; коефіцієнт детермінації