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MACROECONOMIC DIMENSION OF INFORMATION TECHNOLOGY MARKET DEVELOPMENT

ABSTRACT

Information technologies play a crucial role in the modern economic system, acting as a driver for the development of the state. Information technologies are not only one of the most important factors stimulating economic growth but also contribute to the development of society, employment stimulation, and competition enhancement. The information technology market generates a significant portion of the GDP and export revenues. The analysis of the formation and development of the domestic information technology market is a key factor in understanding its importance in shaping the prospects of Ukraine as a digital state. The study analyses the dynamics of the development of the national information technology market, providing a comparative analysis of indicators between the Ukrainian market and several other countries.

The article aims to analyse the macroeconomic impact of the information technology market on the development of the national economy, investigating correlation relationships between the rates of economic growth and various indicators both in Ukraine and in EU countries.

The article explores the directions of the influence of the national information technology market on the dynamics of economic growth. Based on the conducted analysis, conclusions are drawn about the existence of a direct correlation between the growth of information technology export and GDP growth both in Ukraine and in European Union countries. The correlation between the increase in GDP and the growth of other important indicators in the information technology market, including the number of specialists and investments in scientific research, is analysed. Statistical methods reveal a relatively strong connection between the growth rates of investments in scientific research in the field of information technology and the GDP growth rate. At the same time, the correlation between the growth of the workforce in the information technology market and GDP is somewhat weaker.

Keywords: information technologies (IT), information technology market, national economy, export, gross domestic product, economic growth

JEL Classification: C10, E01, L86, O10

INTRODUCTION

The heightened uncertainty resulting from a full-scale war has paradoxically accelerated the growth of the information technology (IT) market in Ukraine. Despite facing new challenges, the market has attained a prominent position within the domestic economy. The war experience in Ukraine has also presented unique opportunities for reevaluating the role of information technology in the post-war development of the country.

The national progress of the market's technological potential exceeds that of several developed countries. This underscores the significance and prospects of the modern information technology market for the Ukrainian economy, emphasizing its pivotal role in contributing to the state budget, augmenting added value, and generating employment.

It is noteworthy that the Ukrainian information technology market has exhibited a steady and remarkable growth rate over the last few decades, averaging approximately

25-30% annually, and currently the market has become the country's second-largest export industry after agriculture. The market's share in the country's GDP structure was more than 4% in 2021 and has become even bigger in wartime. Moreover, the workforce of IT specialists has nearly tripled in size since 2013. Meanwhile, capital expenditure in software development and databases, integral components of the information technology market, witnessed a robust increase, rising from USD 436 million in 2013 to nearly USD 610 million in 2021.

In addition to the abovementioned key facts, the Government of Ukraine in cooperation with corresponding ministries and Ukrainian businesses, associations and experts have already set working groups to discuss and develop specific and comprehensive measures for the development of the key sector of the national economy, including information technology market, under EU's Ukraine Facility programme and governmental strategic plans.

Thus, it's crucial to undertake an analysis to understand the impact of the information technology market on the Ukrainian economy based on real data, finding their correlation and interconnection.

LITERATURE REVIEW

Recent studies on the information technology market and its development have experienced a surge in the last few years. This can be attributed primarily to the growing importance of the market in the context of ongoing global digitization and the widespread diffusion of technology. Additionally, the rising share of the information technology market in the global GDP structure, its impact on global trade relationships, and its direct influence on economic productivity have further fueled the interest in exploring and understanding its dynamics.

D. Krylov (2022) emphasizes in his article the significant role of the information technology market, asserting that its importance extends beyond the development of the national economy and effective growth. Krylov underscores that IT permeates all sectors of the economy, serving as a catalyst for innovation and opening new opportunities for both economic and societal advancement.

Y. Erfan and A. Kushnirchuk (2020) investigated the pivotal role of information technology in international business. Their findings highlight how information technology contributes to enhancing productivity and promoting informed decision-making, ultimately rendering enterprises more competitive in the global marketplace. At the same time, O. Osiyevskyy et al (2023) explored the role of information technology in the new paradigm of entrepreneurship, considering it a vital component of the business ecosystem that ensures high labour productivity and a high level of consumer satisfaction.

K. Nikolaiets et al (2023) examined how the rapid development of the information technology market has prompted a reformatting of the labour market, leading to the emergence of remote work. Simultaneously, this transformation has created the phenomenon of virtual labour migration, opening new opportunities for the national economy.

The transformations occurring in the era of digitisation were analysed by Y. Shestack et al (2023), who specifically identified the latest trends in the impact of information technology on societal development shaping consumer behaviour and new business models in business management. Meanwhile, H. Umantsiv et al (2023), investigated that information technology development could impact business even further through new approaches to intangible assets valuation, including software.

Other Ukrainian researchers, T. Melnyk and E. Zavorodnya (2023) explored the key competitive advantages of the national information technology market in comparison with the global market and outlined the significance of human potential, namely its experience and motivation that played a crucial part in overall growth of the market's export.

L. Tkachyk et al (2023) conducted a comprehensive analysis in their paper, examining the information technology market's trends, delving into both its strengths and weaknesses, and offering insights into its dynamics. Furthermore, the researchers employed a three-case scenario approach to forecast potential market exports from 2023 to 2025, providing a forward-looking perspective on the development of the Ukrainian information technology market.

In the foreign academic literature, the discourse on the role of technology in fostering productivity and economic growth can be traced back to at least the neoclassical growth theory (R. Solow 1956), who pointed out the significance of the technological impact on the U.S. national economy throughout the observed period of 1909-1949. In the following years, the discernible impact of information and communication technologies (ICT) on propelling economic activity and reshaping knowledge-based economies has gained prominence (P. Romer, 1990; R. L. Katz, 2009).

Several empirical and theoretical studies have already confirmed the contribution of IT development to a country's economic growth. For instance, In the research conducted by A. Fernandez-Portillo, M. Almodovar-Gonzalez and R. Hernandez-

Mogollon (2020), the positive effect of ICT on economic performance was identified. The study utilized the Partial Least Squares (PLS) and focused on a sample of European OECD economies. Another research conducted previously by D. Jorgenson and K. Vu (2007) identified a strong impact of investment in information technology on the world economic growth throughout the period 1989-2004, especially in industrialized economies and developing countries in Asia.

S. Zhao et al (2022) addressing the dynamic effect of technological advancement in the Asian region found that an increase in ICT export growth boosted sustainable growth throughout the period from 2004 to 2020.

M. Kurniawati (2022) has made a noteworthy contribution to the academic discourse on the relationship between IT and economic performance – investigating a positive relationship between ICT penetration and economic growth in high-income Asian countries.

Other researchers also found a positive influence of information technology development on economic growth in country-specific and cross-country level studies: H. Khan et al (2020) for South Asia; R. Kumar et al (2016) for China; F. F. Adedoyin et al (2020) for the USA; M. (2020) for OECD countries, etc.

From a different perspective, scholars have shifted their focus beyond merely exploring possible correlations and have delved into a more nuanced examination of how information technology specifically influence economic growth and the underlying mechanisms through which this impact occurs. F. Venturini (2015) pointed out two effects derived from ICT development – on the one hand, it improves communication and information efficiency and on the other hand, those industries that develop ICT generate a great amount of knowledge in the process, disseminating it to others.

K. M. Vu (2011) identified three channels through which ICT can boost economic growth: 1) dissemination of knowledge and innovation, motivated by ICT penetration; 2) improvement of decision-making through effective resource allocation; 3) reduction of production costs, promotion of demand and increase in investment generated by ICT penetration.

Numerous domestic and international scholars have extensively explored issues related to the development of the information technology market. However, there remains a gap in the literature regarding a thorough examination of the correlation between information technology market development – specifically in terms of growth of its export, capital expenditure in components of IT services and the number of specialists – and GDP growth in Ukraine. Furthermore, limited research has been conducted in comparing these aspects with the EU countries, which are considered a target for Ukraine. These facts collectively underscore the imperative need to evaluate the impact of the information technology market on the Ukrainian economy, particularly regarding its GDP performance.

AIMS AND OBJECTIVES

The primary objective of this article is to furnish empirical findings regarding the degree of correlation between the growth rates of these two crucial categories. The growth of the information technology market will be examined through the perspectives of its export, capital expenditure (R&D) and workforce growth rates. Furthermore, this study aims to compare the obtained results of the correlation between information technology export (IT export) and the Ukrainian economy's GDP growth rates with those of the European Union (EU) countries. This comparative analysis seeks to extract valuable insights and shed light on the performance of the Ukrainian information technology market in relation to its peer markets in Europe.

METHODS

To gather the essential data for analysis in this study, both the Ukrainian and EU-27 + UK markets were selected. The Ukrainian market serves as the primary focus and novelty of the article, while the European market acts as a benchmark for comparison when evaluating data from Ukraine.

For Ukraine, the data series spans the period from 2013 to 2022. However, for the EU-27 + UK, the data may not comprehensively cover the mentioned period due to variations in data availability from open sources. Specifically, data for Lithuania, Slovenia, Luxembourg, and Denmark is presented from 2013 to 2021, while data for the Slovak Republic and Finland is available from 2014 to 2022. Data for Malta and Cyprus was unavailable.

Worth noting that the correlation analysis for Ukraine and its information technology market was conducted more comprehensively, taking advantage of the availability of data. Specifically, the analysis delved into the impact of various variables within the information technology market on GDP. These variables included information technology export, capital expenditures in software development and databases, and the number of IT specialists and their growth rates. In contrast,

the correlation analysis for the EU-27 + UK focused solely on the correlation between GDP and information technology export growth rates.

The primary sources of information for the EU-27 + UK data were the UNCTAD and World Bank databases, providing annual GDP and information technology export (or IT service export) data. Meanwhile, the data for Ukraine – GDP, information technology export, capital expenditures in software development and databases and a number of IT specialists – were gathered from a range of sources, including UNCTAD, World Bank, State Statistics Service of Ukraine and National Bank of Ukraine datasets, IT Ukraine Association reports and publications, etc.

All collected data were interpreted through yearly growth rates (GR or percentage change) for subsequent use in correlation analysis.

$$GR = \frac{X+1}{X} \quad (1)$$

In the correlation analysis, two distinct correlations were used – the Pearson correlation coefficient and the Spearman rank correlation coefficient. The primary correlation method used is Pearson correlation, while the Spearman rank correlation serves as an additional verification to ensure the reliability of the obtained results. The formulas representing these two correlations are presented in equation (2) and (3) below.

$$\text{Pearson correlation coefficient} = \frac{n\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{n\Sigma X^2 - (\Sigma X)^2} \sqrt{n\Sigma Y^2 - (\Sigma Y)^2}} \quad (2)$$

where X – represents growth rates of information technology export, number of IT specialists or capital expenditure in software development and databases; Y represents the GDP growth rate; meanwhile n – sample size.

$$\text{Spearman rank correlation coefficient} = 1 - \frac{6\Sigma D^2}{n(n^2-1)} \quad (3)$$

where D – the difference between the X -variable rank and the Y -variable rank for each pair of data; meanwhile X , Y and n definitions are described above in Pearson correlation coefficient in formula (2). While performing such correlation it's also necessary to rank the data from low to high using the Microsoft Excel 2019 formula – Rank.AVG (corresponding value, dataset for all values).

To assess the significance of the obtained correlation, the t-value (test statistic) was calculated using the formula (4). This calculated t-value was then compared with the critical value of t from a Student's t-table, which is available in online sources. The critical value of t sets the threshold for significance in certain statistical tests and establishes the upper and lower bounds of confidence intervals for specific estimates. Conventionally, a significance level of 0.05 is used, corresponding to a common confidence level of 95% (National Institute of Standards and Technology, 2024).

$$t = \frac{r}{\sqrt{\frac{1-r^2}{n-2}}} \quad (4)$$

where r represents Pearson correlation coefficient, and n – sample size.

The Pearson correlation was visualized on graphs using Microsoft Excel 2019, employing the scatter plot type of graph. To create these visualizations, two columns containing the necessary data (X and Y variables) were selected. Then, on the "Insert" tab, within the "Charts" group, the Scatter chart icon was clicked. It's worth noting that the graphs also display the R-squared value, commonly referred to as the Coefficient of Determination.

In addition, some calculations in the paper contain a compound average growth rate (CAGR) that helps to evaluate the historical performance of one's variable. The CAGR formula is presented below in formula (5).

$$CAGR = \frac{V(tn)^{\frac{1}{tn-t0}}}{V(t0)} - 1 \quad (5)$$

where $V(t0)$ represents the initial value in the observed timeline, $V(tn)$ – the end value in the observed timeline, and $tn - t0$ – the number of years.

RESULTS

Ukraine’s information technology market is an export-oriented one (because export constitutes more than 90% of the market hereafter terms “information technology export or IT export” and “information technology market or IT market” would be interchangeable categories) and stands as one of the foremost sectors in the national economy, demonstrating rapid annual growth. The compound average annual growth rate of information technology exports exceeded 20% from 2013 to 2022, resulting in a substantial increase to nearly USD 7.3 billion in 2022. The share of the information technology market in the domestic GDP structure has also risen from 0.7% in 2013 to 4.7% in 2022. Furthermore, the share of information technology exports in total services exports amounted to more than 44% in 2022, meanwhile, its share in total Ukrainian exports reached 7.3% making the information technology market the Ukraine’s second-largest export industry since 2010 (Ukraine IT Association, 2022).

Despite the wartime conditions, the national information technology market continues to fulfil its tax obligations, with some companies even paying taxes in advance to support the state during this challenging period. As of November 1, 2022, the total amount of taxes paid reached UAH 26.6 billion (approximately USD 700 million), slightly less in UAH equivalent than the amount reported as of January 1, 2022, which was UAH 27.8 billion (just over USD 1 billion).

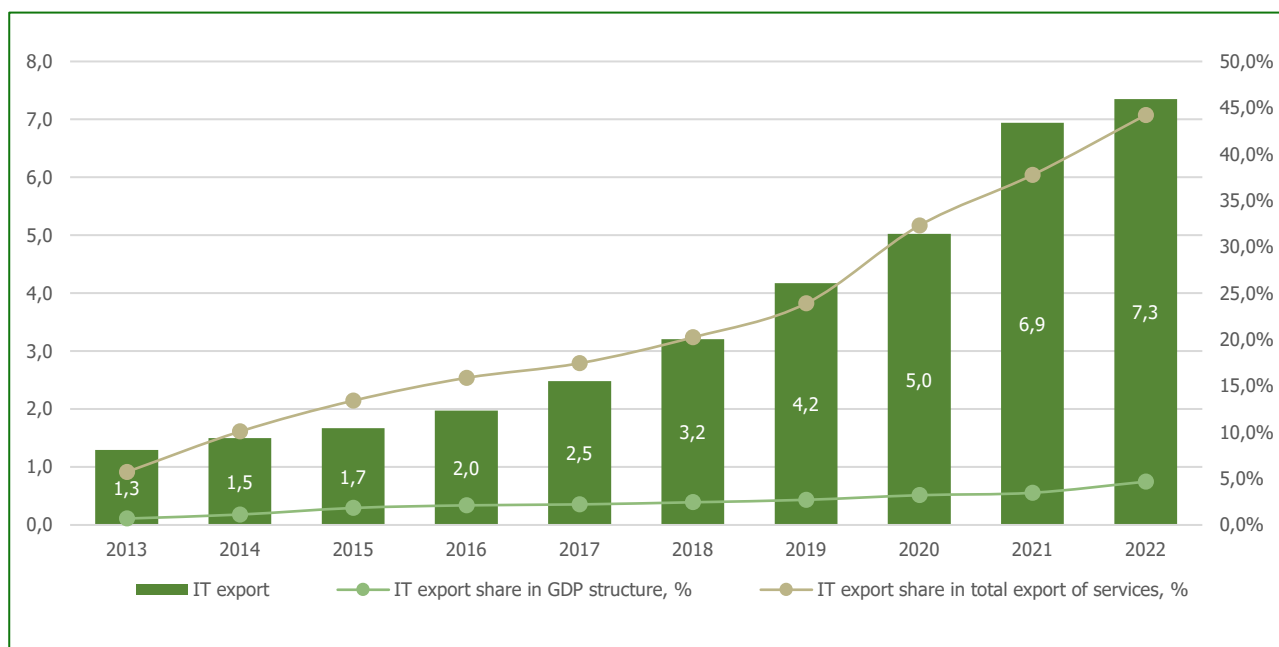


Figure 1. Information technology exports historical dynamics and its share in GDP and export of services structures, USD billion.
 (Source: calculated by the author based on National Bank of Ukraine, UNCTAD and World Bank datasets)

In Figure 2 below, the dynamics of growth rates for both GDP and the information technology export are analysed. It is noteworthy to acknowledge that, despite fluctuations in GDP influenced by political and economic events, including the full-scale war in 2022, the information technology market exhibited consistent and steady growth, but at the same aligning with the overall direction of GDP. Despite the heightened intensity of shelling and power outages in the fourth quarter of 2022, namely from October to December, the Ukrainian information technology export continued to stand firm, experiencing a growth of 5.8% by the end of the year compared to the previous year. It is fair to acknowledge that, based on the preliminary results released in December 2023, the growth rates of information technology exports could potentially experience their first decline, reaching USD 6.8-7.2 billion in 2023, representing a decrease of 2.3%-7.7% (Lviv IT cluster, 2023). At the same time information technology export share in total export of services could also decline from 44.2% in 2022 to 41.5% in 2023.

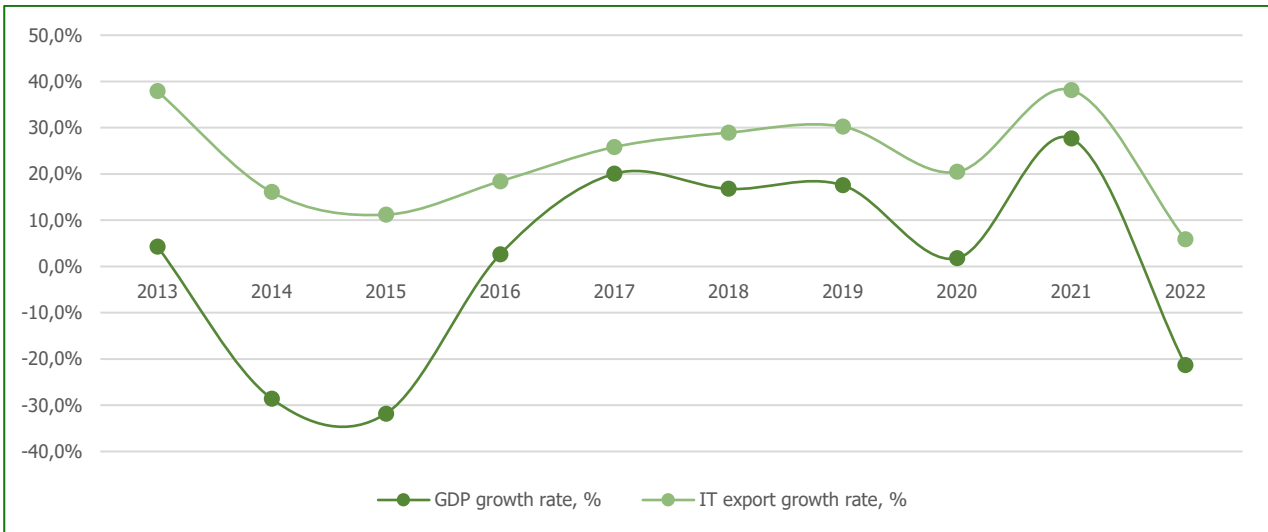


Figure 2. Information technology export and GDP growth rate dynamics, %. (Source: calculated by the author based on National Bank of Ukraine, UNCTAD and World Bank datasets)

The biggest country-recipient of Ukrainian information technology export was the USA with a 40.5% share of total information technology export, followed by the UK – 9.4%, Malta – 7.9%, Israel – 4.7% and Switzerland – 4.5%. Collectively, these top five importers of Ukrainian IT services constitute 67.0% of total information technology exports. Such distribution indicates that the Ukrainian IT business is primarily oriented toward cooperation with developed markets in the West. Figure 3 shows the information technology export structure by the recipient country.

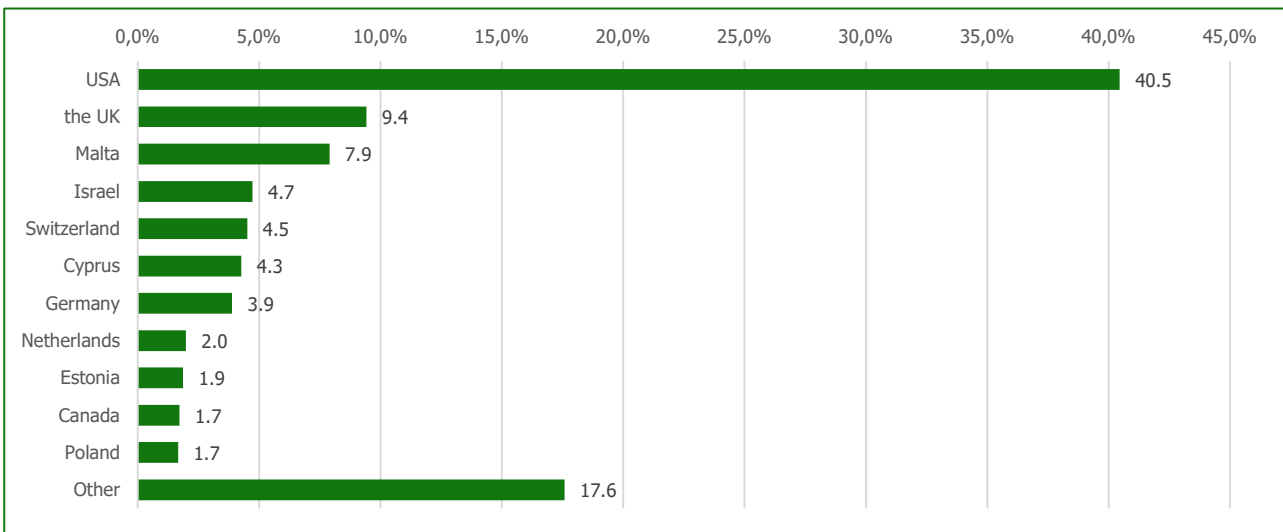


Figure 3. Information technology export structure by the recipient country, %. (Source: National Bank of Ukraine data)

The Ukrainian information technology market encompasses approximately 2,300 companies employing 362,000 IT specialists. The number of IT specialists has consistently risen in tandem with the growth of the information technology market, nearly tripling in size from 135,000 in 2013. The primary contributing factors to this increase can be attributed to the competitive salaries prevalent in the market, the global surge in the tech industry, and the overarching trend towards the digitalization of all business processes, underscoring the ascendancy of service industries over traditional ones. Along with that, the productivity per worker has also risen from USD 7.9 thousand in 2013 to USD 20.3 thousand in 2022 (+156.0%). Figure 4 presents the historical dynamic for these categories over the 2013-2022 period.

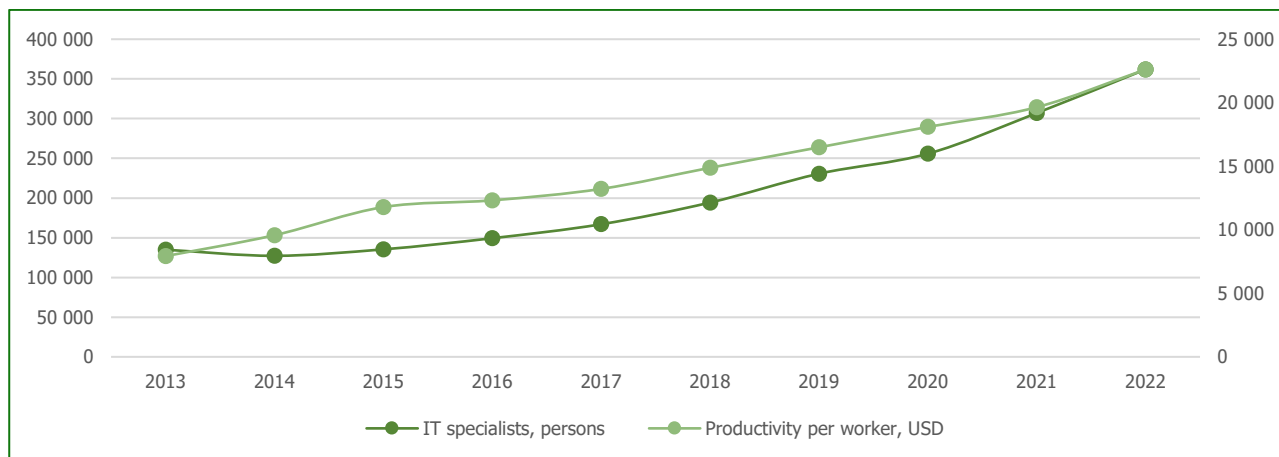


Figure 4. IT specialists (left scale) and their productivity (right scale). (Source: calculated by the author based on IT Ukraine Association data)

Due to the full-scale invasion, almost 71% of domestic information technology companies found it necessary to undergo unplanned relocation. This included 17.5% that fully relocated and 53.3% that partially relocated to foreign countries. The biggest recipient of Ukrainian IT business was Poland which accounted for 40.1% of total relocated companies, followed by Germany – 14.6%, USA – 9.5%, Portugal – 9.5% and Bulgaria – 8.0% (Ukraine IT Association, 2022). Notably, the relocation destination does not always correspond to the countries that are among the top exporters of Ukrainian information technology services, suggesting additional reasons for the decision to relocate.

As previously highlighted, the information technology market in Ukraine might face a downturn, resulting in a reduction in the employment of IT specialists. This decline is anticipated due to decreased job opportunities from foreign clients, influenced by security measures in Ukraine and general fluctuations in the global information technology market. Competition per one job offering has increased from 8.5 to 9.15 candidates in July 2023 (Djinni, 2023). This metric represents a 150% increase compared to the corresponding month in the previous year. Additionally, candidates are submitting five times more job applications than the number of propositions they receive. For more details, please refer to Figure 5.

At the same time, another national market's key challenge is a lack of qualified professionals while the complexity of projects and solutions continues to grow. To remain desirable in the market, it is crucial for specialists to enhance their skills, and companies play a vital role in assisting them in this endeavour. Experienced professionals can tackle complex tasks and handle them more efficiently. According to the Vice President of Strategy at GlobalLogic (2021), to stay competitive and continue rapid development, Ukrainian information technology businesses need to invest at least 1.5% of their income in the education of professionals. This pertains to improving skills for both experienced specialists and beginners. Currently, the situation is further complicated by the phenomenon of "brain drain" from the country due to the ongoing war, better working conditions abroad, the unattractiveness of continuing education and employment in domestic educational institutions.

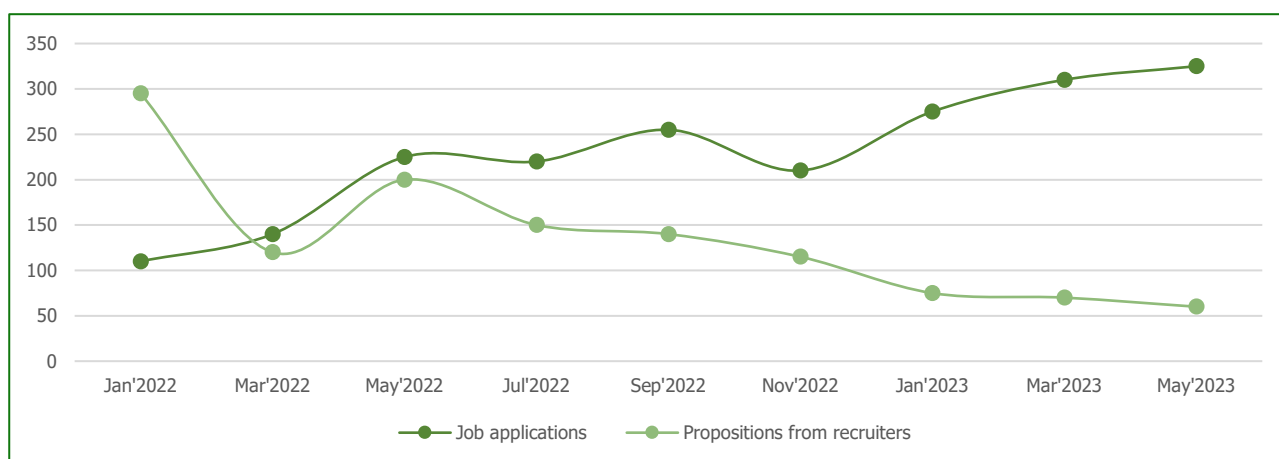


Figure 5. Job applications vs job propositions, thousand. (Source: Djinni data)

Moreover, Ukraine is endeavouring to enhance its information technology expertise by investing in computer software and database Research and Development (R&D). In 2022, the total budget allocated for this R&D reached USD 610 million, reflecting a growth of 40.2% since 2013 (Figure 6). However, this amount is deemed insufficient for conducting robust R&D operations, especially in the capital-intensive information technology market. Notably, Ukraine's overall budgets for all R&D activities have consistently declined from 1.07% of GDP in 2003 to 0.41% in 2020. This figure is significantly smaller than the R&D budgets of Ukrainian counterparts, which stood at 1.8% in 2020 (an average for Poland, Estonia, Slovenia, and the Czech Republic) (OECD, 2022).

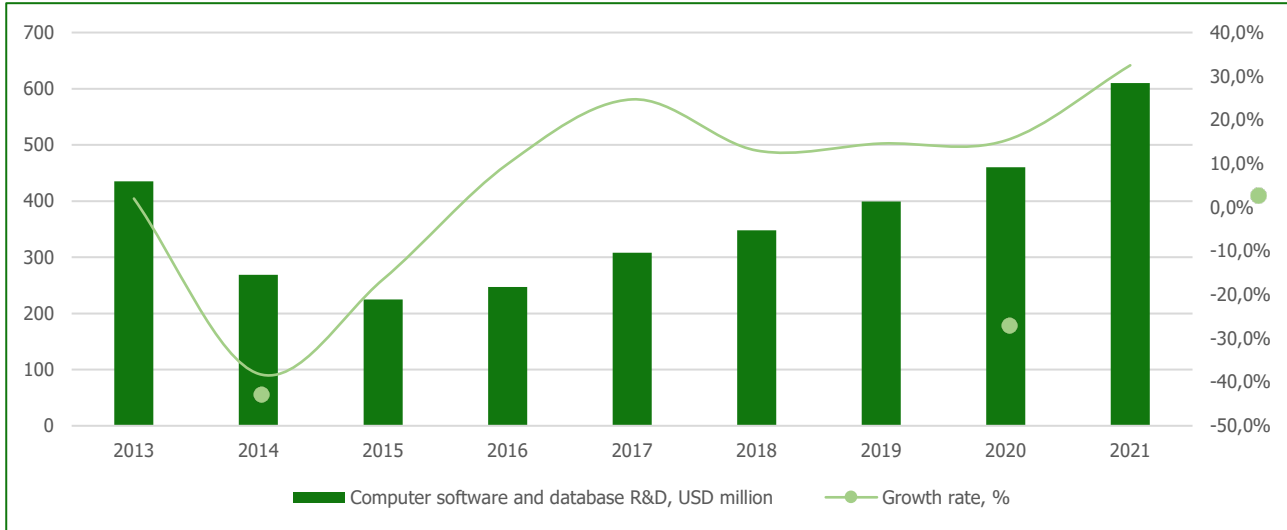


Figure 6. Ukrainian R&D in computer software and database (left scale) and its growth (right scale). (Source: calculated based on State Statistics Service of Ukraine and National Bank of Ukraine datasets)

Another significant drawback of the Ukrainian information technology market is the limited share of substantial and regular investments in innovative infrastructure, specifically in the establishment of specialized sites where intricate hardware, software, and information developments can be tested. In contrast, developed countries often create such sites and entire laboratories with the support of the state, recognizing them as key elements in augmenting expertise within the market.

Having analysed the current and historical pace of development of the Ukrainian information technology market, let's proceed to conduct a correlation analysis between information technology market variables (information technology export, capital expenditures and number of specialists) and with economic performance of Ukraine. The results of correlation analysis using the Pearson correlation coefficient and Spearman rank coefficient are presented below in Table 1.

Table 1. Obtained results using Pearson correlation and Spearman rank correlation coefficients. Notes: ¹ capital expenditure in computer software and databases.

Variables	Pearson correlation		Spearman rank correlation		
	<i>r</i>	<i>t-test</i>	<i>t critical</i>	<i>R</i> ²	<i>r</i>
Information technology export / GDP	0.81	3.97	1.86	0.6633	0.84
Number of IT specialists / GDP	0.67	2.55	1.86	0.4475	0.71
Capital expenditures ¹ / GDP	0.92	6.41	1.86	0.8533	0.80

From the obtained results, it is evident that the correlation between the growth rates of capital expenditure in computer software and databases and GDP is significant (0.92), indicating a strong and positive correlation. Similarly, the correlation between the growth rate of information technology export and GDP is strong (0.81), and the correlation between the growth rates of IT specialists and GDP, while slightly weaker (0.67), remains positive and strong. Additionally, all t-tests for these correlations are greater than their respective critical t-values, indicating statistical significance.

Furthermore, the *R*² value for the capital expenditure/GDP correlation is notably high at 0.8533, indicating a robust relationship between the independent variable (capital expenditure) and the dependent variable (GDP). The same level of

strength in correlation is observed for the information technology export/GDP relationship, with an R^2 of 0.6633. However, the number of IT specialists/GDP correlation exhibits a weaker R^2 , suggesting a relationship between the variables, but a notable portion of the variability in the dependent variable remains unaccounted for by the Pearson correlation.

The graphical interpretations for each obtained Pearson correlation result using are shown in Figures 7-9 respectively. The Spearman rank correlation coefficients for all types of correlation align with their counterparts in the Pearson correlation, providing a consistent double-check of the results. This reinforces the reliability and robustness of the obtained correlations.

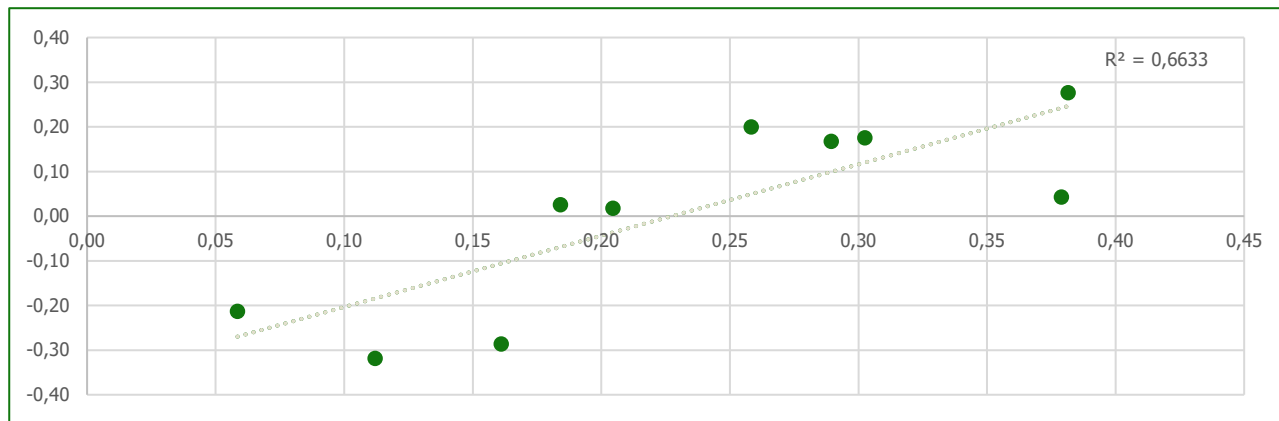


Figure 7. Graphical interpretation of information technology export / GDP Pearson correlation.

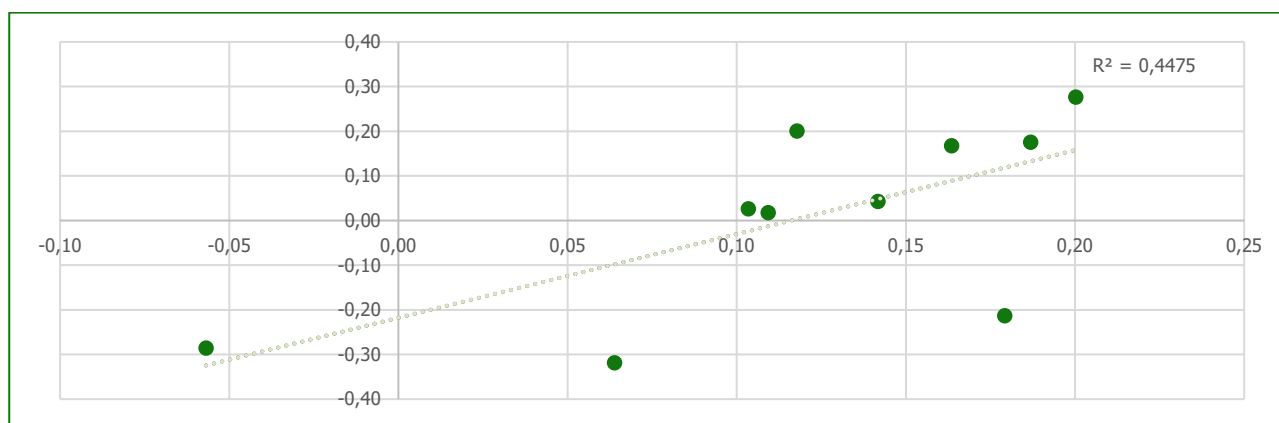


Figure 8. Graphical interpretation of IT specialists / GDP Pearson correlation.

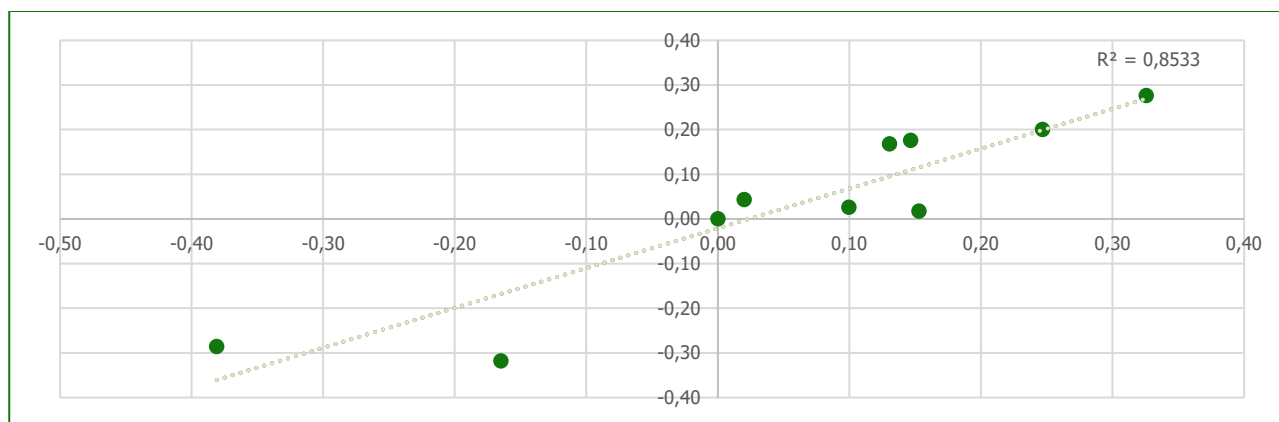


Figure 9. Graphical interpretation of Capital expenditure / GDP Pearson correlation.

To compare Ukraine's results with its sample peers (the EU-27 + UK), the Pearson correlation coefficient was utilized using the same methodology as previously applied for Ukraine. However, this comparison focused specifically on the correlation between the growth rates of information technology export and GDP within this sample, considering the limitations of

available data. Such a comparative analysis provides valuable insights into how well Ukraine is performing in relation to its peers. Moreover, this analysis could spark discussions on whether Ukraine should refine its market stimulation strategies within its national information technology market to catalyse economic performance, fostering its evolution toward becoming a service-oriented economy akin to developed countries in the EU.

Firstly, let's start with the general conditions of economic development and information technology market observation in the EU-27 + UK countries, specifically its GDP and information technology export. Figures 10 and 11 represent such data.

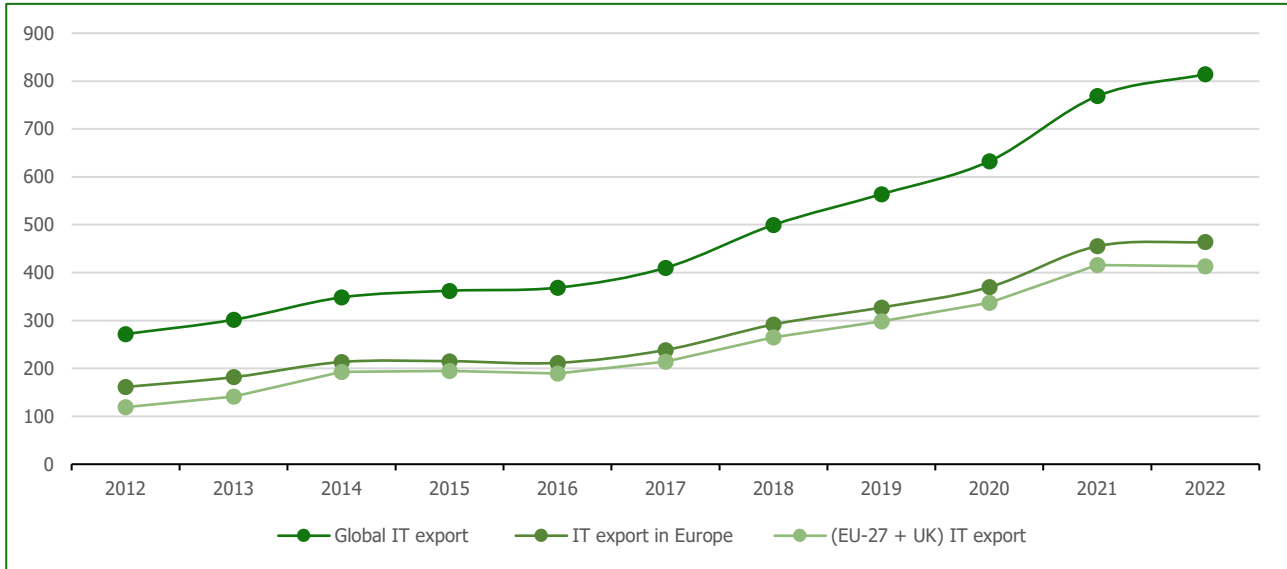


Figure 10. Information technology exports historical dynamics, globally and regionally, USD billion. (Source: UNCTAD database)

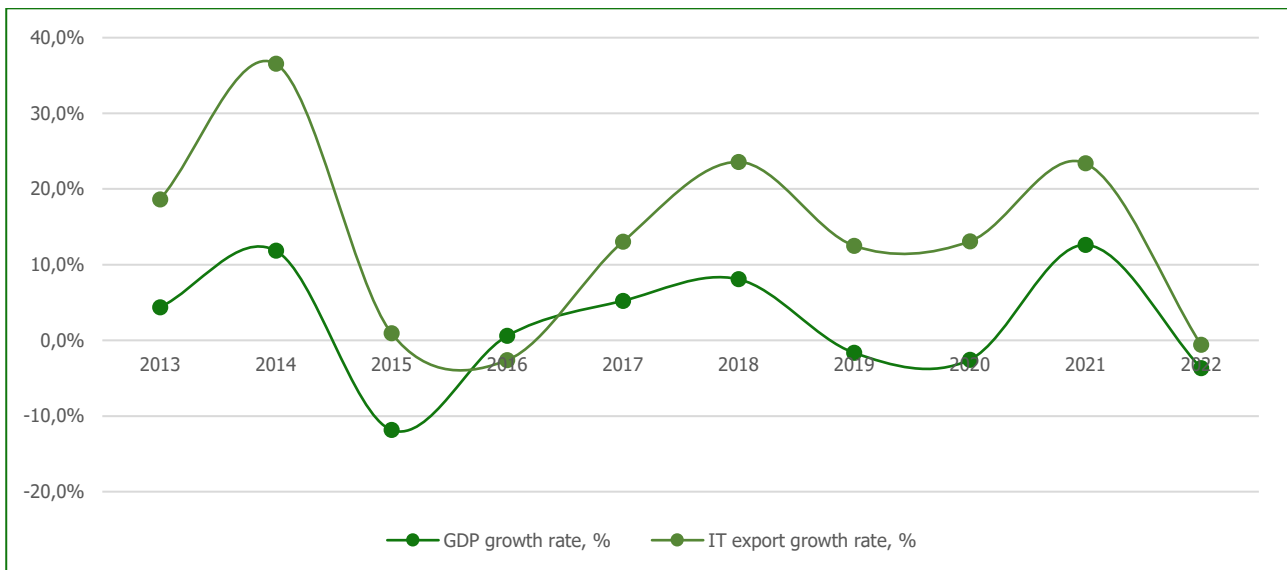


Figure 11. Information technology export and GDP growth rate dynamics in the sample countries, %. (Source: calculated by the author based on UNCTAD and World Bank datasets)

Sample countries constitute more than 90% of total Europe's information technology export, indicating that analysis will cover all substantial countries in the region for comparison with Ukraine's data. From Figure 11 we can conclude that information technology export dynamics is overall moved in the same direction as the GDP did.

The results of the run correlation for the sample countries compared with Ukraine are presented below in Table 2.

Table 2. Pearson correlation results for the EU-27 + UK countries compared with Ukraine

Country	Information technology export / GDP correlation
Spain	0.90
Estonia	0.88
Romania	0.84
Belgium	0.84
Czech Republic	0.82
UK	0.82
Austria	0.81
Ukraine	0.81
Poland	0.77
Portugal	0.76
Luxembourg	0.76
Bulgaria	0.73
France	0.67
Ireland	0.65
EU-27 + UK (median)	0.64
Latvia	0.63
Hungary	0.62
Lithuania	0.61
Italy	0.56
Slovenia	0.50
Denmark	0.48
Greece	0.35
Slovak Republic	0.27
Germany	0.27
Finland	0.22
Sweden	0.17
Croatia	0.01
Netherlands	-0.41

Based on the obtained results, it can be inferred that the impact of information technology export on economic performance in the EU-27 + UK countries is generally characterized by a strong and positive correlation (more >0.6) in most cases (16 countries, including Ukraine). Another set of countries demonstrates a moderate correlation (from 0.3 to 0.6), including Italy, Slovenia, Denmark, and Greece. The weakest correlations are observed in countries such as the Slovak Republic, Germany, Finland, Sweden, and Croatia, with the Netherlands even showing a negative correlation that obviously stands out among other observed countries.

It is noteworthy that the impact of Ukrainian information technology export on its domestic economy exhibits more substantial correlation results compared to most of its European peers. Specifically, Ukraine's results surpass the sample average (0.81 > 0.64). Moreover, Ukraine demonstrates stronger correlations with some of its peers in Eastern and Northern-Eastern Europe, such as Poland (0.77), Bulgaria (0.73), Latvia (0.63), Hungary (0.62), Lithuania (0.61), Slovenia (0.50), and the Slovak Republic (0.27).

DISCUSSION AND CONCLUSIONS

The information technology market in Ukraine plays a pivotal role in the national economy, contributing significantly by fostering a robust trade balance through its exports to developed countries in the West. Despite the anticipated slight

decline in 2023, it is expected to remain one of the strongest markets in the Ukrainian economy helping to transform Ukraine into a service-oriented economy.

Based on the correlations examined, the author can reasonably infer that the information technology market does have a significant impact on domestic economic performance in Ukraine. Moreover, in comparison to the same correlations in EU-27 + UK countries, the Ukrainian information technology market by its impact on economic growth significantly outpaces its peers. This paper signals the need for further governmental support and stimulation to foster the growth of the information technology market, making it not only larger but also more competitive in the global landscape.

Nonetheless, causality and correlation present a challenge in establishing a direct relationship between a country's information technology market development and its economic growth. While there may be a correlation between the two, it is crucial to admit the fact that establishing causality can be difficult due to the presence of other confounding factors that might influence these economic indicators. Identifying a causal relationship requires careful consideration of various potential contributing factors and thorough analysis to draw meaningful conclusions.

Additionally, the obtained results could potentially be further explored to deepen our understanding of the correlation between the impact of Ukraine's information technology market on economic growth. This exploration could involve investigating the relationship between information technology market performance and its growth with overall national productivity, as well as within the key sectors of Ukraine's economy. Such an understanding would shed light on how the pace of IT development impacts both sectoral and national productivity and, the underlying mechanisms through which this impact occurs.

M. Kurniawati (2022), Roller and Waverman (2001), and Czernich et al (2011), have emphasized that information technology can contribute to economic growth through both direct and indirect means. Directly, it enhances productivity and stimulates growth in industries producing IT products and services. Indirectly, it elevates the quality of investment and productivity in industries utilizing IT products and services in their production processes. The researchers further indicated that increased productivity could manifest in several ways, such as enhancing the demand for production inputs, reducing transaction costs, raising labour productivity in IT-using industries, and influencing productivity through its forward and backward linkages with the economy. Moreover, they highlighted that information technology has the potential to enhance economic performance by providing market information, facilitating information diffusion, fostering competition, stimulating entrepreneurial activities, aiding job search processes, and facilitating the distribution of ideas.

As mentioned above, foreign researchers F. Venturini (2015) and K. M. Vu (2011) also pointed out different effects derived from information technology development for the national economy the improvement of decision-making processes, generation of innovation and as a result increase in investment in the information technology market.

Building on these considerations and obtaining strong and positive correlation results for Ukraine, further academic investigation can delve deeper into analysing the intricate linkages of the impact of the information technology market on the economic performance of Ukraine. This could involve examining the direct and indirect impact of IT development on sectoral productivity (for example manufacturing, agriculture, mining, public services, etc), the generation of investment, and other relevant factors to provide a more comprehensive understanding of the multifaceted contributions of the information technology market to economic development of Ukraine.

To summarise, the Ukrainian information technology market undeniably stands out as a catalyst for the development of the national economy. Ukrainian professionals enjoy popularity worldwide, being among the few capable of implementing complex projects. It is also worth noting that the success of further development and market growth depends on the government's policies and coordinated efforts of the business sector, particularly in promoting the improvement of the business environment and investment stimulation.

ADDITIONAL INFORMATION

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CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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МАКРОЕКОНОМІЧНИЙ ВИМІР РОЗВИТКУ РИНКУ ІНФОРМАЦІЙНИХ ТЕХНОЛОГІЙ

Інформаційні технології відіграють важливу роль у сучасній економічній системі, виступаючи при цьому драйвером розвитку держави. При цьому інформаційні технології є одним із найбільш важливих чинників не тільки стимулювання економічного зростання, але й розвитку суспільства, стимулювання зайнятості населення, стимулювання конкуренції. Ринок інформаційних технологій генерує значну частку ВВП та експортних надходжень. Аналіз формування й розвитку внутрішнього ринку інформаційних технологій є одним із ключових чинників для розуміння ступеня його важливості в контексті формування майбутніх перспектив України як цифрової держави. У дослідженні здійснено аналіз динаміки розвитку національного ринку інформаційних технологій. Проведено порівняльний аналіз показників ринку інформаційних технологій України й низки інших країн.

Метою дослідження є аналіз макроекономічного впливу ринку інформаційних технологій на розвиток національної економіки, вивчення кореляційних зв'язків між темпами економічного зростання та низкою показників в Україні і в країнах ЄС.

Розкрито напрями впливу національного ринку на динаміку економічного зростання. На основі проведеного аналізу зроблено висновки про наявність прямого зв'язку між зростанням експорту інформаційних технологій і зростанням ВВП й в Україні, і в країнах Європейського Союзу. Проаналізовано взаємозв'язок між приростом ВВП й зростанням інших важливих показників ринку інформаційних технологій, серед яких кількість фахівців та інвестиції в наукові дослідження. На основі використання статистичних методів виявлено досить тісний зв'язок між темпами зростання інвестицій у наукові дослідження сфери інформаційних технологій і темпами зростання ВВП. Водночас зв'язок між зростанням кількості фахівців у сфері інформаційних технологій і ВВП є слабшим.

Ключові слова: інформаційні технології, ринок інформаційних технологій, національна економіка, експорт, валовий внутрішній продукт, економічне зростання

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