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Economic Marginality Degree: A Factor of Influence on Information Technology

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Abstract

This article examines the extent to which economic marginality functions as a factor influencing information technology. The study seeks to analyze how the drivers of economic marginalization affect a country's overall economic development and to determine the degree to which information technologies shape these dynamics. The study investigates how the level of information system development affects the degree of economic marginality in society, using Ukraine as a case example. To address the research objective, a multifactor regression analysis was conducted, enabling the construction of an economic–statistical model that substantiates the influence of each factor. The findings of the study reveal the key factors influencing GDP formation, highlighting information technology as the primary driver among them. It was concluded that the development of the communication, information technologies, and telecommunications system, along with the scientific and technical sphere, science and education, and the health care and social assistance system, makes a significant contribution to the country's GDP. The research confirmed the hypothesis of a high degree of interrelationship between the impact of information technologies and their increasing role in society, on economic development and equal access to the social sphere, education, science, and healthcare. Stimulating these sectors of Ukraine's economy will contribute to overall economic development and help reduce the degree of economic marginalization.

Keywords: Economic Marginality, Digital Economy, Factors Affecting Marginality, Information Technology.

Introduction

The relevance of the scientific analysis of economic marginality is closely correlated with the global transformational processes occurring in the backdrop of the digital economy's development. The transformation of economic laws, processes, professional identity, and individual competencies is changing the structure of work and levels of employment in information technology management systems in the context of digitalization. This transformation has become a significant factor in strengthening the processes of economic marginalization.

Digitization, which has resulted from globalization, has led to an increase in the number of economically marginalized individuals. Declassification is now reaching significant levels due to several factors: the deterioration of the population's standard of living, rising inflation, growing unemployment, and the deepening of income inequality within the country (Babenko et al., 2017a; 2018; 2020). Consequently, the development of methodological principles for assessing the impact of economic marginality indicators on a country's economic development and identifying the degree of influence of information technologies on these

processes has become particularly relevant (Gontareva et al., 2020; Nesterenko et al., 2024; Savytska et al., 2024).

It is in the context of the formation of the information society and the development of the digital economy that economic marginality can be considered as one of the manifestations of adaptation to changes in the economic sphere and information technology management systems (Babenko, 2013; Kashchena et al., 2024; Kyrylieva et al., 2023; Malyarets et al., 2017).

Modern digital society is a qualitatively different formation: its various cultural, economic, political and other components are in a state of constant interaction. This constant interaction leads to a certain rupture of social ties. In a relatively homogeneous environment, continuous socio-cultural, economic and political changes occur due to the intensification of globalization and informatization processes.

The influence of information technologies on the development of the economy and their role in the creation of the information society has been the subject of research by many scientists (Karpenko et al., 2019; Shorikov & Babenko, 2014; Tomchuk-Ponomarenko, 2015). Some of the researcher of the foundations of the information society is Castells, who substantiated the concept of information economy in their research (Castells, 2010).

The economic foundations of the information society were also substantiated in the scientific research of S. Czaja, who proved the dominance of 5 basic elements of the information economy: 1) knowledge as an economic resource and factor of production; 2) the increasing role of the information component in the structure of the gross national product; 3) the presence of excess production capacity; 4) innovations related to knowledge and transfer of information technologies; 5) competitiveness based on updating information (Czaja, 2010). These elements are part of the concept of information systems management.

In the context of the development of the information society with the further transition to the digital economy, it is worth noting the developments of F. Webster, who proves that "the development of information technologies is associated with the emergence and development of new market instruments: electronic communications, accounting and circulation tools. Currently, the economy widely uses technologies based on the use of Internet services. These include online trading, online advertising, banking technologies, online investments, portal solutions in the field of public finance" (Webster, 2014).

There are a lot of scientists, when studying the problems of the formation of the information society and the digital economy, focused on the development of IT technologies and their role in these processes. For example, Purij (2019) devoted his research to the analysis of the role of information systems and technologies in the management of enterprise activities. Zoppelletto et al. (2023) examined the role of digital transformations and their

impact on the micro level. Ochoa Siguencia devoted his research to the impact of modern information technologies on business management (Ochoa Siguencia, 2018).

Assessing the contribution of scientists to the problem of the formation of the information society and the development of the digital economy, it should be noted that only a small number of studies are devoted to the problems of marginalization of society in the context of the development of information technology management (Babenko et al., 2017; Distributional Effects of Globalization in Developing Countries, 2007). Thus, Djordjevic and Djordjevic (2023) explore the issues of social entrepreneurship as a factor in reducing the degree of marginalization of society. Beck W. considers the problem of marginalization as a factor in globalization, focusing his research on the social role of this factor (Beck, 2019). Based on research in the field of the influence of marginalization on the economic foundations of society's development, it should be noted that insufficient attention has been paid to the issues of assessing the degree of influence of information technologies on economic marginality.

The reasons that contribute to the growth of economic marginality in the context of the development of information technology and the digital economy are the following (Kuznetsov et al., 2029; Marody & Giza-Poleszczuk, 2018). The technological shift that has occurred in the information economy has contributed to a significant release of labour and a reduction in the labour force involved in production. This, in turn, has led to the transformation of labour as a factor of production and has affected changes in the structure of labour and its impact on cost structures (Babenko et al., 2019; Shtal et al., 2023). These changes contribute to the segregation of the population and strengthen the foundations of economic marginality in society. The above processes are accompanied by the development of digital services, which leads to the disappearance of certain professions and uneven access to digital products and assets. It is important to note that digitalization is accompanied by a rapid increase in the volume of information, knowledge and information services that significantly affect all economic processes and everyday life. The above aspects determined the relevance and problems of this study.

The author's research aims to identify the level of influence that factors related to economic marginalization have on the country's overall economic development, particularly in the context of the digital economy and its impact on information technology management.

Methodology

The methodological basis of the research is a set of general philosophical and special methods, principles and techniques, the main methodological approaches (systemic, process, situational). General scientific methods: systematic approach - to justify the parameters for the use of regression-correlation analysis and justify the methodical approach to determining the level of influence of factors related to the occurrence of economic marginalization on the

general economic development of the country in the conditions of the development of the digital economy; analysis and synthesis - to determine trends and trends in the development of the digital economy and the unevenness of the development of human capital and increase the level of economic marginality; methods of theoretical generalization - for grouping factors of influence on the general economic development of the country in the conditions of the development of the digital economy; terminological analysis - to identify and clarify terms that reveal the essence of economic marginality.

Specific research methods: statistical methods - for studying the state and dynamics of inequality of human development in the digital economy, which is the main factor in the emergence of economic marginality; the method of regression-correlation analysis - to identify and assess the factors of influence of factors related to the occurrence of economic marginalization on the general economic development of the country in the conditions of the digital economy and increasing the level of economic marginalization.

Results

In discussing the social structure amid the formation of the information society and the digital economy, it is crucial to address the system of inequality rooted in access to information. As noted, «The expansion of the service sector and the rise in technological production levels mean that many types of work now require substantial training. Consequently, the psychology and living standards of workers in these roles are more aligned with the average worker than with the traditional working class. Additionally, in the post-industrial economy, the interests of entrepreneurs and employees increasingly clash not on material grounds but in terms of decision-making freedom and measures of autonomy» (Distributional Effects of Globalization in Developing Countries, 2007). This form of inequality emerges because the networks that disseminate information technologies, as well as computer networks (both local and global) are heterogeneous.

There is a need to assess the degree of influence that factors related to economic marginalization have on the overall economic development of a country, as measured by GDP, within the context of the aforementioned trends. The analysis utilized indicators of societal informatization to examine heterogeneous access to information resources and evaluate its impact on increasing societal marginalization. This marginalization arises from the unequal access individuals have to digital services and products.

To assess and analyze the factors influencing economic marginalization and their effect on a country’s overall economic development, a multifactor regression analysis was employed. This method provides an economic and statistical model to substantiate the impact of each factor. The analysis is based on socio-economic statistics from the State Committee of Statistics of Ukraine (State Statistics Service of Ukraine, 2022). For this analysis, the following factors associated with economic marginalization and their impact on GDP were

selected: information and telecommunications; professional, scientific, and technical activities; education; health care and social assistance; innovation costs; art, sports, entertainment, and recreation; average indicators of the working-age population; and average indicators of the unemployed population. These factors were chosen for the regression model, which will be used in future assessments to evaluate the impact of access to social benefits and the disparities in access to digital products and assets.

The analysis provided for the assessment of the analysis of the factors of influence associated with the occurrence of economic marginalization on the general economic development of the country by means of the calculation of the pairwise correlation coefficient. The results of the calculation, which were carried out using Excel, are presented in Table 1.

Table 1. The results of the calculation of the correlation coefficient of the regression factors
(Source: Authors)

Year	GDP, UAH million in actual prices	Information and telecommunications, UAH million.	Professional, scientific and technical activities, UAH million.	Education, UAH million	Health care and provision of social assistance, UAH million.	Innovation costs, UAH million.	Art, sports, entertainment and recreation, UAH million.	Labor force of working age on average, thousand persons	Unemployed population on average, thousand people (according to the methodology of the International Labor Organization)
2010	1079346	33011	27265	53462	58478	8045,5	9908	19 164,0	1 712,5
2011	1299991	38390	30471	59377	64303	14333,9	12344	19 181,7	1 660,9
2012	1404669	43379	41966	71771	74131	11480,6	17319	19 317,8	1 589,2
2013	1465198	48372	47712	77986	72603	9562,6	19563	19 399,7	1 510,3
2014	1586915	52724	47139	76068	71755	7695,9	19135	19 035,2	1 847,1
2015	1988544	72596	55789	82778	88636	13813,7	20436	17 396,0	1 654,0
2016	2385367	89268	68460	88996	58858	23229,5	12156	17 303,6	1 677,5
2017	2981227	110296	86537	133213	76140	9117,5	13652	17 193,2	1 697,3
2018	3 560 302	138828	113354	158620	77130	12180,1	17719	17 296,2	1 577,6
2019	3977198	182667	141523	172645	95435	14220,9	21300	17 381,8	1 486,9
2020	4222026	209394	137192	186049	113642	14406,7	21756	16917,8	1673,3
2021	5450849	255635	157569	235042	134883		25437	16666,8	1709,5
2022	5191028	238589	96163	215550	126905				
correlation coefficient		0,99	0,92	0,99	0,89	0,3	0,65	-0,86	-0,10

The results of the calculation carried out using Excel. The pair correlation coefficient allows you to establish the degree of relationship between the variables Y and X based on a selection of values (xi, yi), . The pairwise correlation coefficient varies from +1 till -1. The closer it is to unity in absolute value, the closer the statistical relationship between Y and X is to a linear functional one. A positive value of the coefficient indicates that the relationship

between the features is direct (with the growth of X, the value of Y increases); a negative value indicates feedback (as X increases, the value of Y decreases). The following qualitative interpretation of the possible values of the correlation coefficient can be given: if | r | <0.3 – there is practically no connection; 0.3≤ | R| <0.7 - medium connection; 0.7≤ | R| <0.9 – the connection is strong; 0.9≤ | R| <0.99 – the connection is very strong.

Based on the results of the calculations, it can be seen that all identified factors have a direct impact on Ukraine's GDP, except for two related to population employment. The strongest degree of direct influence on GDP is provided by expenditures on the development of information and telecommunications (R = 0.99); professional, scientific and technical activity (R = 0.92); education (R = 0.99); health care and social assistance (R = 0.89). Thus, increasing the contribution to these sectors of Ukraine's economy will stimulate general economic development and contribute to reducing social tension in society and reducing the degree of economic marginalization. It can be stated that the development of the communication system, information and telecommunications, the scientific and technical sphere, science and education, the system of health care and social assistance makes a significant contribution to the country's GDP, and at the same time these factors are closely related to indicators affecting the human development index. This confirms the hypothesis of a high degree of interrelation between the impact of informatization of society, its economic development and equal access to the social sphere, education, science and the sphere of health care. Stimulating the development of all these directions will contribute to the growth of GDP and the elimination of significant social differentiation.

As for other factors of direct influence that were analyzed, it can be seen that they have low values of the correlation coefficient in the range of 0.29≤ | R| <0.65, which indicates a weak and medium relationship between the influence of variables X on variable Y. The results of the calculations indicate that the least impact on GDP is the costs of innovation (R = 0.29) and the average impact is the costs of art , sports, entertainment and recreation (R =0.65). Thus, it can be argued that the greater the expenditure on innovation, the less impact they have on GDP.

An interesting result is the inverse relationship between GDP and two factors: the average indicators of the number of the working age workforce (R = -0.86) and the average indicators of the number of the unemployed population (R = -0.10). From the given data, it follows that the growth of GDP affects the decrease in the employment of the working population and the increase in the number of the unemployed population. Let's make a correction, it was taken for analysis to the GDP in actual prices, which is not indexed to the inflation index However, the inverse relationship between GDP and average indicators of the number of working-age labour force is quite high (R = -0.86).

Table 2. Correlation Matrix (Source: Authors)

	У	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	x12	x13
У	1													
x1	-0,42	1												
x2	0,91	-0,20	1											
x3	0,97	-0,40	0,90	1										
x4	-0,52	0,65	-0,43	-0,61	1									
x5	0,96	-0,30	0,93	0,97	-0,49	1								
x6	0,97	-0,32	0,92	0,97	-0,52	0,99	1							
x7	0,89	-0,68	0,73	0,91	-0,74	0,83	0,84	1						
x8	0,90	-0,64	0,75	0,93	-0,76	0,85	0,87	0,99	1					
x9	0,92	-0,62	0,78	0,95	-0,73	0,88	0,89	0,99	0,99	1				
x10	0,95	-0,52	0,84	0,98	-0,66	0,93	0,93	0,96	0,98	0,98	1			
x11	0,86	-0,76	0,68	0,81	-0,63	0,74	0,75	0,93	0,91	0,91	0,87	1		
x12	0,89	-0,71	0,70	0,90	-0,89	0,81	0,83	0,99	0,98	0,99	0,96	0,92	1	
x13	0,94	-0,58	0,81	0,96	-0,72	0,90	0,92	0,97	0,98	0,99	0,98	0,90	0,98	1

In order to provide the most complete substantiation of the conclusions made, multicollinearity between the factors was analysed, which makes it possible to detect a linear relationship between all variables, which can be manifested in a functional or stochastic form. Multicollinearity provides an opportunity to investigate the relationship between the selected factors and to carry out a quantitative assessment of the closeness of the relationship using the methods of correlation analysis. The final goal of the correlation analysis is the selection of factor characteristics X1, X2, ..., Xi for further construction of the regression equation. The first step of our research will be the selection of factors X1, X2, ..., Xi, which can be included in the multivariate regression model in the future. The method of sequential step-by-step inclusion or exclusion of factors in the model allows you to choose from a possible set of variables exactly those that will enhance the quality of the model. When implementing this approach, a correlation matrix was calculated using Excel (Table 2). The presence of collinear factors is revealed on the basis of paired correlation coefficients. Factors Xi Xj are considered collinear and if Rxixj > 0.7. Only one of the interrelated factors can be included in the future model. If there are no collinear factors among the factors, any factors that significantly affect У. can be included in the mode.

The calculated correlation matrix made it possible to select the factors with the greatest collinearity. The following 4 factors were attributed to these factors: information and telecommunications *(X1);* professional, scientific and technical activity *(X2);* education *(X3);* health care and provision of social assistance *(X4)*.

These factors were used as a basis for the construction of the future multifactorial regression, which will make it possible to determine the prospects of further economic development of Ukraine and the influence of these factors, which are the most significant for assessing the degree of economic marginality. Data for regression analysis are presented in Table 3.

Table 3. Data for regression analysis (Source: Authors)

Year	GDP, UAH million in actual prices (У)	Information and telecommunications, UAH million. *(X_1)*	Professional, scientific and technical activities, UAH million. *(X_2)*	Education, UAH million *(X_3)*	Health care and provision of social assistance, UAH million. *(X_4)*
2010	1079346	33011	27265	53462	58478
2011	1299991	38390	30471	59377	64303
2012	1404669	43379	41966	71771	74131
2013	1465198	48372	47712	77986	72603
2014	1586915	52724	47139	76068	71755
2015	1988544	72596	55789	82778	88636
2016	2385367	89268	68460	88996	58858
2017	2981227	110296	86537	133213	76140
2018	3 560 302	138828	113354	158620	77130
2019	3977198	182667	141523	172645	95435
2020	4222026	209394	137192	186049	113642
2021	5450849	255635	157569	235042	134883
2022	5191028	238589	96163	215550	126905

The statistical analysis of multivariate regression is carried out similarly to the analysis of simple linear regression. As a result of the statistical analysis, the standard error must be estimated, the accuracy, adequacy and reliability of the obtained model are calculated. The accuracy of the model is characterized by coefficients: R – correlation coefficient, R2 – coefficient of determination and standard error. These coefficients take values from 0 to 1 (modulo) and characterize R - the strength of the relationship between the data, R2 - the percentage of situations that are described. The coefficient of determination R2 represents the share of the variation of the dependent variable Y, which is explained by the relationship of Y with variables X. In our case, these coefficients are presented in the form of Table 4.

These indicators take insufficiently large values, which indicates a fairly high accuracy of the model. The next step is to calculate the standard error, which shows how much the original data points deviate from the straight regression. The value of the standard error should not exceed 30% of the absolute value of the difference between the maximum and minimum values of the time series. In our case, the difference in values is equal: 5191028 – 1079346 = 4 111 682.

Table 4. Results of regression statistics (Source: Authors)

Regression statistics	Value
The multiple R	0,997631916
R^2	0,995269441
Standardized R^2	0,992904161
Standard error	128676,8177
Observations	13

The standard error value is 128676.8177. Thus, (128676.8177/4 111 682)*100 = 3.12%. This indicator does not exceed the maximum value of the standard error, so the model is sufficiently reliable. The model is considered reliable if these coefficients do not exceed the absolute value of 0.05 (Table 5).

Table 5. Results of diapersion analysis (Source: Authors)

Dispersion analysis					
	df	SS	MS	F	Significance F
Regression	4	2,7868813	6,9672112	420,7829756	0,024944409
Remainder	8	1,3246211	16557723402		
Total	12	2,8001313			

In our case, the reliability parameters are equal to the F-criterion (420.78>0.05). This indicator is very high and indicates the high reliability of the model. But according to the P-value, one of them for Y = 0.024944 <0.05, which in turn indicates a sufficiently high reliability of the model.

The adequacy of the model is characterized by the autocorrelation coefficient R, which can take values from 0 to 1, and for the adequacy of the model, its value should be as small as possible, that is, close to 0. Unlike the correlation coefficient, which shows the strength of the relationship between dependent variables, the autocorrelation indicates the strength of the relationship between the values of one variable. The results of the obtained regression equation are presented in Table 6.

Table 6. Regression equation results (Source: Authors)

	Coefficients	Standard error	t-statistics	P-Value	The lower ones 95%	The upper ones 95%
Y-intersection	628960,3	269766,0	2,331502	0,048048	6878,667	1251042,0
Variable X 1	12,06289	3,518563	3,428359	0,008976	3,94907	20,17672
Variable X 2	-3,303367	2,406803	-1,37251	0,207148	-8,85346	2,246732
Variable X 3	13,87398	4,318032	3,213034	0,01236	3,916586	23,83138
Variable X 4	-7,838276	3,994921	-1,962060	0,085385	-17,0505	1,374027

It was obtained the following equation of the multivariate regression model based on the calculations:

$$y = 628960{,}37 + 12{,}06 \times X_1 - 3{,}30 \times X_2 + 13{,}87 \times X_3 - 7{,}83 \times X_4 \quad (1)$$

where: Y – forecast volumes of GDP, UAH million.; X_1 – Information and telecommunications, UAH million; X_2 – Professional, scientific and technical activities,

UAH million; X_3 - Education, UAH million ; X_4 - Health care and provision of social assistance, UAH million.

Based on the given regression statistics and the obtained equation of the multivariate regression model, it should be concluded that information and telecommunications and investments in education have the greatest influence on the formation of GDP. Thus, of all the factors that were the basis of the analysis and formed the basis of indicators of economic marginality, it turned out that it is the informatization of society and free access to education that form the foundation for reducing the marginalization of society. In the resulting equation of the multivariate regression model, two indicators, namely: professional, scientific and technical activities and health care and social assistance have a low impact on the country's GDP, since the sign of these variables in the equation is negative.

The study investigated factors influencing GDP formation in Ukraine that also serve as indicators of economic marginality. The research reveals that the development of the digital economy, set against the backdrop of societal informatization, is a product of the evolution towards a post-information system and a knowledge economy. The statistical methods employed confirm the significant contribution of information technologies and the education system to the country's GDP. These factors are crucial indicators of economic marginality, and without considering them, it is challenging to forecast the future development of both society and the economic system.

On one hand, marginality reflects the instability within social life; on the other hand, significant processes and emerging future realities often arise at the intersection of collapsing social and spiritual structures. While the transformation process inherently involves the emergence of marginal strata, it is important to acknowledge that the current scale and pace of economic marginalization in Ukraine are becoming increasingly concerning.

The marginalization of Ukrainian society is characterized by the emergence of a new class of marginals who possess high levels of education and qualifications. These individuals have a well-developed system of needs, high social expectations, and significant political activity. As a result of declassification, these marginal groups undergo changes in their value systems, diverging from the values they previously held.

Discussion

In the context of the techno-informational evolution and the development of an information society in Ukraine, there is a noticeable increase in economic inequality. Research into economic marginality—a highly controversial social phenomenon under these conditions—has become particularly relevant. Today marginalization affects not only individuals but also entire social groups. It is important to note the heightened intensity of marginal processes. They are characterized by the disruption of socio-economic ties and the marginal status of

individuals or groups within the economic system. Economic marginality, within the broader scope of marginality, is a complex process that can lead to both negative and positive transformations within the social structure. In the face of ongoing transformational processes affecting modern Ukrainian society, economic marginality represents the displacement of individuals or entire social groups beyond the existing social and economic frameworks.

Conclusion

The study was conducted on the assessment of the impact of economic marginality in the conditions of the digital economy. Conclusions are made regarding the increase in the intensity of the marginalization of society, the main features of which are, first of all, the breakdown of socio-economic ties, the limited state of the object in the economic system, the low level of the human development index and limited access to social benefits. The conducted research made it possible to assess the factors of influence associated with the emergence of economic marginalization on the general economic development of the country. To solve this problem, a multifactorial regression analysis was used, which made it possible to obtain an economic-statistical model for substantiating the influence of each factor. As a result, the factors that are associated with the emergence of economic marginalization and have an impact on the country's GDP were determined.

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Author Contributions

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Conflict of interest

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