Digital Tools to Ensure Business Competitiveness and Self-Development of the Territories

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Abstract

The article is devoted to the identification of the application areas of digital tools (DT) to ensure the business competitiveness and self-development of the territories. The issue of finding ways to establish sustainable forms of self-development of the territories by building the competitive environment for the functioning of the business sector in the digitalisation conditions is increasingly gaining popularity and relevance, which determines further scientific exploration in this scientific area. The issue of substantiating the provided business competitiveness and self-development of the territories requires qualitative deepening, based on the current realities of digital development of progressive economic systems in modern conditions. The methodological approach is proposed to assess the level of business competitiveness in the context of ensuring self-development of the territories in the digitalisation context, which is built using the tools of the taxonomic analysis, which allows for the selection of analytical parameters in the absence of restrictions on their quantity, qualitative nature, dimension or type of the selected descriptive statistical parameter, and to maintain the representativeness of the assessment despite the possible heterogeneity of the array of analytical parameters. The proposed methodological approach includes the following sequence of actions and calculations, namely; formation of the complex system of analytical parameters; normalization of the values of the analyzed parameters; qualitative analysis of the constructed array of analytical parameters; construction of the ideal vector, calculation of the values of the taxonomic distance between the normalized levels of analytical parameters and the values of the ideal vector; calculation of the intermediate calculated values to assess the level of business competitiveness in ensuring self-development of the territories represented by various types of deviations; calculation of the value of the maximum deviation of analytical parameters from the ideal vector; determination of the integral assessment of the level of business competitiveness in ensuring self-development of the territories; analytical interpretation of the obtained integral assessments using the

Harrington verbal-numeric scale. Directions for the application of DTto increase the level of business competitiveness and to ensure self-development of the territories are proposed.

Keywords: Digitalization, Digital Tools, Open Data, Blockchain, Bid Data, Smart City, Artificial Intelligence, Internet of Things, Self-Development, Region, Business Competitiveness.

Introduction

Today, one of the key problems to ensure stable functioning of the regional economic systems is the search for relevant forms of organization and instrumental support to implement the systemic policy in the territorial development, which is due primarily to a wide range of risks and threats caused by the action of the legal regime of martial law and the associated challenges, embodied in the deepening of the asymmetry of spatial development of the territories, the intensification of problems of the socio-demographic nature, the physical destruction of the industrial and production potential of individual regions and the general reconfiguration of internal and external economic relations within the regional systems. In this context, the issue of finding ways to establish sustainable forms of self-development of the territorial entities by building the competitive environment for the functioning of the business sector becomes particularly relevant. This approach is based on the idea to achieve progressive synergy of interaction between factors of the stable environment to carry out the entrepreneurial activity and the targeted management policy aimed at ensuring the optimal involvement of existing components of the resource potential of the regions and building the appropriate network of interregional ties, which ultimately allows forming the systemic basis for the development of the competitive potential of the entrepreneurial sector based on self-development of the territories.

Self-development as an economic category is characterized by high level of complexity and can be defined as a systemic process to ensure the balanced development of the regional economic system, based on the rational use of existing resource potential and competitive advantages to achieve a high level of manageability of the organizational and managerial, financial, infrastructural and social subsystems of the region.

It is worth noting that the self-development concept of the territories is in close semantic and ontological relationship with the concept of business competitiveness, which function simultaneously within the specific regional economic system, interacting with each other in terms of the issues of formation, distribution and use of productive forces and the external effects of development generated by them, both positive and negative.

The self-development concept of the territories in its content covers not only accumulation and reproduction of existing elements of the resource potential, but also the capabilities of the system itself to ensure transformation of the relevant reproduction into sustainable competitive advantages based on ensuring their institutionalization and applying measures to stimulate the initiative activity of the business sector. In turn, the business competitiveness level directly depends on spatial conjuncture conditions, which are determined by the degree of infrastructure provision, the availability of qualified personnel, the development level of the local sales markets, and the characteristics of the regional innovation ecosystem. Thus, achieving the high level competitiveness by the business sector contributes to the growth of the volumes of generated added value, received tax revenues and is generally a catalyst for the investment and innovation activity of the territories, thereby expanding the financial base of their stable functioning, forming the appropriate prerequisites to accelerate the internal expanded reproduction.

Thus, there is a duality of the structural relationship between the concepts of self-development of the territories and ensuring business competitiveness, creating the corresponding multiplicative effect, because ensuring the sustainability of self-development of the territories forms an objective basis for the effective functioning of the competitive business sector, which in turn acts as a stimulating factor for the progressive spatial development of territories, contributing to the strengthening of the resource autonomy of the region and effective relevant adaptive properties of the system.

The purpose of the study is to substantiate theoretical and

conceptual foundations and to develop the methodological approach to assess the business competitiveness level in ensuring self-development of the territories in the digitalisation context.

Literature review

Scientific research Guerra J. D., et al. (2025), Peng L. et al. (2025)is devoted to redesigning business models to increase the production sustainability using DT.

Adula M. et al. (2025), Gupta S. T. et al. (2025) analyzed the impact of innovation and DTon the business management, and explored the role of DTand technology to enable the knowledge exchange and business development.In Liao M.-H. et al. (2025), Kochuma, I. et al. (2024), Shwawreh S. et al. (2025) the features of development of the business strategy using DTare investigated, the marketing activities of the enterprise in the digital age are analyzed.

Lal R. et al. (2024), Salah A. H. et al. (2024), Abramova A. et al. (2021) assessed the optimizing of digital marketing strategies, and determined the impact of DTon the e-commerce development.

Varga J. et al. (2024), Sprokholt A. et al. (2024), Telukdarie A. et al. (2024) analyzed the impact of DT on the business competitiveness of Hungarian and Slovak enterprises, investigated business activity tools to support decision-making in digital transformation, and provided the analysis of DTto promote digital business opportunities.

Sousa M. (2024), Hazlehurst C. et al. (2023), Ravindran D. et al. (2023) investigated the role of digital communication technologies in the international business, and outlined the impact of the Internet of Things on the business efficiency and sustainability.

Csordás A. et al. (2022), Niemann J. et al. (2021), Dabas S. et al. (2021) analyzed the existing tools for digital business transformation, and assessed the advantages and disadvantages of implementing digital marketing tools at enterprises. Aquino-Arrieta K. et al. (2020), Řepa V. et al. (2019), Aagaard A. et al. (2018), Viknianska A. et al. (2021) analyzed the digital model as a tool to test the digital entrepreneurship in the economic system transformation.

However, it should be added that in modern conditions, the study of the issues of ensuring business competitiveness and self-development of the territories requires its qualitative deepening, based on the current realities of digital development of the progressive economic systems. After all, the possibility of the qualitative integration of the business sector and territorial entities into the modern digital environment determines their ability to overcome existing limitations of traditional models to ensure socio-economic development; effective use of information, knowledge, and intellectual resources of territories; the integration into global chains of the added value generation and generally serves as the indicator of institutional progressivity in the public administration, a guarantee of the transparent and legal regulatory system.

Methodology

Based on the above, it can be concluded that the issue of ensuring business competitiveness and self-development of the territories in modern trends of the digitalization of socio-economic systems is characterized by complex nature, covering a wide range of the influential variables and factors that determine the ability of spatial systems to organize the sustainable environment, increase competitiveness and achieve a state of self-development. Based on this, there is a need to form the holistic methodology to assess the relevant processes, aimed at carrying out the objective analysis and measuring the current level of business competitiveness in ensuring self-development of the territories, which will determine possible application of the selected digital management tools.

Within the framework of this study, as the methodological basis to implement the analytical procedures for assessing the business competitiveness level in ensuring self-development of the territories in the digitalisation conditions, it is proposed to apply the tools of the taxonomic analysis. The choice of the taxonomic analysis method as a key tool to assess the business competitiveness level in ensuring self-development of the territories is explained by the need to ensure quantitative consideration of the multi-faceted manifestations of the researched issues and the formation of the relevant analytical conclusions. The essence of the taxonomic analysis is to consider the studied objects (regions) and their corresponding

descriptive data as individual points of the multidimensional space with the subsequent calculation of the parameters of the Euclidean distance between these points. The quantitative parameters of the dimension of the corresponding multidimensional system are determined by the number of selected analytical parameters that describe the studied objects. It should be noted that this method allows free selection of analytical parameters without restrictions on their quantity, qualitative nature, dimension or type of the selected descriptive statistical parameter. That is, the taxonomic analysis method allows for preserving the representativeness of the assessment despite the possible heterogeneity of the array of analytical parameters, which is achieved by implementing the procedure to normalize the levels of analytical parameters provided for by this method, which in turn allows for reducing the heterogeneous array of data to the comparable form, obtaining the final result of the integral assessment. Therefore, the application of the taxonomic analysis method in the assessing the business competitiveness level in ensuring self-development of the territories allows for the application of the entire available spectrum of descriptive analytical parameters, forming generalized integral assessments on their basis.

Conducting the taxonomic analysis of the business competitiveness level in ensuring self-development of the territories involves the implementation of sequential calculation, which can be summarized as the following list of stages (Fig. 1):

1. Formation of the complex system of analytical parameters based on a set of indicators that most accurately characterize the research problem, the corresponding set of analytical indicators will serve as an input array of information, based on which the following calculations will be made. In general, the input array of information can be represented by the matrix (1):

$$A=\begin{bmatrix} x_{11} & x_{1j} & x_{1m} \\ x_{i1} & x_{ij} & x_{1m} \\ x_{n1} & x_{nj} & x_{nm} \end{bmatrix}, \quad (1)$$

where: A is the observation matrix;
n –number of analyzed time periods (study periods);
m –number of analytical evaluation parameters;
x_{ij} – value of analytical parameter j in period i.

2. Normalization of the values of the analyzed parameters presented in the observation matrix to ensure the comparability of the corresponding values and the overall representativeness of the following calculation stages (2):

$$z_{ij}=\frac{x_{ij}-\bar{x}_j}{\sigma_{x_j}} \quad (2)$$

where:x_{ij} – level of analytical parameter i in array j;
$\bar{x}_j$ –average value of the analytical parameter and in array j ;
σ_{x_j}–value of the standard deviation for the i-th analytical parameter.

3. Conducting the qualitative analysis of the constructed array of the analytical parameters for the nature of the orientation of the selected indicators in terms of their impact on the business competitiveness level in ensuring self-development of the territories, which involves the differentiation of the selected analytical parameters into parameters whichquantitative growth contributes to the increased business competitiveness level (positive impact) and those that contribute to the reduction in the corresponding level (negative impact).

4. The construction of the ideal vector based on the obtained results of the normalized analytical parameters and the qualitative analysis of their impact on the business competitiveness level in ensuring self-development level of the territories. From the point of view of economic content, the ideal vector reflects the best possible state of the studied system according to the selected array of analytical evaluation parameters. In general, the ideal vector has the following form (3):

$$y_{0j} = \begin{cases} \max_i y_{ik}, \text{provided that the descriptive indicator is positive} \\ \min_i y_{ik}, \text{provided that the descriptive indicator is negatively oriented} \end{cases} \quad (3)$$

5. Based on the obtained values of the ideal vector, the next calculation stage is the calculation of the values of the taxonomic distance between the normalized levels of analytical parameters (during the entire studied period for each of the selected objects) and the values of the ideal vector by using formula (4).

$$d_{i0}=\sqrt{\sum_{j=1}^{n}\left(y_{ij}-y_{0j}\right)^2} \quad (4)$$

where d_i0is – the taxonomic distance between the values of the ideal vector and y_{ij}.

6. Based on the obtained values of the taxonomic distance between the levels of normalized analytical parameters and the ideal vector, intermediate estimated values to assess the business competitiveness level in ensuring self-development of the territories are subsequently calculated, represented by various types of deviations on which basis the value of the integral assessment is determined. To begin with, it is necessary to calculate the average level of the obtained deviations from the reference vector and the corresponding value of the standard deviation (5-6).

$$M(d_{i0})=\overline{d_0}=\frac{1}{m}\sum_{i=1}^{m} d_{i0} \quad (5)$$

where, $M(d_{i0})$is the average level of deviations of the analytical parameters from the ideal vector.

$$\sigma_0=\sqrt{\frac{1}{m}\sum_{i=1}^{m}\left(d_{i0}-\overline{d_0}\right)^2} \quad (6)$$

where $\sigma_0$is the standard deviation level d_i0.

7. The calculation of the maximum deviation of analytical parameters from the ideal vector according to the three sigma rule with subsequent determination of the intermediate indicator to assess the business competitiveness level in ensuring self-development of the territories, which is represented by formulas (7-8):

$$d_0=\overline{d_0}+3\times\sigma_0 \quad (7)$$

where $d_0$is the maximum deviation of the analytical parameters from the ideal vector according to the three-sigma rule.

$$c_i^* = \frac{d_{i0}}{d_0} \quad (8)$$

where $c_i^*$is the intermediate indicator to assess the business competitiveness level in ensuring self-development of the territories.

8. The determination of the integrated assessment of the business competitiveness level in ensuring self-development level of the territories is carried out using the following formula (9):

$$C_i=1-c_i^* \quad (9)$$

where C_iis the integral assessment of the business competitiveness level in ensuring self-development of the territories.

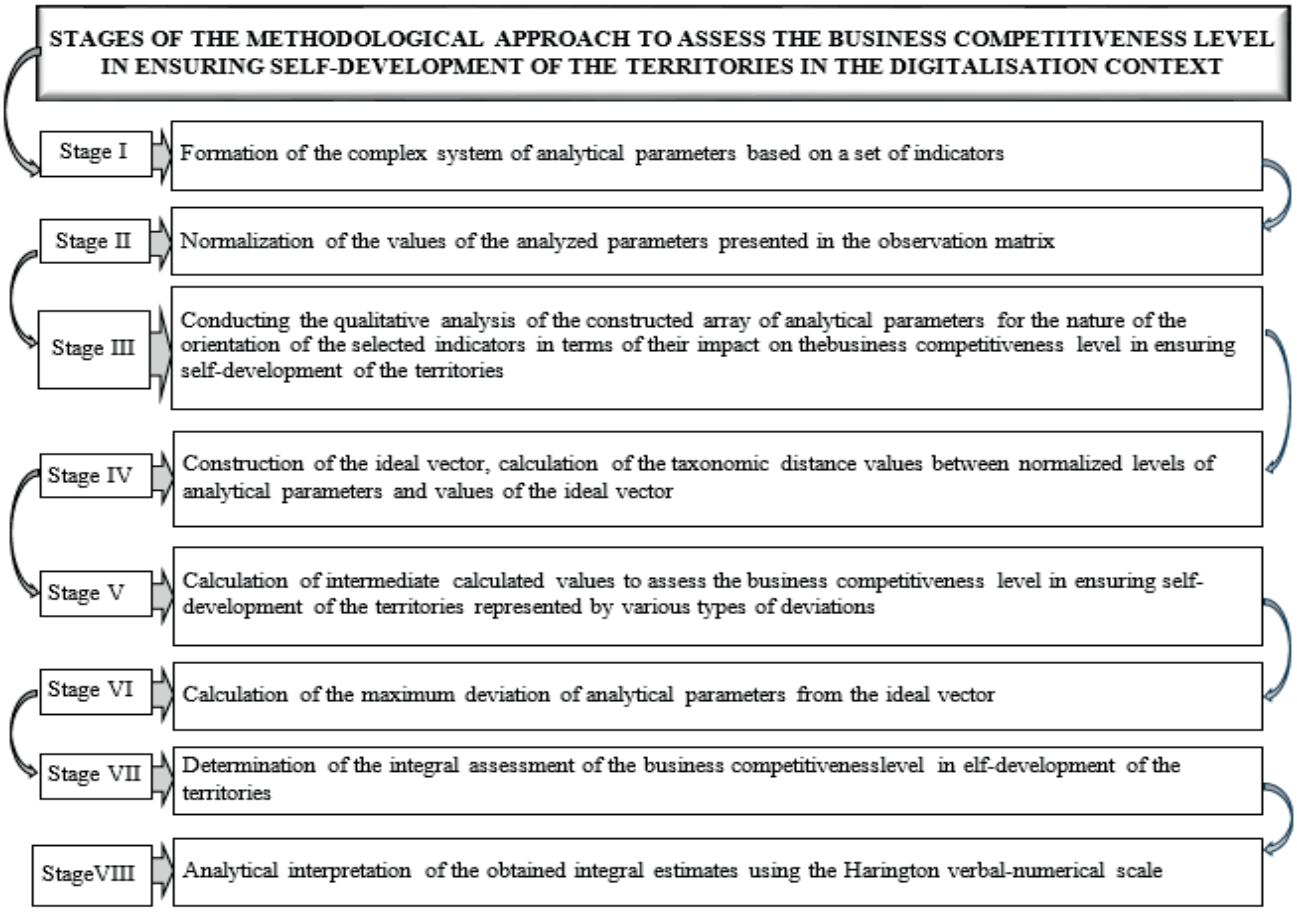
9. The analytical interpretation of the obtained integral estimates using the Harrington verbal-numeric scale, which involves establishing the correspondence of the current business competitiveness level of a particular territory with the corresponding needs and opportunities for the practical implementation of modern digital tools.

The implementation of the above-described stages of carrying out calculation procedures using the methodological apparatus of the taxonomic analysis requires the formation of the input array of information data represented by the system of analytical parameters to assess the business competitiveness level in ensuring self-development of the territories. Taking into account the previously identified features of the researched issues, it is proposed to implement the comprehensive approach to the formation of the system of analytical parameters, which allows covering a wide range of factors influencing the business competitiveness level within regional economic systems, taking into account the economic, social and environmental components of the analysis.

Results

The economic component of the analysis of business competitiveness in ensuring self-development of the territories is designed to take into account, within the framework of the proposed methodology, the effective indicators of the functioning of the region, the basic parameters of financial stability and investment activity of the business sector within the region, which serve as the indicators of the competitiveness level of business entities, while forming the prerequisites for the effective implementation of ensuring self-development. Within the framework of this analytical component, it is proposed to use the following analytical parameters, namely: volume of products sold (goods, services) of business entities; the number of operating business entities; added value at the cost of production of business entities; capital investments; net profit (loss) of enterprises; consumer price index; regional volumes of exports of goods; share of enterprises that have suffered losses in the total number of enterprises.

Fig. 1.Stages of a methodological approach to assess the business competitiveness level in ensuring elf-development of the territories in the digitalization context



Source: built by the authors

The social component of business competitiveness in ensuring self-development of the territories involves supplementing the input array of the analytical parameters with indicators that reflect the provision of the region with human resources, the availability of sufficient financing of the human resource component of the functioning of the business sector, the development level of the knowledge potential of personnel and the prospects to provide the region with a sufficient number of the qualified specialists. This range of indicators directly characterizes the resource

degree of self-sufficiency of the regional entities in the development level of the human capital. Within the framework of this analytical component, it was proposed to apply the following analytical parameters: the number of employees by business entities in the region; personnel costs of business entities in the region; the number of higher education institutions; the number of applicants to higher education institutions.

The environmental component of business competitiveness in ensuring self-development of the territories characterizes the current state of the natural environment of the region, which directly affects the degree of ecological safety of the territories, the level of population health, and available technogenic and ecological risks. Within the framework of this analytical component, it is proposed to use the following analytical assessment parameters: emissions of pollutants into the atmospheric air from stationary sources; current costs of environmental protection in the region; emissions of carbon dioxide into the atmospheric air from stationary sources of emissions by region.

Therefore, the proposed system of analytical parameters to assess the business competitiveness level in ensuring self-development of the territories includes 15 analytical parameters; the study is based on these indicators for the period 2019-2023 (State Statistics Service of Ukraine, 2024).

Table 1. Dependence of the main macroeconomic indicators of Ukraine and the average for the European Union on the state of human capital as a factor of state regulation of the national economy, 2023

Region/ Indicator	Number of higher education institutions	Number of students	Volume of products sold (goods, services) by business entities	Number of employees in business entities	Personnel costs of business entities	Regional volumes of goods exports	Consumer Price Index	Current expenses for environmental protection	Number of operating business entities	Value added by production costs of business entities	Capital investments	Share of enterprises that suffered losses in the total number of enterprises	Emissions of pollutants into the atmosphere from stationary sources	Carbon dioxide emissions into the atmosphere from stationary emission sources by region	Net profit (loss) of enterprises
Vinnytsia	12	37898	358961303	260138	33512737	1698854	104	1173504	73106	109719995	19212450	24	80.5	3860	15760531
Volyn	8	28035	295123421	177437	22885407	823812	105	480223	45974	98217314	12497407	23	4.4	437	8874057
Dnipropetrovsk	29	82444	1411494863	735314	140191535	4696391	104	7758115	160478	366793942	63067801	26	385.1	16311	29471822
Zhytomyr	5	21454	201802230	186305	22969046	531141	105	380934	52588	60583262	11566280	27	7	565	5697931
Transcarpathian	7	22493	131054206	149316	17681914	1359226	105	497766	48761	37858343	8893280	27	2	152	5503674
Zaporizhzhia	12	50540	295402213	213663	32296191	1456744	105	1750939	51204	75727735	8563679	32	52	6862	-71873854
Ivano-Frankivsk	10	36610	174019413	191832	19216980	616154	105	792740	60421	51645150	12002208	20	147	9975	3723451
Kiev	7	20868	881154518	434389	72865670	1837566	105	1501994	124761	253380512	51184367	25	55	3771	43676007
Kirovohrad	7	17270	178062237	146102	17032298	810194	105	299846	39725	52253778	9147036	20	7	476	8475899
Lviv	21	108968	855380676	526134	71688782	2552393	105	1519012	149350	323318393	44790018	26	57	2208	44516834
Mykolaiv	9	21561	168079257	146907	18066517	1000672	105	642501	49324	52715403	8991126	26	5	547	33916
Odessa	21	75355	574738189	397437	44174969	1797917	104	702391	128752	191767018	19150399	31	27	723	15058798
Poltava	8	41174	375757319	282728	38912618	1433241	104	6801886	67411	125755051	24130778	25	30	1928	17239370
Rivne	7	26128	156042832	170756	17601771	594570	104	787405	47982	40204828	13506009	26	7	1608	2743040
Sumy	6	22979	153332816	154301	19168351	701728	104	698415	41630	49035632	8956585	28	12	849	6555486
Ternopil	6	37971	163166516	149189	17593483	686741	104	96786	41357	46445361	11823173	24	8	305	7788928
Kharkiv	30	119032	507562185	439788	49184510	777989	105	1742706	150589	184942862	18057050	33	38	3837	2223350
Khmelnytskyi	11	27109	200328256	207751	22278998	777887	106	540141	67226	59952927	15153113	22	18	2029	11276177
Cherkasy	8	32436	342516924	208046	26644553	1221196	105	557985	57843	91422459	14283813	24	61	2898	10921704
Chernivtsi	3	20964	99741984	111986	9498149	193684	105	187243	42402	28760681	4741733	28	1	152	2516375
Chernihiv	4	15941	143750292	151430	18557554	893235	104	535483	42186	39880134	12631781	31	14	554	2356993
City of Kyiv	83	281428	5776861345	1828760	462832078	9401102	106	5246272	321032	2066501024	226008702	33	27	3968	268727378
x_{jser}	18.3277311	48997	512396589	348447	45223217	2071983	231013	932803	79137.76	155828844	23761159	26	75	3908	3718459
s_j	18.3376864	57114	980347160	380733	76240017	2731877	906708	1709500	60360	320154287	37909368	4	147	5468	26228953

Source: constructed by the authors based on State Statistics Service of Ukraine (2024)

During the practical implementation of the proposed author's methodology to assess the business competitiveness level in ensuring self-development of the territories, the implementation stages of the taxonomic analysis were sequentially carried out, previously defined. Intermediate indicators of the assessment are presented in Table 2.

It is worth adding that, given the current conditions of the legal regime of the martial law and the limited access to descriptive data characterizing the regions of Ukraine that are partially or fully under temporary occupation, the calculation of relevant integral estimates for the Luhansk, Donetsk, and Kherson regions in 2022-2023 is impossible.

Table 2. Intermediate estimated values to assess the business competitiveness level in ensuring self-development of the territories

Region/Year	2019		2020		2021		2022		2023	
	d_{i0}	c_i^*	d_{i0}	c_i^*	d_{i0}	c_i^*	d_{i0}	c_i^*	d_{i0}	c_i^*
Vinnytsia	21,740	0.815	21,950	0.842	21,871	0.830	21,947	0.836	21,370	0.745
Volyn	22,172	0.831	22,377	0.858	22,298	0.846	22,285	0.849	21,989	0.766
Dnipropetrovsk	17,972	0.674	19,133	0.734	18,693	0.709	19,391	0.739	18,530	0.646
Donetsk	21,365	0.801	22,013	0.844	21,887	0.831	-	-	-	-
Zhytomyr	22,233	0.834	22,384	0.859	22,351	0.848	22,591	0.861	22,269	0.776
Transcarpathian	22,167	0.831	22,387	0.859	22,374	0.849	22,456	0.856	22,240	0.775
Zaporizhzhia	20,501	0.769	21,362	0.819	21,073	0.800	22,011	0.839	23,383	0.815
Ivano-Frankivsk	22,072	0.827	22,251	0.853	22,206	0.843	22,257	0.848	22,082	0.769
Kiev	20,777	0.779	21,196	0.813	20,924	0.794	21,429	0.816	20,151	0.702
Kirovohrad	22,305	0.836	22,425	0.860	22,370	0.849	22,411	0.854	22,209	0.774
Luhansk	22,433	0.841	22,567	0.866	22,623	0.859	-	-	-	-
Lviv	20,540	0.770	20,911	0.802	20,743	0.787	20,676	0.788	19,409	0.676
Mykolaiv	21,628	0.811	22,028	0.845	21,893	0.831	22,450	0.855	22,282	0.776
Odesa	20,918	0.784	21,202	0.813	21,075	0.800	21,585	0.822	20,976	0.731
Poltava	21,089	0.791	21,569	0.827	21,518	0.817	21,910	0.835	21,420	0.746
Rivne	22,286	0.836	22,434	0.860	22,322	0.847	22,470	0.856	22,237	0.775
Sumy	22,093	0.828	22,379	0.858	22,300	0.846	22,684	0.864	22,292	0.777
Ternopil	22,332	0.837	22,483	0.862	22,442	0.852	22,446	0.855	22,210	0.774
Kharkiv	20,017	0.750	20,485	0.786	20,338	0.772	21,373	0.814	20,896	0.728
Kherson	22,260	0.835	22,394	0.859	22,333	0.848	-	-	-	-
Khmelnytskyi	22,038	0.826	22,132	0.849	22,107	0.839	22,192	0.846	21,856	0.762
Cherkasy	21,934	0.822	22,130	0.849	22,092	0.838	22,137	0.843	21,816	0.760
Chernivtsi	22,586	0.847	22,682	0.870	22,789	0.865	22,770	0.868	22,640	0.789
Chernihiv	22,272	0.835	22,443	0.861	22,320	0.847	22,770	0.868	22,516	0.785
City of Kyiv	13,943	0.523	15,509	0.595	14,912	0.566	15,765	0.601	10,773	0.375
$M(d_{i0})$	21.26690637		21.63299774		21.5141489		21.72763594		21.16118193	
σ_0	1.802402111		1.480184789		1.611459661		1.506137121		2.512091258	
d_0	26.6741127		26.0735521		26.34852788		26.24604731		28.6974557	

Source: compiled by the authors based on calculations

Using the obtained intermediate estimated values of the assessment of the business competitiveness level in ensuring self-development of the territories, the corresponding integral indicator was calculated. The indicators of the dynamics of the integral assessment of the business competitiveness level in ensuring self-development of the territories are presented in Table 3.

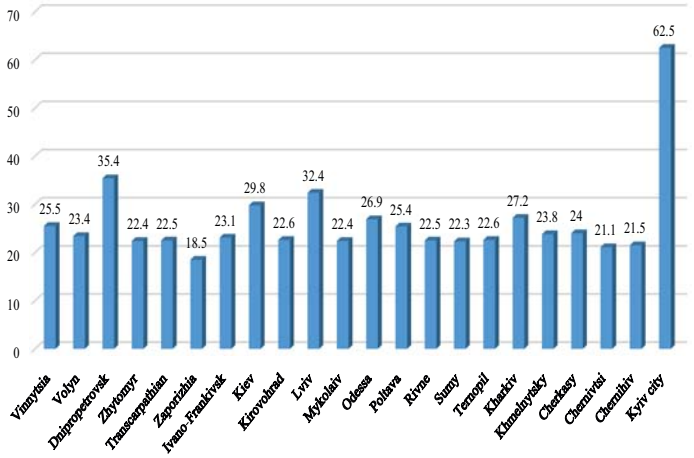
Table 3 – Dynamics of the integrated assessment of the business competitiveness level in ensuring self-development of the territories in 2019-2023

Region	Year , %					Deviation , +/-, %			
	2019	2020	2021	2022	2023	2020Δ	2021Δ	2022Δ	2023Δ
Vinnytsia	18.5	15.8	17.0	16.4	25.5	-2.7	1.2	-0.6	9.2
Volyn	16.9	14.2	15.4	15.1	23.4	-2.7	1.2	-0.3	8.3
Dnipropetrovsk	32.6	26.6	29.1	26.1	35.4	-6.0	2.4	-2.9	9.3
Donetsk	19.9	15.6	16.9	-	-	-4.3	1.4	-	-
Zhytomyr	16.6	14.1	15.2	13.9	22.4	-2.5	1.0	-1.2	8.5
Transcarpathian	16.9	14.1	15.1	14.4	22.5	-2.8	0.9	-0.6	8.1
Zaporizhzhia	23.1	18.1	20.0	16.1	18.5	-5.1	1.9	-3.9	2.4
Ivano-Frankivsk	17.3	14.7	15.7	15.2	23.1	-2.6	1.1	-0.5	7.9
Kiev	22.1	18.7	20.6	18.4	29.8	-3.4	1.9	-2.2	11.4
Kirovohrad	16.4	14.0	15.1	14.6	22.6	-2.4	1.1	-0.5	8.0
Luhansk	15.9	13.4	14.1	-	-	-2.5	0.7	-	-
Lviv	23.0	19.8	21.3	21.2	32.4	-3.2	1.5	-0.1%	11.1
Mykolaiv	18.9	15.5	16.9	14.5	22.4	-3.4	1.4	-2.4%	7.9
Odesa	21.6	18.7	20.0	17.8	26.9	-2.9	1.3	-2.3%	9.1
Poltava	20.9	17.3	18.3	16.5	25.4	-3.7	1.1	-1.8%	8.8
Rivne	16.4	14.0	15.3	14.4	22.5	-2.5	1.3	-0.9%	8.1
Sumy	17.2	14.2	15.4	13.6	22.3	-3.0	1.2	-1.8%	8.7
Ternopil	16.3	13.8	14.8	14.5	22.6	-2.5	1.1	-0.3%	8.1
Kharkiv	25.0	21.4	22.8	18.6	27.2	-3.5	1.4	-4.2%	8.6
Kherson	16.5	14.1	15.2	-	-	-2.4	1.1	-	-
Khmelnytskyi	17.4	15.1	16.1	15.4	23.8	-2.3	1.0	-0.6	8.4
Cherkasy	17.8	15.1	16.2	15.7	24.0	-2.6	1.0	-0.5	8.3
Chernivtsi	15.3	13.0	13.5	13.2	21.1	-2.3	0.5	-0.3	7.9
Chernihiv	16.5	13.9	15.3	13.2	21.5	-2.6	1.4	-2.0	8.3
Kyiv	47.7	40.5	43.4	39.9	62.5	-7.2	2.9	-3.5	22.5

Source: compiled by the authors based on calculations

Thus, as a result of the assessment of the business competitiveness level in ensuring self-development of the territories based on using the taxonomic analysis method, it was found that the vast majority of the regions of Ukraine are characterized by a low level of the business competitiveness. Moreover, during the studied period, two crisis periods of the reduced integral indicator were recorded, which took place in 2020 and 2022, which is explained by the impact of the direct consequences of the coronavirus pandemic and the beginning of the full-scale invasion on the ability to maintain the effective functioning of both the business sector and local authorities.

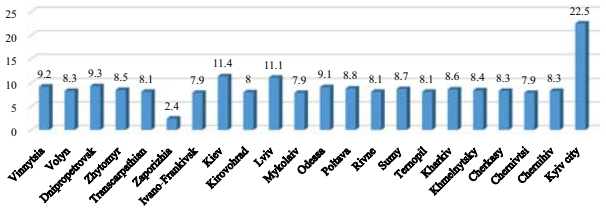
Fig. 2. Integrated assessment of the business competitiveness level in ensuring self-development of the territories, 2023



Source: constructed by the authors

The largest levels of reduction in the integral assessment indicator in 2020 are observed for Kiev (7.2%), Dnipropetrovsk (6.0%), Zaporizhzhia (5.1%) and Donetsk (4.3%) regions. During 2021, a partial recovery of the values of the integral assessment indicator of the business competitiveness was observed, however, with the beginning of the full-scale invasion, a further reduction has taken place. During 2022, the highest levels of the reduced analyzed indicator were demonstrated by the most industrially developed regions of Ukraine, close to the zones of active hostilities, in particular Kiev (2.9%), Kharkiv (4.2%), Zaporizhzhia (3.9%) and Dnipropetrovsk (2.9%) regions. In 2023, the highest indicators of the business competitiveness level in ensuring self-development of the territories are characteristic of Kiev (62.5%), Dnipropetrovsk (35.4%), Lviv (32.4%), city of Kyiv (29.8%), Kharkiv (27.2%) and Odessa (26.9%) regions.

Fig. 3. Deviation of the integrated assessment of the business competitiveness level in ensuring self-development of the territories, 2023.



Source: constructed by the authors

Based on the obtained integral assessments of the business competitiveness level in ensuring self-development of the territories, it is proposed to consider the analytical interpretation of the values of integral assessments in terms of the application of a specific range of DTaimed at increasing the business competitiveness level of the regions and ensuring their effective self-development. The interpretation table is built based on the Harrington's verbal-numeric scale with the corresponding promising areas of the application of DTfor different values of the integral assessment indicator (Table 4).

Table 4. Interpretation of the results of the integrated assessment of the business competitiveness level in ensuring self-development of the territories

The meaning of the integral estimate business competitiveness level	Promising directions for the application of digital tools in ensuring self-development of the territories
Very high (0.8-1)	Implementation of Internet of Things and "smart city" technologies in the functioning of the region's transport, energy and utility infrastructure; strategizing regional self-development based on big data analysis tools and artificial intelligence; application of blockchain technologies in contracting foreign economic activities of business entities; integration into global digital systems
High (0.63-0.8)	Creation of expanded platforms for the provision of digital services, their comprehensive integration with state digital services; introduction of tools for modeling scenarios of socio-economic development based on big data and artificial intelligence technologies; application of blockchain technologies in the formation of digital registers and means of recording contract procedures
Average (0.37-0.63)	Ensuring full-scale digitalization of the local government system in terms of a wide range of electronic document management services, digital service platforms and open data platforms; finding ways to integrate big data analysis tools into monitoring socio - economic indicators of the region; stimulating the business sector to implement digitalization of business processes

The meaning of the integral estimate business competitiveness level	Promising directions for the application of digital tools in ensuring self-development of the territories
Low (0.2-0.37)	Implementation of digital administrative services, in terms of business registration, reporting and licensing; creation of comprehensive educational programs to expand the digital skills of the population; use of specialized software in the field of management as a source of reducing costs associated with the implementation of bureaucratic procedures
Very low (0-0.2)	Ensuring the gradual development of basic elements of digital infrastructure (Internet coverage, digitalization of the simplest accounting procedures in the document flow system, creation of advisory centers for overcoming the "digital divide" for entrepreneurs and the population), search for grant funding for digital development programs of territories

Source: developed by the authors

The key systemic features of ensuring the effective implementation of the territorial self-development include the following:

- promoting the achievement of resource autonomy of the region to limit the economic dependence of territories in terms of ensuring the stability and continuity of supply of certain types of raw materials;

- development of the institutional and legal basis for the functioning of territories on the self-development principles, which involves the legal consolidation and normalization of certain regulatory aspects of ensuring self-development processes both from the point of view of the appropriate level of authority of local authorities and applied mechanisms for financing and ensuring fiscal decentralization;

- ensuring structural and organizational orderliness of the strategic principles of the region's development in terms of analyzing its competitive potential and identifying relevant promising areas for implementing existing competitive advantages;

- ensuring the innovative orientation of the regional development policy, which involves the implementation of modern digital solutions, the implementation of applied principles of building a knowledge economy, and the formation of a trajectory of inclusive development of the region;

- prioritization of the strategic goal-setting strategy of the spatial development of territories, which includes the implementation of scenario planning approaches to form the roadmap for the functioning of the management system in objectification of individual probabilistic scenarios of the state of the external environment in the long and medium term;

- application of the cluster approach in managing the regional self-development, which allows for the reasonable differentiation of territorial entities based on an assessment of their respective competitive capabilities to achieve optimal organization of the system of cooperative relationships and infrastructural support for the expanded reproduction;

- promoting the localization of the region's production potential to achieve the resource and raw material independence of the region's enterprises and resource concentration , which will ensure synergy of interaction between the financial, production, infrastructure, logistics and production components of the region's resource potential.

Next, we propose to consider in more detail the key DTdesigned to increase the efficiency of implementing self-development of the territories and ensuring business competitiveness in modern conditions:

1. Open Data Digital Platforms is an open information environment that provides free access to structured data sets that describe current indicators of the functioning of the state and local authorities, their interaction with the private sector, and contains generalized information on

general economic indicators of the functioning of territories. Digital open data platforms allow for the high level of the information transparency, openness and accountability, serving, on the one hand, as a tool for public control, and on the other, as a source of reducing information asymmetry in the functioning of the business sector.

2. Blockchain technologies are one of the progressive tools to form the digital security infrastructure of the public administration systems, which allows for full protection of the integrity, inviolability and transparency of commercially and publicly sensitive information (data from state registers, land cadastres, budget monitoring, public procurement, etc.), thereby ensuring the high level of reliability of contractual interactions and overall digital security of territories.

3. Digital document management and electronic services tools are a set of digital products aimed at automating key administrative processes related to the documentation of internal procedures and direct management decisions of the local authorities, providing a wide range of state administrative services to the population and business. Using these tools allows, on the one hand, to unify the internal document management system, thereby reducing a significant share of financial and time costs, and on the other, to reduce the administrative burden on the business sector by reducing the bureaucracy degree of the adopted system of the formal interactions between authorities and business.

4. Big Data Analysis Tools represent a set of methodological tools to carry out the procedures for processing and analyzing information arrays of very large data volumes, which allows ensuring a high level of representativeness of the obtained analytical conclusions and can be used to build complex systems to monitor socio-economic indicators of territories and justifying management decisions formed on their basis.

5. Smart City Technologies are complex high-tech tools for optimizing the spatial organization of the city management, allowing for permanent monitoring and analysis of information flows in the field of transport provision, the functioning of municipal services, waste management, energy resource consumption, etc., thereby contributing to cost reduction and improvement of local logistics. Thus, “smart city” technologies allow for the the formation of the holistic digital ecosystem of the territories aimed at ensuring sustainable self-development.

6. Artificial intelligence and machine learning tools are complex software solutions aimed at ensuring multifunctional automation of the standardized administrative operations and forming the expanded system of analytical support for management decision-making based on complex algorithmic models of forecasting and scenario modeling of the state of socio-economic systems.

Internet of Things are represented by high-tech intelligent systems designed to integrate the physical and digital environment of the spatial organization of local economic systems. These technological solutions allow for more effective implementation of control and monitoring functions in the development of the methodological approach to assess the impact of digital technologies on the effectiveness of territorial development management and ensuring their self-development.

Conclusion

Thus, as a result of the study, the application of the author's methodology to assessing the level of business competitiveness in the context of ensuring the self-development of territories in the context of digitalization was substantiated and tested, the corresponding values of integral assessments were calculated and a table of interpretation of the values of the integral assessment of the region's competitiveness and a prospective list of measures for using DTto ensure the self-development of territories was formed.

It is substantiated that the key DTthat contribute to ensuring the self-development of territories by increasing business competitiveness are: digital platforms of open data, blockchain technologies, digital document management tools and electronic services, big data analysis tools, "smart city" technologies, artificial intelligence and machine

learning tools, "Internet of Things" technologies.

Further research is required on issues related to the development of a methodological approach to assessing the impact of digital technologies on the effectiveness of territorial development management and ensuring their self-development.

The scientific novelty of the study lies in the development of a methodological approach to assessing the level of business competitiveness in the context of ensuring the self-development of territories in the context of digitalization, which, unlike existing ones, is built using taxonomic analysis tools.

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