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Article

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Image of Higher Education Institutions: Main Components and Determinants

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Abstract: In the modern world, a significant role in the development of the innovative economy of the state is played by the training of highly qualified specialists who can produce new innovations and knowledge and build an efficient growing economy, manifested in the growth of the country's GDP. The training of such specialists is the responsibility of higher education institutions, which in today's, mainly Ukrainian, realities are struggling for applicants, which manifests itself in the formation of stakeholders' perceptions of the university, i.e., the formation of its own image. The image of a higher education institution becomes an intangible resource on par with industrial and intellectual property. Today, higher education institutions are moving away from just teaching students and are becoming research centers in Ukraine and the world, working in the format of teaching, research, and commercialization. The reputation and perception of a higher education institution (HEI) by its stakeholders directly depend on its ability to operate effectively and serve as a link between highly qualified specialists and businesses. This creates competition between universities in shaping their own image. Along with traditional determinants, including rankings, it is now necessary to consider new factors that reflect the digital level of representation and communication of higher education institutions in the internet space. For this study, we selected higher education institutions (HEIs) with the highest positions in the Times Higher Education rankings in Ukraine and the countries of the Visegrad Group. These countries were chosen because of their geographical proximity to Ukraine, shared history and borders, and because they were among the last to become members of the European Union, which Ukraine aspires to join. This approach allows for an objective assessment of the image of Ukrainian higher education institutions in the context of Ukraine's European integration aspirations. The methodological toolkit of the study was the entropy method of analysing the performance of the selected HEIs according to the Times Higher Education ranking and key indicators of the dynamics and visibility of their websites. The results obtained for the specific weights of the image subindices indicate a 43% influence of presence on the internet. This study empirically confirms and theoretically proves that digital presence and visibility on the internet are significant factors in forming the image of higher education institutions. This indicates the need to strengthen the digital communications and representation of Ukrainian higher education institutions to improve their image. The research results can be helpful for educational institutions, politicians, and communication specialists who seek to enhance the image of their higher education institutions. The obtained results can be used to develop strategies for improving internet presence and communication practices, which will contribute to a general increase in the rating and prestige of higher education institutions.

1. Introduction. The image of higher education institutions (HEIs) directly impacts the economic development of the national economy. The high level of education and the reputation of universities contribute to attracting foreign investment, as investors look for countries with a skilled workforce and innovative potential (Peri & Sparber, 2011; Rizard et al., 2023). In particular, countries with highly ranked higher education institutions, such as the United States and the United Kingdom, attract significant amounts of foreign direct investment (OECD, 2021; Damgaard & Sánchez-Muñoz, 2022). Successful universities graduate qualified specialists who become the driving force behind economic growth. According to a study by the US National Bureau of Economic Research, each additional year of university education increases wages by 10% (Card, 1999). This contributes to developing new technologies, increased productivity, and overall economic growth. The image of an HEI also determines its ability to attract grants and other forms of funding for research. According to the European Commission, higher-ranked institutions receive more research funding from Horizon 2020 and other programs (European Commission, 2020). This funding enables innovative research, the development of new technologies, and their introduction into production, contributing to economic development. Universities with a high level of international recognition can attract talented students from other countries, which also has a positive economic impact. According to UNESCO, the number of international students in the world has grown from 2 million in 2000 to 5.3 million in 2020, with the main recipient countries being the United States, the United Kingdom, Australia, and Canada (UNESCO, 2021). These students not only contribute to tuition fee revenues but also spend money on accommodations, food, and other services, which contributes to the region's economic development. Attracting international students also promotes cultural exchange and international cooperation, which can lead to new economic opportunities and partnerships. Graduates of foreign universities often return to their home countries with new knowledge and skills, which contributes to the economic development of their home countries and the strengthening of international relations (Altbach, 2013). In addition, graduates from highly qualified HEIs become more competitive in the labor market, which helps to reduce unemployment and increase the country's economic stability. They can start new businesses, create jobs, and stimulate economic growth through innovative approaches and entrepreneurial activity (Audretsch, 2007).

With the development of information technology and widespread access to the internet, digital presence has become an integral part of any successful HEI strategy (Karadag et al., 2022). Universities' websites, social media, online courses, and other digital platforms are now not only tools for communication (Mandagie & Rana, 2023; Rutter et al., 2017) but also important elements that influence the overall perception and image of the institution. In the context of globalization and competition for students, faculty, and research grants, universities need to ensure a high level of visibility and activity in the digital space. Rankings such as Times Higher Education provide potential students, faculty, and investors with important information about an institution's academic achievements and reputation. At the same time, modern students are increasingly paying attention to how universities are presented online. The availability of a high-quality and informative website, active participation in social media, and transparency and accessibility of information all influence the decision to choose an educational institution. Digital presence also plays an important role in international cooperation and attracting students from abroad. Universities that make effective use of digital platforms are able to present their programs, research achievements, and opportunities to international students in a favorable light. This, in turn, helps to increase their attractiveness and competitiveness in the international education market

Despite the large number of studies on the impact of HEIs' image on various aspects of their performance, there is still a significant theoretical gap in understanding the complex impact of digital presence on HEIs' performance and economic development in national economies. Most studies focus either on the traditional academic determinants of image, such as academic rankings and research achievements (Huang, 2011; Hazelkorn, 2009; Foroudi et al., 2019), or on specific aspects of digital visibility, such as the use of social media or websites (Bituleanu & Dascalu, 2021; Permatasari et al., 2014; Stevic et al., 2017; Faraoni et al., 2024; Acosta-Vargas et al., 2020). However, comprehensive studies that integrate both of these approaches and assess their mutual impact on economic development are still lacking. The purpose of this study is to fill this theoretical gap by comprehensively analyzing the determinants of the image of a higher education institution and forming an integral index for its assessment. This research focuses on the integration of traditional and modern determinants of reputation, including academic rankings, research achievements, and digital visibility and activity in the internet space. This article provides a significant theoretical contribution to the literature on the management of HEI reputation and its impact on economic development. First, it considers the digital determinants of reputation, which is relevant in the current digital age. Second, this article develops an integral indicator that combines traditional and digital indicators for a comprehensive assessment

of the impact of HEIs on economic development. The practical contribution of this article is to develop recommendations for educational institutions, policymakers, and HEI managers to increase their digital presence and improve their overall reputation. This article also provides practical tools for assessing the effectiveness of HEIs' digital strategies and their impact on economic development. In addition, the results of the study can be used to formulate policies aimed at strengthening the education system and increasing its contribution to the national economy.

The structure of the article consists of the following sections. The next section is the literature review, which presents the previous work of scientists in the field of research on the marketing and management of higher education institutions, the management and support of the institution's positive image, and the analysis of communication methods and channels used to form and support the image of higher education institutions. Methodology and research methods show the data necessary for the research, present the resources from which they were collected, and describe the method by which calculations were carried out within the framework of this research. The following section presents the main results obtained during the research. The discussion and conclusions summarize the key results and outline policy implications, limitations and directions for further investigations.

2. Literature Review. Research by Ivy (2001) states that if a university does not create its own image, its competitors will. The constantly growing competition for students and decreasing funding pose complex challenges to higher education institutions in creating and maintaining an excellent image in the market of educational and scientific services. HEIs are increasingly resorting to aggressive marketing promotion strategies to create a positive image among applicants, students, employers, and sponsors. Ivy (2001) also identified tools specific to the promotion of older UK universities. Using the multidimensional method of structural equations (Sanchez Garza et al., 2024), scientists have proven that the main marketing activity of HEIs in the web space consists of four dimensions—entertainment, exchange, advertising, and personalization—and that these dimensions have a positive effect on the image and the formation of loyalty to HEIs.

In their work, Snadrou and Haoucha (2024) note that many, if not all, HEIs try to build strong brands for their institutions, creating a brand image that influences the perception of HEIs. Brand image is more than just the perception of others, which makes you choose HEIs. It consists of various factors, both rational and emotional, which form a complete image in the surrounding environment. The image needs not only consideration but also evaluation because, in the modern environment, it becomes an intangible asset of the university, which ensures the favor of stakeholders and allows them to survive in a growing competitive environment. Therefore, scientists are increasingly beginning to pay attention to image calculations, offering their own calculation methods and approaches (Spry & Pich, 2021)

According to researchers (Irfan et al., 2020), if an HEI wants to operate in a highly competitive higher education environment, it must develop a positive image by maintaining a high level of service quality to achieve the satisfaction and loyalty of potential and existing students and alumni. It is important for an HEI to take care of its image and to know how its image is perceived by different audiences, how it is perceived in relation to competitors, and how HEIs should monitor the gap between the actual image and the expected image (Nguyen et al., 2022).

HEIs are attempting to increase their competitiveness to become outstanding centers of learning and research (Aithal & Kumar, 2020). Different ranking agencies independently develop their own assessment methodologies and publish their respective rankings of HEIs. Their opinions and assessments transform over time. The purpose of ranking is to generate healthy competition and provide stakeholders with relatively objective information about HEIs. Some rankings consider the institution's industry cooperation, international outlook, alumni, overall reputation, and financial stability. Academic performance is one of the main indicators, if not the main indicator, in most popular global rankings. The fact that countries are different and have different habits in organizing education, including higher education, adds to the complexity and subjectivity of the rankings.

Annually, rating agencies that improve the methodology for calculating the ratings of higher education institutions are confirmed by the evolution of global ratings, dominated by the ARWU, and then by Times Higher Education (THE) in partnership with Quacquarelli Symonds (QS) and Webometrics. In contrast, more user-oriented Leiden Ranking and U-Multirank emerged. U-Multirank rating. There have also been attempts to measure the performance of HEIs by the Lisbon Council. No rating has become an ideal measure of the image of ZVO for management because popularity in the web space is not considered. The ratings of higher education institutions allow you to assess where you should invite highly productive lecturers and scientists.

In their work, Aithal and Kumar (2020) noted that the ratings of higher education institutions constantly consider new indicators to form a holistic picture. Many subcriteria are introduced into the rankings due to national characteristics and the need to eliminate external influence for the sake of the business environment. If the ranking parameters are used differently, the ranking results will be correspondingly incomparable. Hazelkorn (2017) noted that regardless of the criticism of university rankings and their evaluation methodology, they are still used as international quality indicators.

Since 2000, university rankings have become one of the most influential measures. Rankings are not only about students' perceptions of universities but also about the geopolitical positioning of universities and countries. Global rankings are an inevitable manifestation of the internationalization of the higher education market and the global economy. They are evidence that the ability versus the inability to compete at this level has become a powerful driver in itself. At the same time, these developments have changed – and are changing – the ways in which universities interact with the cities, regions, and nations of their founding and vice versa.

In their paper, Hamann and Ringel (2023) identified two ways of criticizing rankings: one focusing on negative consequences and the other drawing attention to the methodological shortcomings of university rankings. Criticism of rankings is aimed at making them a legitimate form of evaluating the activities of HEIs

According to William Locke (2011), everything that is wrong with a ranking matters significantly less than the simple fact that a ranking matters. Scholars (Ghorbanzadeh & Sharbatiyan, 2024) have proven the importance of university website functions in strengthening a university's image and brand reputation through student behavior. There are three indicators for measuring the effectiveness of a site in building an image: ease of use, accessibility and information. The scientists in the study used quantitative sampling methods, and the data were obtained by interviewing the students. To test the hypotheses obtained, partial modelling of structural equations by the least squares method (Kamarulzaman et al., 2018) was used. According to the results of the research, website functions have a positive effect on promoting the behaviour of cocreating values, which in turn improves the university's brand image and reputation. Finally, the brand image created by website features and member behavior has a positive effect on brand reputation. The findings of this study encourage university leaders, information technology managers, and marketers to consider the unique role of university websites in facilitating cocreation, which in turn contributes to a university's brand image and reputation in the higher education marketplace. One way to assess a university's image and reputation is the use of a university rating system.

Research on the role of brand image in higher education suggests that it is essential to understand how students perceive their university. This study builds on existing empirical work (Alcaide-Pulido et al., 2017) and uses a structural equation modelling approach using least squares (LSM) and decision tree analysis on a sample of 624 undergraduate students from England, Spain and Portugal. The results of the study highlight both commonalities and differences between the various cultures and nationalities considered in the study.

Laba (2024) considered the transformation of a university website from an information tool to a tool for promoting HEIs. The author substantiates the strategic importance of the main page of the website, which affects the visibility and traffic of the university itself on the internet.

In today's competitive environment, universities need to increase their visibility, which is possible through promotion on the internet, where websites play an important role in interdisciplinary research (Lazetic, 2019; (Khajeh Nobar et al., 2020) noted that activities in the internet space affect brand awareness and image. The most powerful tool for promoting higher education institutions is their official websites, which are transformed from information resources to tools for promoting and retaining interested and committed individuals.

3. Methodology and research methods.

3.1. Data and sources

The first set of indicators reflects the traditional academic determinants of image, such as academic rankings and research achievements. For the study, we chose the raw data of the Times Higher Education (THE) ranking, which is the most popular of the selected HEIs. In the public domain, THE publishes the evaluation indicators (scores) of the overall ranking of higher education institutions in terms of dynamics by year, which allows for comparative analysis between different higher education institutions and assessment of the dynamics of their performance over time. This rating considers the following indicators: Teaching (TTEA) – the quality of teaching, which includes the learning environment, student-to-teacher ratio, reputation of teaching, and resources and support for students; Research (TRES) – research volume, income and reputation, which takes into account the number of publications, research funding, and the reputation of research activities among the academic community; Citations (TCIT) – The impact of research is measured by the number of citations of scientific papers, which is an indicator of the impact and significance of research conducted at the university; Industry Income (TIND) – industry income reflects a university's ability to attract

funding from commercial enterprises for research and development; International Outlook (TINT) – an international outlook, including the percentage of international students and faculty, as well as international collaboration in research. These indicators provide a comprehensive assessment of traditional academic achievements and the ability of universities to maintain high-quality education and research.

The second set of indicators covers aspects of digital visibility. Google Trends (GTRE) data, as well as "site visibility dynamics" (SVID) and "site traffic dynamics" (SDTR) indicators, were used to evaluate the sites of the selected educational institutions. The results of the search for HEIs (for example, Sumy State University) are presented in Figure 1.
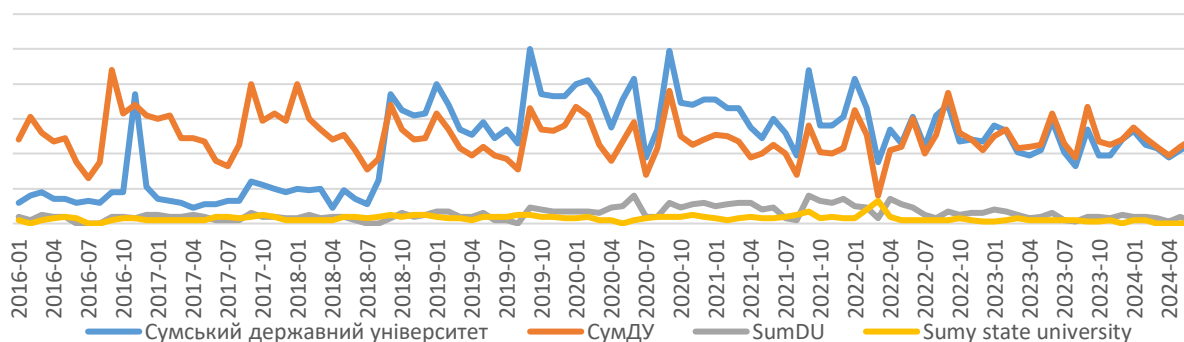
Figure 1. The frequency of user queries in the Google search engine for Sumy State University (obtained using Google Trends)
Sources: developed by the authors.

The initial data of the last two indicators (site visibility dynamics (SVID) and site traffic dynamics (SDTR)) were collected using the tools of the Serpstat service, which provides systematic data on the attendance and visibility of official pages of higher education institutions in the Google search network with subdomains of these countries (Figs. 2-3).
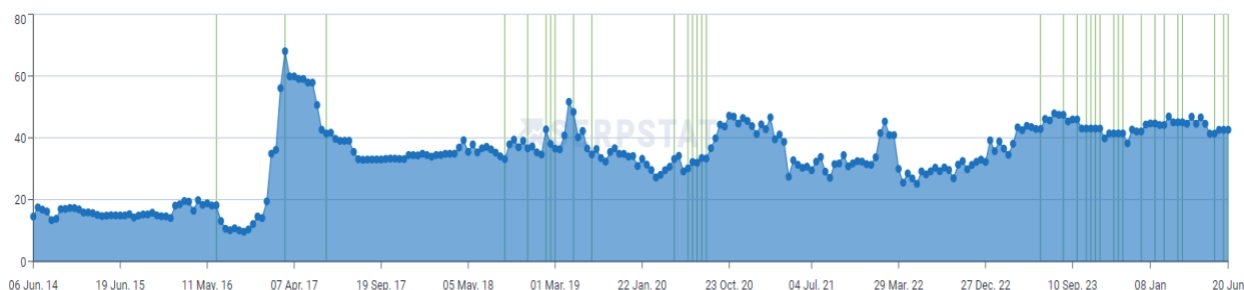
Figure 2. Dynamics of the visibility of the main page of the Sumy State University website in the "Serpstat" service
Sources: developed by the authors.

Figure 3. Traffic dynamics of the main site of Sumy State University in the "Serpstat" service
Sources: developed by the authors.

The countries chosen for this research are those with common historical ties, geography, and cultural similarities, namely, Ukraine and the Visegrad countries (Poland, Czech Republic, Slovakia, and Hungary). In each of these countries, the most influential universities were selected according to The Ranking (THE).

The selected universities have been included in the rankings since 2016 on a regular basis, and each country has at least one university that is not located in the capital of the respective country. The research interval is limited to the years from 2016 to 2024 (data for 2024 were taken at the time of writing); this interval is related to the number of years the selected universities have been included in the ranking (THE). The following HEIs were studied: in Ukraine - Sumy State University, Lviv Polytechnic National University, Ivan Franko National University of Lviv, Taras Shevchenko National University of Kyiv, V.N. Karazin Kharkiv National University, in Slovakia - Comenius University in Bratislava, Slovak University of Technology in Bratislava, Technical University of Kosice, in Hungary - Semmelweis University, Budapest University of Technology and Economics, Eötvös Loránd University, in Poland - University of Warsaw, Jagiellonian University, Adam Mickiewicz University, Poznan, in the Czech Republic - Brno University of Technology, Charles University, Masaryk University.

3.2. Estimated method

To calculate an integral indicator that combines traditional and digital indicators for a comprehensive assessment of the impact of higher education institutions, the entropy method was used. The entropy method is used to estimate the weight of each indicator in the overall analysis model. The entropy method is used to assess the weight of each indicator in the overall analysis model. This method allows us to determine the relative importance of each indicator by calculating the entropy for each indicator and normalizing it. In this context, entropy is a measure of the uncertainty or spread of indicator values. A high entropy indicates that the values of an indicator are highly variable, while a low entropy indicates a more homogeneous distribution of values.

The set of indicators for research is as follows:

$$SCO = \{SCO_1, SCO_{2,...,}SCO_8\}, \tag{1}$$

where $SCO_1 \dots SCO_8$ are the indicators TTEA, TRES, TCIT, TIND, TINT, GTRE, SVID, and SDTR, respectively, $i = 1,2....8$ (d=8).

Each indicator in the corresponding year is normalized to eliminate differences in the scale of the indicators. It is calculated using the following formula:

$$SCO_{iu}^N = \frac{SCO_{iu} - \min(SCO_i)}{\max(SCO_i) - \min(SCO_i)} \tag{2}$$

The next step is to determine the probability of each normalized indicator using the following formula:

$$P_{iu} = \frac{SCO_{iu}}{\sum_{u=1}^m SCO_{iu}} \tag{3}$$

where m – the number of HEIs

The entropy ERIHEI$_i$ for each indicator SCO$_{iu}$ is calculated by the following formula:

$$ERIHEI_i = -KN \sum_{u=1}^m P_{iu} \ln(P_{iu}) \tag{4}$$

where *KN=1/ln(m)* – normalization factor

The indicator weights $SCO_1 \dots SCO_8$ are determined by the following formula:

$$w_i = \frac{1 - ERIHEI_i}{d - \sum_{i=1}^d ERIHEI_i} \tag{5}$$

The integral image index (IRIHEI) of each HEI by year, calculated as a weighted sum of normalized indicators

$$IRIHEI_i = \sum_{i=1}^d w_i * SCO_{iu}^N \tag{6}$$

The IRIHEI makes it possible to quantify the level of uncertainty and weight of various indicators of the image of a higher education institution. It provides an objective approach to the analysis and ranking of universities, considering both rating indicators and internet popularity. To assess the level of image of a higher

education institution, we use the dispersion method, which allows us to determine the variability of the integral indicator. This helps to understand how much the values of individual HEIs deviate from the average, which is important for assessing the stability and reliability of the image.

The variance is calculated using the following formula:

$$\sigma^2 = \frac{1}{N}\sum_{i=1}^{n}(IRIHEI_i - AVIRIHEI)^2 \tag{7}$$

where N is the number of values SCO_{iu}^{N}, $IRIHEI_i$ is the integral indicator of the image HEI, *and AVIRIHEI is* the average value of the image of the HEI.

The gradation scale of the integral level of the image of HEIs has important economic significance since the level of reputation of higher education institutions directly affects their ability to attract students, teachers, funding and international partnerships.

High level: The image of the HEI in the country is significantly greater than the average value for the sample of countries plus one standard deviation. This indicates a strong reputation and high level of recognition both nationally and internationally.

$$I_{IRIHEI_k} \geq I_{AVIRIHEI_t} + \sigma^2 \tag{8}$$

where I_{IRIHEI_k} is the actual value of the IRIHEI in the kth country in the t period, and $I_{AVIRIHEI_t}$ is the average value of the IRIHEI in the t period for the selected countries.

Above average level: The image of the country's HEIs is between the average of the sample of countries and the average plus one standard deviation. This indicates an above-average level of reputation that provides a significant competitive advantage.

$$I_{AVIRIHEI_t} \leq I_{IRIHEI_k} < I_{AVIRIHEI_t} + \sigma^2 \tag{9}$$

Average level: The country's image of higher education institutions corresponds to the average value for the sample of countries. This indicates a stable and fairly positive image but with room for improvement.

$$I_{AVIRIHEI_t} = I_{IRIHEI_k} \tag{10}$$

Below average level: The image of the country's HEI is between the mean minus one standard deviation and the average for the sample of countries. This indicates a need to improve reputation and promotion strategies.

$$I_{AVIRIHEI_t} - \sigma^2 \leq I_{IRIHEI_k} < I_{AVIRIHEI_t} \tag{11}$$

Low level: The image of the country's HEIs is significantly lower than the average for the sample of countries minus one standard deviation. This indicates a weak image and points to the need for significant efforts to improve it.

$$I_{IRIHEI_k} < I_{AVIRIHEI_t} - \sigma^2 \tag{12}$$

A high level of image contributes to the inflow of foreign investment and improves the region's economic situation by increasing the number of students and research. In addition, a strong reputation for higher education institutions increases the country's competitiveness in the global education market, contributing to the development of human capital and innovation.

4. Results. Descriptive statistics of the components of the image of the researched universities of Ukraine and the Visegrad Four for the selected universities, in a limited range of years from 2016 to 2024, are presented in Table 1.

Table 1. Descriptive statistics indicators

Indicator	Mean	Max	Min	Standard deviation
TTEA	23,27778	45,2	15,1	5,45413

TRES	15,0366	33,1	3,1	6,310994
TCIT	31,71503	94,5	1	22,02923
TIND	35,68627	70,3	1,4	8,286213
TINT	43,5634	81,7	19,5	14,11373
GTRE	592,8105	1985	98	337,8667
SVID	241,4614	1418,07	0,65	268,7065
SDTR	404584,3	2187765	1126	508915,9

Sources: developed by the authors.

The results of using the entropy method to determine the share of each IRHEI component are presented in Table 2.

Table 2. Specific weight of each IRHEI component (*weights of indicators $SCO_1 \ldots SCO_8$*)

TTEA	TRES	TCIT	TIND	TINT	GTRE	SVID	SDTR
0,104709	0,120124	0,16859	0,03613	0,137585	0,10506	0,13502	0,19278

Sources: developed by the authors.

According to the results of calculations of the share of indicators, 43% of the influence on the image of higher education institutions (HEIs) is made up of indicators of presence and popularity on the internet. This indicates the significant role of digital indicators in shaping the overall image of higher education institutions. In particular, these indicators include Google Trends data, website visibility dynamics, and website traffic dynamics. The weights of these indicators indicate that higher education institutions with high activity and popularity on the internet have a better image.

It was also determined that the weights of the following indicators are greater than the average value (0.125), which indicates that they have a significant impact on the image of the institution: website traffic dynamics (0.1928), citation of scientific papers (0.1686), international view (0.1376) and website visibility dynamics (0.1350). These results emphasize the importance of both traditional academic indicators such as citations and international views and digital determinants such as website traffic and visibility in shaping the image of an HEI.

The dynamics of changes in the integral image indicator (IRIHEI) of the selected HEIs are presented in Table 3.

Table 3. IRIHEI of universities by year

HEI	IRIHEI								
	2016	2017	2018	2019	2020	2021	2022	2023	2024
Ukraine									
Sumy State University	0.1818	0.1816	0.1941	0.2150	0.2290	0.3456	0.3771	0.4077	0.3454
Lviv Polytechnic National University	0.0660	0.0652	0.0732	0.1076	0.1732	0.2578	0.2380	0.2128	0.1675
Ivan Franko National University of Lviv	0.1154	0.1001	0.1190	0.1458	0.1559	0.1614	0.2216	0.2234	0.1656
Taras Shevchenko National University of Kyiv	0.1373	0.1509	0.1462	0.1398	0.1322	0.1364	0.1467	0.1717	0.1942
V.N. Karazin Kharkiv National University	0.1307	0.1401	0.1403	0.1443	0.1536	0.1551	0.1571	0.1546	0.1729
Slovakia									
Comenius University in Bratislava	0.2485	0.2595	0.2670	0.2687	0.2794	0.2934	0.3352	0.3505	0.3676
Slovak University of Technology in Bratislava	0.1739	0.1747	0.1832	0.1654	0.1941	0.1770	0.1753	0.1803	0.2132
Technical University of Kosice	0.1732	0.1732	0.1732	0.1535	0.1704	0.1859	0.2082	0.2267	0.2477
Hungary									
Semmelweis University	0.3559	0.3731	0.3918	0.4333	0.4965	0.5287	0.5713	0.6006	0.6074
Budapest University of Technology and Economics	0.1882	0.2136	0.2074	0.2111	0.2285	0.2314	0.2499	0.2676	0.2933
Eötvös Loránd University	0.2653	0.2819	0.3076	0.3634	0.4024	0.4725	0.5021	0.5218	0.4885
Poland									
University of Warsaw	0.2873	0.3010	0.3132	0.3183	0.3703	0.4171	0.5137	0.5232	0.5730
Jagiellonian University	0.2197	0.2402	0.2334	0.2652	0.3589	0.4209	0.4666	0.5192	0.5418
Adam Mickiewicz University, Poznan	0.1297	0.1357	0.1543	0.1622	0.2156	0.3073	0.3213	0.3713	0.3791
Czech Republic									
Brno University of Technology	0.1911	0.1990	0.2096	0.2107	0.2211	0.2494	0.2450	0.3024	0.1911
Charles University	0.4445	0.4452	0.4820	0.5683	0.5577	0.5675	0.6367	0.6834	0.4445
Masaryk University	0.3651	0.4060	0.4026	0.4562	0.4752	0.5467	0.6162	0.6743	0.3651

Sources: developed by the authors.

The majority of universities show a tendency to improve their image during the study period. Sumy State University shows a significant increase in its image, especially between 2019 and 2023, reaching a peak in 2023. This is indicative of effective strategies for improving academic performance and actively working on digital presence. Similarly, Semmelweis University in Hungary also shows a significant increase in image, reflecting its success in research and international rankings, especially between 2018 and 2024. Taras Shevchenko National University of Kyiv and Charles University in the Czech Republic show a steady increase in their image with slight fluctuations, reaching peak values in 2024. This reflects the sustainability of their academic and research achievements, as well as their successful adaptation to new digital requirements. The University of Warsaw and Jagiellonian University in Poland have shown positive dynamics, especially since 2018, indicating successful investments in research, international projects and digital visibility. The steady increase in the rankings of many universities underlines the importance of integrating traditional academic achievements with an active digital presence to build a positive image internationally. This not only improves the reputation of higher education institutions but also promotes student attraction, funding and international cooperation.

Graphically, the results (IRIHEI) are shown in Figure 4 for selected countries by year and in Figure 5 for Ukrainian universities by year.
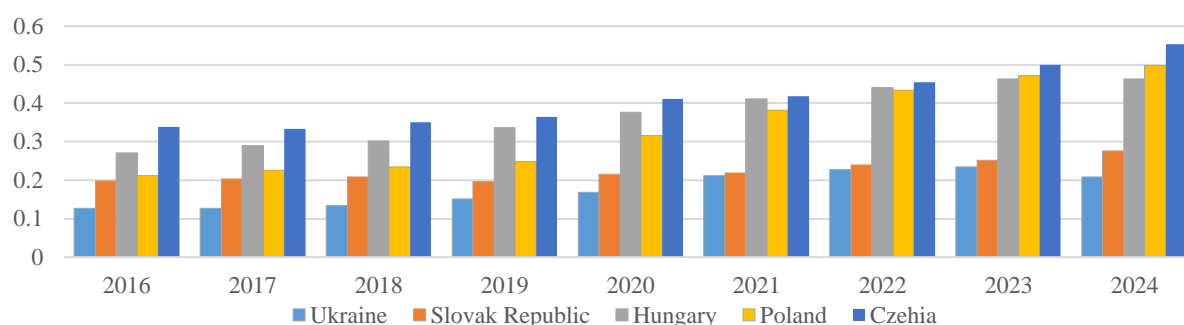
Figure 4. IRIHEI dynamics for analysed countries 2016–2024
Sources: developed by the authors.

The best situation with the image according to data (IRIHEI) by year is observed in the Czech Republic, and the worst situation is observed in Ukraine. Although the image of Ukraine's higher education institutions grew rapidly until 2022, it grew faster only in Poland. During 2023-2024, a decrease is observed only in Ukraine and Poland.
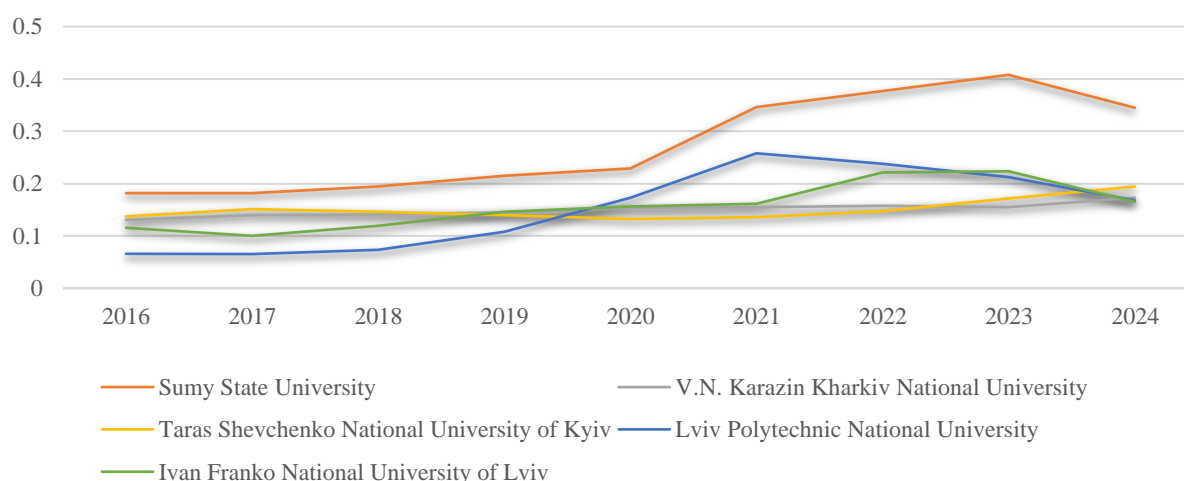
Figure 5. IRIHEI dynamics for Ukrainian universities by year
Sources: developed by the authors.

According to Table 4, the indicators TRES, TINT, and GTRE were above average in 2016, and TCIT and TINT were above average by 2024. This means that the attention given to the citations of SumDU scientists has increased, but the level of research activity, which includes subitems such as reputation, income, and

research productivity, has decreased. Visibility and attendance indicators are critically low, which means the need to involve professional digital marketers and SEO settings for the HEI website.

Table 4. IRIHEI values for Sumy State University with impact indicators

YEAR	TTEA	TRES	TCIT	TIND	TINT	GTRE	SVID	SDTR	IRIHEI
2016	0.0162	0.0274	0.0220	0.0190	0.0467	0.0475	0.0011	0.0018	0.1818
2017	0.0162	0.0274	0.0220	0.0190	0.0467	0.0448	0.0032	0.0022	0.1816
2018	0.0162	0.0274	0.0220	0.0190	0.0467	0.0568	0.0034	0.0026	0.1941
2019	0.0162	0.0274	0.0220	0.0190	0.0467	0.0756	0.0032	0.0048	0.2150
2020	0.0162	0.0275	0.0220	0.0190	0.0467	0.0837	0.0042	0.0098	0.2290
2021	0.0162	0.0290	0.1414	0.0189	0.0552	0.0730	0.0022	0.0097	0.3456
2022	0.0204	0.0334	0.1413	0.0205	0.0772	0.0707	0.0030	0.0106	0.3771
2023	0.0152	0.0366	0.1674	0.0201	0.0867	0.0623	0.0039	0.0156	0.4077
2024	0.0318	0.0414	0.1216	0.0097	0.1005	0.0210	0.0044	0.0152	0.3454

Sources: developed by the authors.

The average IRIHEI values for each country are presented in Table 5.

Table 5. The average value of the indicators and the calculated IRIHEI for the selected years in the selected countries

| Country	Indicator								IRIHEI
	TTEA	TRES	TCIT	TIND	TINT	GTRE	SVID	SDTR	
Ukraine	0.0220	0.0250	0.0337	0.0159	0.0407	0.0299	0.0024	0.0071	0.1767
Slovakia	0.0249	0.0379	0.0341	0.0184	0.0398	0.0207	0.0336	0.0137	0.2229
Hungary	0.0328	0.0486	0.0813	0.0200	0.0789	0.0406	0.0253	0.0449	0.3724
Poland	0.0322	0.0642	0.0719	0.0173	0.0423	0.0178	0.0153	0.0745	0.3355
Czech Republic	0.0335	0.0766	0.0682	0.0194	0.0847	0.0255	0.0506	0.0551	0.4137

Sources: developed by the authors.

Table 6 shows the dispersion of the integral indicator of the HEI image.

Table 6. Dispersion of the calculated integral indicator

Value	Min	Mean	Max	σ
IRIHEI	0.0652	0.2892	0.6833	0.1461

Sources: developed by the authors.

The dispersion values of the integral indicator of the HEI image presented in Table 5 are the basis for determining the variable integral indicator IRIHEI, which allows us to assess the stability and reliability of the image on the scale: high level, above average, medium level, below average, and low level of the integral indicator of the HEI image (Figure 6).
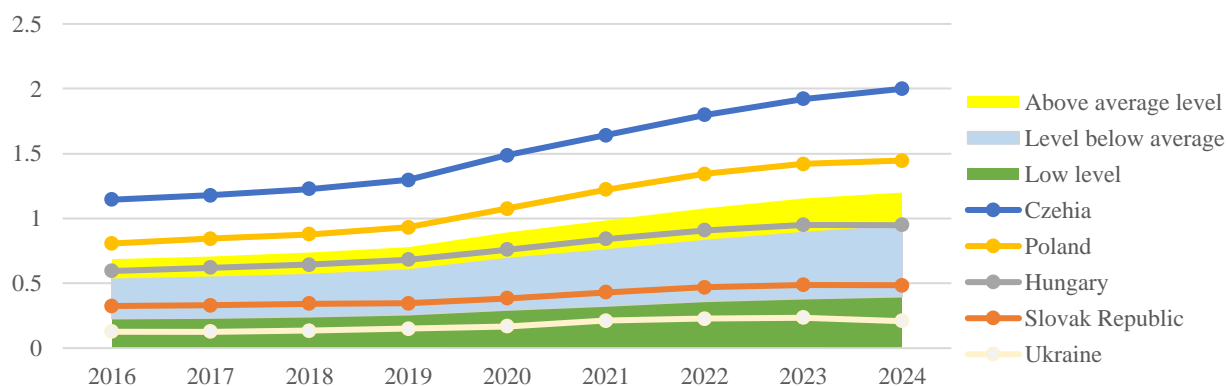
Figure 6. IRIHEI levels in each selected country
Sources: developed by the authors.

Polish and Czech HEIs enjoy a strong reputation and high level of recognition both nationally and internationally. In contrast, Ukrainian HEIs have a low level of integral HEI and require significant effort to improve their image. Compared with Ukrainian HEIs, Slovak HEIs have a better image of their institutions but are the worst among selected EU member states. Figure 7 shows the universities by IRIHEI level.
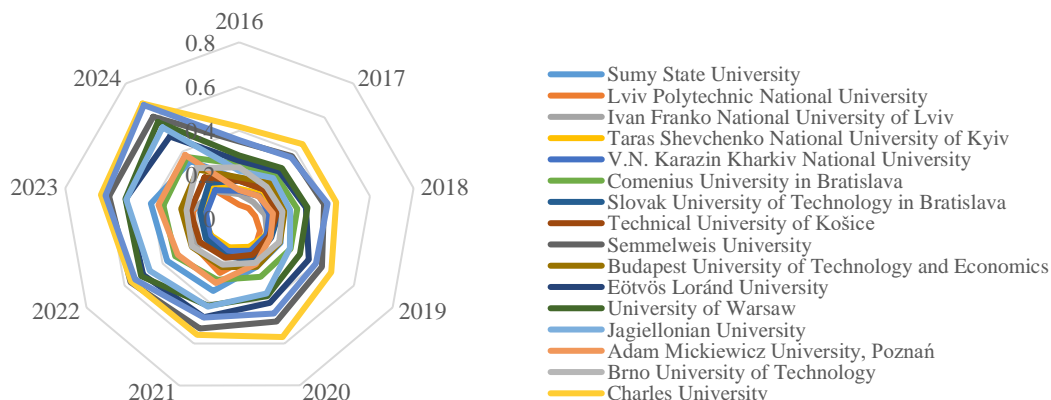
Figure 7. IRIHEI values for the selected HEIs
Sources: developed by the authors.

The top 5 universities according to the IRIHEI level were Charles University (Czech Republic), Masaryk University (Czech Republic), Semmelweis University (Hungary), the University of Warsaw (Poland), and Jagiellonian University (Poland). No university among the selected universities was among the top 5 from Slovakia and Ukraine. Sumy State University turned out to have the best level of image in Ukraine, which also has a strongly leading position in the ranking (THE) compared to other universities in the country.

5. Discussion. The publication develops a methodological toolkit for assessing the image of a higher education institution (IRHEI), which comprehensively combines traditional academic indicators with digital visibility indicators to form a comprehensive assessment of the university's image. This approach is supported by studies such as (Yaping et al., 2023; Alwi et al., 2020; Li, Gong, 2022; Tan et al., 2022). This finding demonstrates the positive impact of online marketing activities on brand awareness and loyalty in higher education. In addition, the use of the Times Higher Education (THE) ranking as the main indicator of the efficiency of higher education institutions is consistent with the works of (Alkhawaldeh et al., 2020; Fang et al., 2020), and (Rizard, et al., 2023), who analysed the impact of global rankings on HEIs and their contribution to research and knowledge production. The entropy method used in the study to weigh these metrics provides a detailed understanding of the factors that affect a university's reputation. For a qualitative interpretation of the integral level of the image of a higher education institution, this paper proposes a method of distribution based on the standard deviation. This methodology is consistent with the approach of Le (2019), who compared different academic rankings to assess their effectiveness in reflecting scientific capabilities and the overall success of HEIs.

The results highlight the importance of a university's digital presence, indicating that 43% of the impact on a university's image comes from its online visibility. This finding is consistent with previous research highlighting the growing role of digital media and online visibility in university branding and reputation management. In particular, (Gao, 2024; Tran et al., 2023). identify how public higher education institutions can increase their visibility in the digital age and (Chapleo et al., 2011) analysed the impact of social media on the popularity of university websites. Similarly, (Hai et al., 2022; Mafofo & Banda, 2014; Opoku et al., 2008) noted that the digital reputation of universities, measured through website visibility and social media activity, plays a key role in shaping their image.

A high level of image has a direct impact on the attraction of funds to both HEIs and other economic sectors in the country and, as a result, the development of human capital and innovation. This is in line with previous studies (Noor et al., 2019; Rutter et al., 2016) showing that highly skilled immigrants have a positive impact on the economic development of countries. (Imbayani et al., 2023; Kuthoos et al., 2014) also emphasize that countries with leading higher education institutions attract significant foreign investment due to their reputation for a highly skilled workforce.

The results of the research can be useful for applicants, HEIs, the Ministry of Education and Science of Ukraine (Educational and Scientific Ministries of the countries), politicians and communication specialists

who seek to work systematically on the image of their higher education institutions. Due to the obtained integral level of image, HEIs can develop effective steps to improve their internet presence and communications.

6. Conclusions. This research fills the theoretical gap in the understanding of the complex impact of digital presence on HEI activities and comprehensively analyses the determinants of HEI image. An integral index, the IRHEI, was formed to assess the image, and its levels were distributed. To calculate the integral index of the HEI image, this paper comprehensively combines determinants such as academic ratings, scientific achievements, and digital visibility and activity in the internet space. The results of the article make a significant theoretical contribution to the literature on the image management of higher education institutions and its impact on economic development. The developed integral indicator, which combines traditional and digital indicators for a comprehensive assessment of the impact of HEIs on economic development, makes it possible to develop recommendations for increasing their digital presence and improving their overall reputation for educational institutions, policy makers and managers of HEIs.

The best situation according to the data (IRIHEI) by year is observed in the Czech Republic, and the worst situation is observed in Ukraine, with the best growth rates occurring in Poland. In 2023-2024, the image of higher education institutions is expected to decline only in Ukraine and Poland. Slovak higher education institutions have the worst situation among the better situations of the EU member states studied, although they are better than those in Ukraine. Hungary has one Semmelweis University, which is among the top 5 universities according to the IRIHEI. The majority of universities improved their image during the study period, which means that their management is interested in a high level of image and understands the direct dependence of the level of image on attracting stakeholders and obtaining funding in a competitive environment.

The results of the integrated level of the integrated level of the image of higher education institutions (IRIHEI) of the selected higher education institutions and countries show a tendency toward a high level of influence of the image of higher education institutions, which is typical for more developed countries, Poland and the Czech Republic; the level above the average belongs to Hungary, and Slovakia has a level below the average. The lowest level of influence is observed in Ukraine.

Thus, the universities of Poland and the Czech Republic have a strong reputation and recognition both at the national and international levels of advantages in attracting international students. At the same time, Ukraine has a weak image of higher education institutions, and its reputation and promotion strategies need to be improved. In this study, the indicators of the main pages of the websites of the studied HEIs were used, and their presence and effectiveness in social networks were not considered, which limits the use of the obtained IRHEIs and their distribution. This study was conducted only at 17 universities in Ukraine and the Visegrad Four. Such a study can be carried out in different ways; it is possible to separately analyse universities by the form of ownership, expand the geography of the study, increase the time horizon, and introduce new components (subindices) to the IRHEI, which will consider, in particular, the activity of social networks, both in general and for each network separately. In further research, it is worth conducting a more in-depth study of each university and comparing the results with those of previous years to determine the dynamics of development and the main areas of improvement. It will be valuable to build a model that will identify the level of dependence on the image of the university and investment in the country.

Author Contributions: conceptualization development of the theoretical framework, S. S., A. B., and M. Z.; literature review and methodology, S. S., A. B., and M. Z.; data collection, S. S., A. B., and M. Z.; formal analysis, S.S., A. B., and M. Z; writing-final draft, S. S., A. B., and M. Z; supervision, S. S., A. B. and M. Z; writing review and editing, S. S., A. B. and M. Z.; major revision, S. S., A. B. and M. Z.

Conflicts of interest: The authors declare no conflicts of interest.

Data availability statement: Not applicable.

Informed Consent Statement: Not applicable.

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Імідж закладів вищої освіти: основні компоненти та детермінанти

У сучасному світі значну роль в розвитку інноваційної економіки держави відіграє підготовка висококваліфікованих спеціалістів, які можуть продукувати нові інновації та знання, та будують ефективну зростаючу економіку, яка проявляється у зростанні ВВП країни. Підготовка таких спеціалістів лежить, зокрема, на закладах вищої освіти, які в сучасних, особливо Українських, реаліях, знаходяться в боротьбі за абітурієнта, яка проявляється у формування сприйняття ЗВО у стейкхолдерів, тобто формування власного іміджу. Імідж ЗВО стає нематеріальним ресурсом на рівні з об'єктами промислової й інтелектуальної власності. Наразі ЗВО відходять від лише навчання студентів, а й стають науково-дослідними центрами в Україні і світі, які працюють в форматі: навчання – дослідження – комерціалізація. Репутація та сприйняття закладу вищої освіти (ЗВО) стейкхолдерами безпосередньо залежать від його здатності ефективно здійснювати свою діяльність та слугувати зв'язуючою ланкою між висококваліфікованими спеціалістами і бізнесом. Це створює конкуренцію між університетами у формуванні власного іміджу. Поряд із традиційними детермінантами, що включають рейтинги, сьогодні необхідно враховувати нові фактори, які відображають цифровий рівень представленості та комунікації ЗВО в інтернет-просторі. Для даного дослідження було обрано заклади вищої освіти (ЗВО) з найвищими позиціями у рейтингу «Times Higher Education» в Україні та країнах Вишеградської четвірки. Вибір зосереджений на цих країнах з огляду на їхню географічну близькість до України, спільну історію та кордони, а також на той факт, що вони одними з останніх набули членства в Європейському Союзі, членом якого прагне стати Україна. Такий підхід дозволяє об'єктивно оцінити імідж українських ЗВО у контексті євроінтеграційних прагнень України. Методичним інструментарієм проведеного дослідження став ентропійний метод аналізу показників обраних ЗВО за рейтингом «Times Higher Education» та ключових показників динаміки і видимості вебсайтів цих ЗВО. Отримані результати питомої ваги підіндексів іміджу свідчать про 43% впливовість присутності в інтернеті. Дослідження емпірично підтверджує та теоретично доводить, що цифрова присутність і видимість в інтернеті є значущими чинниками формування іміджу ЗВО. Це вказує на необхідність посилення цифрових комунікацій та представленості українських ЗВО для покращення їхнього іміджу. Результати проведеного дослідження можуть бути корисними для освітніх установ, політиків та фахівців з комунікацій, які прагнуть підвищити імідж своїх закладів вищої освіти. Отримані результати можуть бути використані для розробки стратегій покращення інтернет-присутності та комунікаційних практик, що сприятиме загальному підвищенню рейтингу та престижу ЗВО.

Ключові слова: імідж університету; маркетинг; рейтинг; метод ентропії; динаміка видимості; динаміка трафіку; вищий навчальний заклад.