Assessing the Digital Pulse: A Comprehensive Evaluation of European Universities´Digitalization Using the IDDI Model

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Abstract

This research introduces an analytical approach to assess universities' digital proficiency within the European Union. Employing a comprehensive model, our method gauges the extent of digitalization across HEIs. We aim to develop a refined Institutional Digitalization Development Index (IDDI) tailored explicitly to Higher Education Institutions, using a combination of decision support models and quantitative analysis techniques.

Our approach leverages predictive analytics to forecast digital trends and identify opportunities for improvement. The tailored model will quantify the digital presence of EU universities and provide insights into the effectiveness of their digital marketing efforts. We will extract valuable information through rigorous quantitative analysis to guide strategic decision-making in marketing and digital transformation efforts.

This study aims to provide marketing researchers and web managers with an essential tool for making data-driven decisions in an increasingly digitalized educational environment.

Keywords: IDDI, Digitization, Universities.

Track: Marketing Methods, Models and Analysis.

1. Introduction

The need for the digital transformation of European universities is becoming increasingly crucial today as society moves towards complete digitalization (Curaj et al., 2020). The transformation process is heterogeneous across all members of society (Siachou et al., 2021). They are faced with the problem of establishing their digital presence unevenly within the digital ecosystem (Gómez et al., 2021).

The drive for digital transformation in European universities can be understood in the broader societal trend towards their full digitalization. The pandemic has accelerated this transition, magnifying the disparities in digital presence between regions, thereby accentuating the digital divide (Shakina et al., 2021). The European Commission's plan for a European Digitalization Decade (2020-2030) highlights the need for a comprehensive strategy to achieve a fully digital European society. It highlights the importance of digital transformation within European institutions, including higher education institutions (HEIs).

As essential pillars of society, European universities must be actively involved in their digital transformation efforts (Dobudko et al., 2019). This engagement focuses on more than the adoption of new technologies. It aims to transform its products, services, and strategies to achieve digital transformation. The advent of the digital revolution has brought about a fundamental change in which institutions that do not use digital platforms face the danger of becoming irrelevant and losing their relevance (Ponzoa et al., 2023).. They need guidance in responding to emerging societal demands arising from digital developments, which requires a solid and comprehensive digital presence and expertise (Zhao et al., 2021).

Universities should prioritize inbound marketing tactics to improve their online presence. (Erdmann & Ponzoa, 2021). These tactics consist of producing content that responds to internet users' search queries to attract them to university websites and convert them into active visitors. The integration of effective digital marketing strategies, together with search engine optimization (SEO) and search engine marketing (SEM), is crucial to achieving greater exposure and engagement in search engine results pages (SERPs). (Ponzoa et al., 2023)..

An essential digital presence component is the usability of websites. Universities should investigate user navigation patterns, focusing specifically on the regions that are visited most and least frequently, as well as the number of clicks required for specific actions (Choon, 2022; Figueiredo & Ferreira, 2022; Wang et al., 2023). This research can improve consumers' digital

experience by optimizing the accessibility and usability of the information and services provided.

The use of key performance indicators (KPIs) is crucial for assessing and improving the online presence of universities (Järvinen & Karjaluoto, 2015). KPIs provide measurable indicators that enable decision-makers to adopt improved activities based on data analysis. These metrics are essential to connect digital plans to the university's overall goals (Verhoef et al., 2021).

The digital transformation confronting European institutions is of utmost significance and warrants immediate attention. A holistic approach is needed, including digital marketing, user experience optimization, and data-driven decision-making. To remain relevant, effective, and responsive to the demands of a technology-centric society, universities must adapt and evolve in a fully digital environment.

2. Research objectives

The primary objective of this research is to provide marketing researchers and university web managers with a comprehensive methodology that facilitates data-driven decision-making toward optimizing natural search engine ranking. This study seeks to contribute to the existing literature on the subject while serving as a practical guide for organizations looking to enhance their SEO strategies.

To this end, and taking as a basis the professional techniques and tools used to improve this positioning, a model is proposed that allows researchers and decision-makers to discover which parameters, indicators, or elements of analysis have to be considered and how these have to be treated individually and as a whole with the ultimate aim of constructing an indicator the IDDI (Institutions Digital Development Index) capable of evaluating the reputation granted by search engines to the different universities to position them or show them in their SERP or search results.

It is well known that both search engines (Google, Yahoo, or Bing) and professional tools (SEMrush, Similarweb, Sistrix, or Ahrefs) give a "Page Rank" "Authoriry score" or "Domain Authoriry" to evaluate on a scale (generally between 0 and 100) the quality of the website in terms of reputation on the web. As aforementioned, the evaluation is paramount in determining the website's position in search engine rankings. This position, in turn, significantly

impacts the website's traffic, particularly from the student community, who constitute the primary user base of the website in this particular case study.

It is also known that these indicators are granted through a "black box" process by the analysis tools. The purpose of this paper is to discover and show a valid methodology for the creation of an "open box" or "glass box" index that allows us to evaluate and track how the different elements of analysis affect the reputation building of the website.

3. Research design and methodology

Using as a basis for the study the overview of the dominance of the homepages of European universities that appear simultaneously in the three main university rankings, namely: QS World University Ranking (www.topuniversities.com), produced by the consultancy Quacquarelli Symonds, Times Higher Education World University Ranking (www.timeshighereducation.com) and the Academic Ranking of World Universities (ARWU), produced by the Center of World-Class Universities at Shanghai Jia Tong University (https://www.shanghairanking.com) a total of 247 universities were selected from 27 European countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden. The study was conducted from January to June 2023.

To extract the data included in the study, the SEMRush tool was used, a solution widely used by the industry to study user behaviour on a specific website or domain, and also used in scientific research ((SEMrush, 2019; Vyas, 2019).

The following elements have been considered:

- Relative to the attractiveness of the website and its interaction with users: (1) Sum of visits: total number of visits that a given domain had had during the six months that comprised the study period. (2) Sum of unique visitors: sum of the total number of unique visitors (different IPs or Internet access user identifiers) accessing each domain studied in each of the months included in the study. (3) Average number of pages viewed: different URLs visited in each session by each visitor or user of the domain accessing each university included in the study. (4) Average duration of the visit: time (in minutes) that a user spends on average in the visits to a specific domain or university

on the Internet. (5) Average bounce rate: considering the bounce rate or percentage of times that a user visits the website of a university (usually the home page) and leaves without performing any other action (interacting with other pages, scrolling through the page visited, spending a minimum time reading or performing any other interaction that shows their interest in the page visited).

- Relative to the digital ecosystem of a specific website: (1) Backlinks: total number of links from other websites that lead or direct to the domain of the different universities analysed. (2) Domains: the total number of domains from other operators in the network that are directed to the domain studied in each university. (3) IPs: sum of the different unique identifiers that point or can direct to the website of one of the universities included in the study.

- (1) Followed links: hyperlinks considered by Google and other search engines to calculate the authority of a given web page. (2) No-followed links: hyperlinks that, due to their technical construction or content, are irrelevant to Google and, therefore, alert the search engine robots so that they are not followed, ceasing per se to transmit authority to the website for its classification in the search engine and its display in the search results. They contribute to the relevance and value of the follow links. (3) Text links: hyperlinks associated with words, a set of words or phrases. They are the primary source search engines, and their robots are used to classify web pages and give them authority (along with other indicators) in their search results or SERP. (4) Image links: hyperlinks associated with tagging images (words or phrases with which they are tagged). (5) Form links: links that lead to general or secondary user records, access to surveys, forms, special reports, or to launch a particular page where data can be entered or displayed. (6) Frame links: the space where the user can view or modify data, display messages and illustrations, or choose between different predefined options; includes a virtual boundary around a structure; examples are the title bar, the menu bar, the border of a frame or the toolbar.

Once all these parameters or indicators were exported from SEMRush to Excel, they were classified by month, compiled, and debugged from SPSS to arrive at a single double-entry table: university to be analyzed and web measurement indicators for each.

4. Results and conclusions of the proposed analysis model.

A correspondence factor analysis was carried out to evaluate the correlations between the elements analysed. Initially, it was intuited that the structural classification of the website would resemble the classification structure provided by the analysis tools in its visual configuration; however, the results obtained were different (table 1 and 2).

Table 1: Rotated component matrix [a]

	Component		
	1	2	3
1. Sum of views	0,156	0,819	0,219
2. Total unique visitors	0,360	0,840	0,076
3. Average Pages/Visits	-0,009	0,021	0,939
4. Average duration of visits	0,031	0,168	0,827
5. Average bounce rate	-0,035	-0,061	-0,778
6. Backlinks	0,982	0,188	0,024
7. Domains	0,175	0,922	0,025
8. Ips	0,161	0,927	0,033
9. Follow links	0,977	0,175	0,026
10. Nofollow links	0,976	0,197	0,021
11. Text links	0,982	0,188	0,024
12. Image links	0,982	0,188	0,024
13. Form links	0,982	0,188	0,024
14. Frame links	0,982	0,188	0,024

Extraction method: principal component analysis. Rotation method: Varimax with Kaiser normalization.

The rotation has converged in 5 iterations.

Table 2. Component transformation matrix

Component	1	2	3
1	0,906	0,416	0,084
2	-0,384	0,719	0,580
3	-0,181	0,557	-0,811

Table 3: Total variance explained (extraction method: principal component analysis)

Component	Sums of squared extraction charges			Sums of charges squared by rotation		
	Total	% variance	Accumulated %	Total	% variance	Accumulated %
1	7,9	56,426	56,426	6,94	49,573	49,573
2	2,709	19,347	75,772	3,363	24,023	73,597
3	1,926	13,76	89,532	2,231	15,935	89,532

The factor analysis explains 89.532% of the variance.

After performing the correspondence factor analysis, a regression is performed with the following adjustments and results:

Table 4: Summary of the model. Fit between the dependent variable (Authority Score) and IDDI.

Model	R	R square	Adjusted R-squared	Standard error of the estimate	Durbin-Watson
1	0,814[a]	0,662	0,658	5,957	1,908

a. Predictors: (Constant), REGR factor score 3 for analysis 1, REGR factor score 2 for analysis 1, REGR factor score 1 for analysis 1
b. Dependent variable: Authority score

Table 5: ANOVA[a]

Model		Sum of squares	gl	Root mean square	F	Sig.
1	Regression	16881,336	3	5627,112	158,586	,000[b]
	Waste	8622,397	243	35,483		
	Total	25503,733	246			

a. Dependent variable: Authority score
b. Predictors: (Constant), REGR factor score 3 for analysis 1, REGR factor score 2 for analysis 1, REGR factor score 1 for analysis 1

Table 6: Coefficients [a]

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statist	
		B	Error	Beta			Tolerance	VIF
1	(Constant)	44,680	0,379		117,883	0,000		
	REGR factor score 1 for analysis 1	1,092	0,380	0,107	2,874	0,004	1,000	1,000
	REGR factor score 2 for analysis 1	8,071	0,380	0,793	21,252	0,000	1,000	1,000
	REGR factor score 3 for analysis 1	1,511	0,380	0,148	3,979	0,000	1,000	1,000

The proposed model shows a high level of congruence with the SEMRush "authority score" for assessing the reputation of university websites in the EU27 region, thus demonstrating its effectiveness in explaining the investigated phenomenon.

We can therefore conclude that the IDDI can be used in the field of analysis of the digital ecosystem of European universities to calculate their potential to appear in the search results pages (SERP) of Google, Yahoo, Bing, and other search engines.

Similarly, the IDDI can be used to measure the degree of online reputation of European universities. This is essential for assessing their digital presence and, therefore, their level of digitalization in this regard.

5. Implications.

The use of algorithms in marketing automation processes is becoming increasingly common. These algorithms belong to patents or are based on calculation rules and methodologies that are not available to their users. They are "black boxes" that need to be deciphered and understood in order to apply them appropriately in terms of the effort/result ratio, the ethics of their applicability and the lowering of the market entry barrier for small competitors with small budgets. IDDI proposes an open methodology through a "glass box" in which researchers and practitioners are shown how to establish an indicator comparable to

the one generated by a "black box" that pursues similar objectives. This indicator explains, in turn, the ratios to be considered (links, visits, web structure...) and the relationship between them in order to implement effective and efficient marketing actions by web managers of educational institutions.

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