

ASPECTS INFLUENCING THE VISIBILITY OF MUSEUM WEBSITES IN THE ORGANIC SEARCH IN SLOVAKIA

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Abstract:Employing 44 tests divided into groups based on their focus, this article concentrates on the quantitative mapping of the contemporary status of the Slovak museum SEO (search engine optimization) websites (N=82). Using the Pareto analysis, 21 most common website problems were identified. The influence of factors (type of founder and administrative classification) on the SEO testing results is statistically verified. This allows us to compare the results of the selected representative national museum with other national museums located in the EU.

Key words: search engine optimization, museum, website.

1. INTRODUCTION

Based on the growing global competition in the market of recreational opportunities [1], cultural institutions need to withstand the increasing amount of pressure with regard to attracting larger audience, achieving a higher number of visits, and their overall visibility. One of the available tools is represented by online channels. They demonstrate the potential to heighten the awareness of cultural institutions as well as to increase the number of both online and offline customers [2]. Gradual digitalization of cultural heritage also synergically contributes towards this [3]. Its presentation in the form of digitalized objects on the existing platform (institutional websites) is, however, a necessary precondition in this regard. If these objects have various technical problems (ambiguity in website specialization, lack of securing information transfer by HTTPS protocol, slow webpage loading, etc.), their visibility in an unpaid, the so-called “organic” part of search results, is lower [4]. The objective of gaining a better position within the results can be achieved by the search engine optimization (SEO).

2. PROBLEM STATEMENT

The SEO is a special application for the purpose of increasing the quality and quantity of organic (earned, natural, or free) traffic from a search engine to a web page or website [5]. Giving reasons for the need of SEO analysis of museum websites arises out of the legislatively declared openness of museums towards the public [6], [7]. Further, objects of cultural heritage must not only be maintained and handled expertly and examined in a scientific manner, but they must also be made available to the public. The SEO represents a battery of techniques and procedures, which aim at improving the structure of websites in relation to the rules and norms of search engines [8], and which ultimately result in increasing the website visits [9]. Online activities of the museum institution website visitors have their specificities. Using the search tools is the most common method for obtaining and searching for information, which is also true for the older population visitors [10].

Exploring the website problems of cultural institutions has been examined in numerous works. However, most of them investigate the usability, availability, and presentation of content or website features [11, 12]. Some of the papers predominantly explore the utilisation of social media that are used for the purposes of communication with the cultural public [13, 14].

Examining the SEO websites of cultural institutions appears to be under examined in the academic research. Increasing the website visits of a particular cultural institution in Hungary [15] or several national cultural institutions of the selected types (libraries, archives, museums) in Serbia [16] are at the centre of attention. The aim of the works is to point out that there exist some specific aspects of website optimization.

The objective of this article is to enhance the knowledge of the contemporary state of museum websites by exploring the model of Slovak museums, which, from the standpoint of the SEO analysis results, examines its administrative categorization determination and the type of founder. The quantitative comparison of SEO analysis of the selected national museums in the EU is also performed. The following research questions have been formulated:

Q1: What are the most common website problems of Slovak museums from the point of view of their organic search visibility?

Q2: Is there a concurrence between the SEO websites results determined by (a) type of founder (b) territorial administrative museum subsuming?

In case of the affirmative answer to *Q2*, the national representative can be selected to compare the achieved status within the SEO in Slovakia and in the EU, and *Q3* can be answered.

Q3: What is the position of the Slovak national representative from the point of view of the SEO measuring results of the selected national museums in the EU states?

3. SEO TESTING AND SLOVAK MUSEUM WEBSITES

In Slovakia, there are 112 museums in eight self-governing regions. The number of websites in the database created for the research purposes does not, however, match this number. The Slovak national museum (SNM) can be regarded as an explanatory example. There are 18 specialized museums subsumed in its structure. They use the SNM website for the presentation of their exposition activity, exhibitions, and other cultural and educational activities. This means that the SNM website was included in the database only once due to the protection of research data before duplicity and subsequent misinterpretation of research results.

A specific situation occurred within the collection of data from three specialized SNM museums as they run their own websites. In this case, all the websites were tested, and those with better score were included in the database. The reason behind this lies in the ethical approach with an effort not to cause any harms by means of results to any of the museums.

On the other side, there is a lack of interest or potential personal and financial inability of a founder to promote museum activity on the Internet. The Slovak legislation explicitly states who or what can be a museum founder. Central state administration bodies (CSAB), regional governments (RG), municipalities and other legal entities (OLE) such as the church or private companies can act as founders [7].

Seven museums were identified in the annual report of Slovak museums [17], which did not mention any URLs. Moreover, they could not be found by entering the full name of the museum into the Internet browser (tested in Google, Yahoo, and Bing). Seven other museum websites were not available during the process of writing this article, or they were actively blocking the access to the SEO analysis. The database regarding the data on the state of Slovak museum website optimization includes 82 instances – unique websites of Slovak museums ($N_{SK} = 82$) (Table 1).

Table 1. Distribution of Slovak museum websites according to regions and types of founder

Region	Number of museums				Founder	Number of museums			
	A	B	C	D		A	B	C	D
<i>Banska Bystrica</i>	16	1	1	1	<i>CSAB</i>	24	16	0	0
<i>Bratislava</i>	18	9	0	1	<i>RG</i>	34	0	3	0
<i>Kosice</i>	8	1	2	0	<i>Municipality</i>	14	0	2	4
<i>Nitra</i>	8	0	0	3	<i>OLE</i>	10	0	2	3
<i>Presov</i>	10	2	0	1	Total	82	17*	7*	7*
<i>Trencin</i>	6	2	1	1	Legend: (A) with an original website;				
<i>Trnava</i>	8	0	0	0	(B) with a duplicate website; (C) with a				
<i>Zilina</i>	8	2	3	0	locked website; (D) without a website;				
Total	82	17*	7*	7*	(*) not included in the research				

TESTS SEO

The results of 44 tests (available at www.seositecheckap.com) can be attributed to achieving one of the three states, which were assigned the score as follows: 0 – the museum website passed the test without detecting deficiencies, 1 – the museum website passed the test, but existing problems were pointed out, 2 – the museum website failed the test. The evaluated SEO tests can be divided into groups (Table 2).

Table 2. Overview of the used SEO tools

Group	Tests
Common SEO (14 tests)	1.Meta Title, 2.Meta Description, 3.Keywords Usage, 4.Heading Tags, 5.Robots.txt, 6.Sitemap, 7.SEO Friendly URL, 8.Image Alt, 9.Inline CSS, 10.Deprecated HTML Tags, 11.Google Analytics, 12.Favicon, 13.JS error, 14.Social Media
Speed Optimizations (15 tests)	15.HTML Page Size, 16.HTML Compression, 17.Site Loading Speed, 18.Page Objects, 19.Page cache, 20.Flash, 21.CDN Usage, 22.Image Caching, 23.JavaScript Caching, 24. CSS Caching, 25.JavaScript Minimization , 26.CSS Minimization , 27.Nested Tables, 28.Framset, 29.Doctype, 30.URL Redirects
Server and Security (6 tests)	31.URL Canonicalization, 32.HTTPS, 33.Safe Browsing, 34.Server Signature, 35.Directory Browsing, 36.Plaintext Emails
Mobile Usability	37.Media Query Responsive
Advanced SEO (7 tests)	38.Structured Data, 39.Custom 404 Error Page, 40.Noindex Tag, 41.Canonical Tag, 42.Nofollow Tag, 43 Disallow Directive, 44.SPF Records

4. RESULTS AND DISCUSSION

On the basis of measuring results in these tests (T_i for $i = 1 - 44$), it is possible to summarize the data on each website and analyse the entry data by means of contingency tables in relation to each test group, region, or founder.

4.1. SEO analysis of museum websites in Slovakia

Each test T_i (for $i = 1$ to N_T) is represented by the weighted mean M_{T_i} by its achieved results in the database. It is true that tests with a higher number of failures achieve a higher average value of unsuccess ranged at interval [0.2]. The distribution of SEO test mean values is in accord with the general Pareto distribution ($K-S$ $p = 0,126643$; $A-D$ $p = 0,041294$; χ^2 $p = 0,182562$). This allows us to select the most common problems of museum websites by means of the Pareto analysis (Figure 1), which statistically separates a limited number of input factors as making the highest impact on an outcome (either desirable or undesirable), cumulating 80% of warnings and website failures. Eight tests (T_i for $i \in \{3, 4, 7, 17, 25, 26, 31, 39\}$) signal high-priority problems.

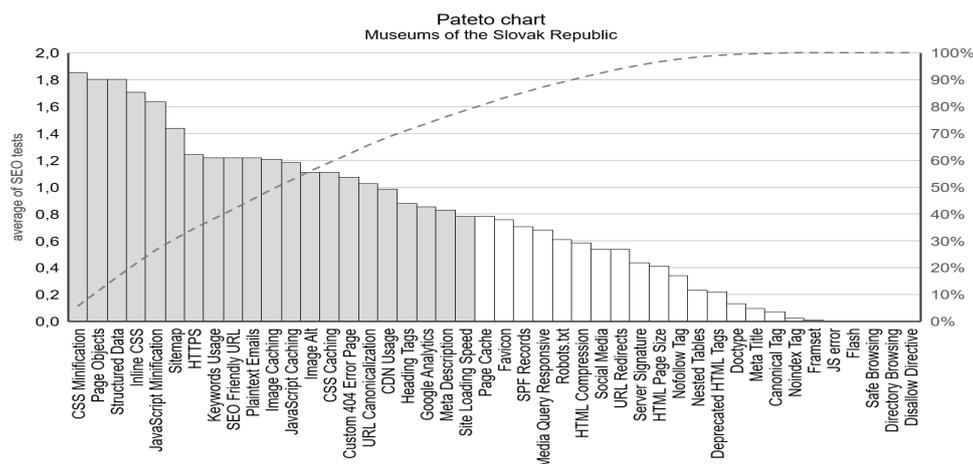


Fig. 1. Pareto chart of the SEO tests of Slovak museum websites

Employing the Pareto analysis, it can be established that the mean value tests $M_T > 0,7800$ fall into the group of tests with a higher number of failures. As far as the first research question, which deals with the most common problems of Slovak museum websites, is concerned, the following summary of 21 problems, distributed according to the particular analysed test groups, attempts to address this issue.

The first group tests *Common SEO Issues* (Figure 2, left) selected eight most frequent technical problems of websites in descending order: the presence of Inline CSS properties unnecessarily increase page size ($M_{T9} = 1,7073$), website does not contain the file *sitemap.xml*, which is important for indexing the content by search tools ($M_{T6} = 1,4390$), absence of primary keywords in the website title and description, ($M_{T3} = 1,2195$), inappropriate use of special characters within URL pages ($M_{T7} = 1,2195$), missing alternative information in the attribute <alt> for better interpretation of the subject of a picture ($M_{T8} = 1,1098$), not using or incorrect use of headings <h1> a <h2> HTML, which help explain the topic or the purpose of web page ($M_{T4} = 0,8780$), missing interconnection with Google Analytics, which offers free analysis of a website in the form of measuring and analysing visitor statistics ($M_{T11} = 0,8537$), missing or incorrect input webpage meta descriptions ($M_{T2} = 0,8293$).

In the group *Speed Optimizations* (Figure 2, right), eight problems were detected: absence of the CSS files minimization, which reduces the web page size and its overall loading time ($M_{T25} = 1,8519$), increased amount of HTTP request web page ($M_{T17} = 1,8049$), absence of the JavaScript minimization ($M_{T24} = 1,6342$), not using cache headers for image caching ($M_{T21} = 1,2073$), for all JavaScript resources ($M_{T22} = 1,1829$) and for all CSS resources ($M_{T23} = 1,1098$). Web page resources (images, JavaScript, and CSS files) are not provided by the CDNs ($M_{T20} = 0,9878$) and time of loading a website exceeding average value for this purpose ($M_{T16} = 0,7865$) [18], [4].

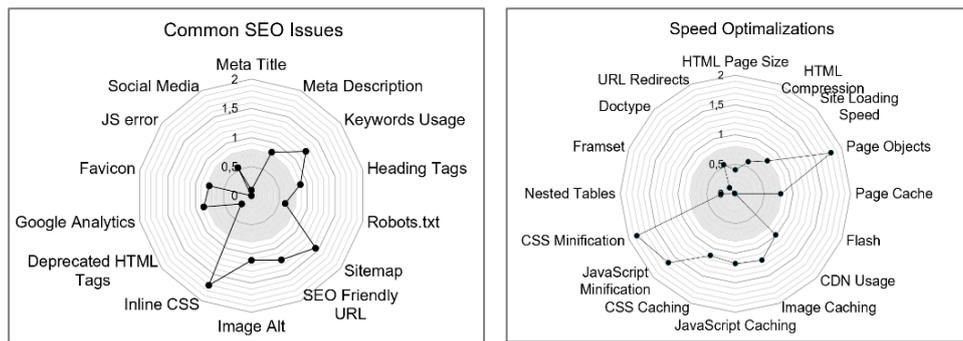


Fig. 2. SEO results within Common SEO Issues (left) a Speed Optimizations (right)

In the third group, *Server and Security* (Figure 3 left), three problems were identified: not using the secure communication protocol HTTPS ($M_{T32} = 1,2439$), protecting e-mail addresses on a webpage before spam harvesters ($M_{T36} = 1,2195$), and URLs canonization ($M_{T31} = 1,0244$).

Response design examined within the *Mobile Usability* was not included among the most frequent problems by means of the Pareto analysis. 54 tested museum websites passed the media query responsive test without detecting deficiencies.

Within the last group of the *Advanced SEO* tests (Figure 3, right), the problems that may be regarded as important include not using advantages offered by the HTML Microdata specification ($M_{T38} = 1,8049$) and the absence of “404 Not Found” web page ($M_{T39} = 1,0732$).

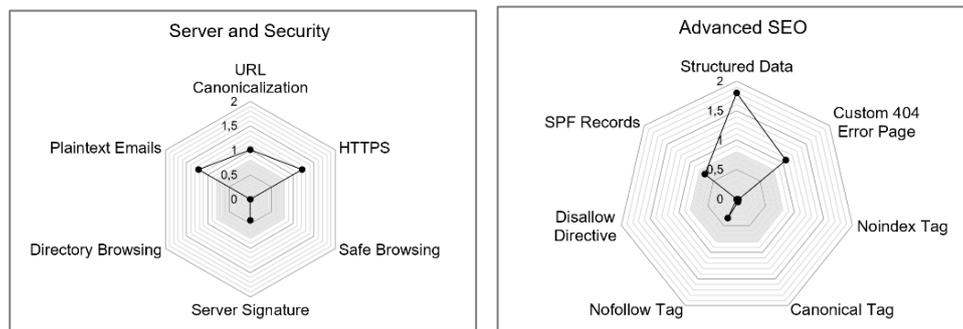


Fig. 3. SEO tests results Server and Security (left) and Advanced SEO (right)

4.2. Museum websites by Founder and by Regions

Arising out of the multisource system of museum financing in Slovakia, we concentrate on two possible determinants of the results of the Slovak museums SEO website analysis: (a) type of founder, (b) territorial administrative subsuming under a region (Table 4).

Table 4. Descriptive statistics of the SEO groups according to the founder type and regions

Founder (Group)	N_{SK}	SEO (Mean)	SEO (SD)	Region (Group)	N_{SK}	SEO (Mean)	SEO (SD)
RG	34	0,759358	0,187173	Banska Bystrica	16	0,690341	0,167602
Municip.	14	0,673701	0,166679	Bratislava	18	0,805556	0,134845
OLE	10	0,772199	0,102216	Kosice	8	0,724432	0,140855
CSAB	24	0,799242	0,154532	Nitra	8	0,849432	0,168304
Total	82	0,757973	0,168616	Presov	10	0,829545	0,191728
				Trencin	6	0,730180	0,095360
				Trnava	8	0,704545	0,260551
				Zilina	8	0,713068	0,118989
				Total	82	0,757973	0,168616

ANOVA enables to perform the comparison of the museum website SEO means of several groups if the following conditions are true:

- distribution of the SEO museum websites results meets the condition of normal distribution ($K-S p > .20$; Lilliefors $p > .20$; *Shapiro-Wilk* $p = ,34771$),
- distribution of the SEO museum websites results ($N_w = 82$) meets the condition of the multivariate normal distribution across all type groups of a founder (4) and regions (8) included in the comparison (for all groups in our research (it is true that $K-S p > 0,20$ *Shapiro-Wilk* $p > 0,13650$),
- the assumption of deviation homogeneity (Table 5) and variable independence – resulting from the study description.

Table 5. Tests for Homogeneity of Variances

SEO	Tests for Homogeneity of Variances				
	Hartley (F-max)	Cochran (C)	Bartl (Chi-kv.)	SV	p
Effect: "Founder"	3,353102	0,360638	4,278529	3	0,232916
Effect: "Region"	7,465353	0,305330	8,997406	7	0,252842

The issue of conformity between the SEO groups means, created base on founder type and regions, were addressed separately, employing One-way ANOVA with stated effects (Table 6).

Table 6. ANOVA results for the observed effects

Effect	Univariate ANOVA; Sigma-restricted parameterization Effective hypothesis decomposition						
	SC	df	MS	F	p	η^2	Observed Power ($\alpha = 0,05$)
Founder	0,142389	3	0,047463	1,713503	0,171082	0,061829	0,431700
Error	2,160554	78	0,027699				
Region	0,284685	7	0,040669	1,4911556	0,183664	0,123618	0,588223
Error	2,018257	74	0,027274				

No statistically significant differences were detected between the group means ($F(7,74) = 1,4912, p = ,18366$ a $F(3,78) = 1,7135, p = ,17108$). In both instances, the results of ANOVA test do not disprove the conformity of SEO museum websites means between the factorized groups according to the type of founder (the strength of the effect 6.18%) or based on regions (the strength of the effect 12.36%). Statistical confirmation of the conformity existence also provides an answer to the second research question.

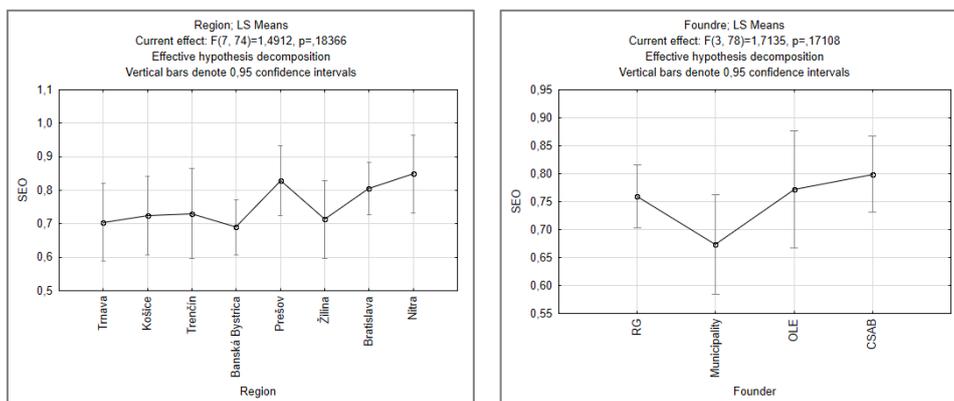


Fig. 4. SEO measuring results according to the regions (left) and founder (right)

This fact offers statistically objective view on the museum website disparity, administered by various founders in the field of SEO (Figure 4). It was not confirmed that private institution will pay more attention to achieving a better visibility of museum websites than the state and self-governing founders because of number of visits. In the same manner, it is gratifying to mention that existing regional diversity is also not statistically reflected in the results. From the point of view of the SEO websites, the SNM website can be included in the comparison of the EU museums, being aware of the fact that the SNM museum website does not serve as an ultimate example of Slovak museum websites, and that its selection will not positively discriminate Slovakia against other countries.

4.3. Museum websites in EU

Nowadays, there are more than 300 museums in the 27 EU countries which contain the words “national”, “royal”, or “state” in their titles, or which contain the name of a particular state in its title (in its national language or in the English language). For the purposes of comparing the achieved SEO, we will use the term “national museum”.

Three museums, within which it was possible to clearly identify their positions in terms of the structure of national museum institutions, were included in our research. The website functionality of a particular museum was verified within each record. When all the records underwent the SEO tests ($N'_{EU} = 324$), a new database

of national museum websites was created in the EU ($N_{EU} = 27$) according to the rules analogous to the rules with regard to creating the Slovak museum website database. It is true that:

- each member state in the database is assigned one museum website,
- if there are more (various) websites of national museums in a member state, the website with the lowest arithmetic mean M_{EU} , reflecting its error rate within the SEO, is included in the research.
- if the calculated means of the SEO national museum websites in a member state are in accord, the amount of performed SEO tests and the amount of conducted test with warning, respectively, will determine the inclusion.

The number of the SEO tests ($N_T = 44$) and the principle of evaluating their results remains preserved. Based on their evaluation, it is possible to create the order of webs in the SEO according to their success rate (Figure 5), describing the state to 15th January 2021. When compared to other EU countries (answer to $Q3$), the SNM website took 26th place. The top-rated national museum websites included Museum Catharijneconvent (Netherlands), Muzeum Narodowe w Szczecinie (Poland), and Harmas Jean-Henri Fabre Musée & Jardin (France).

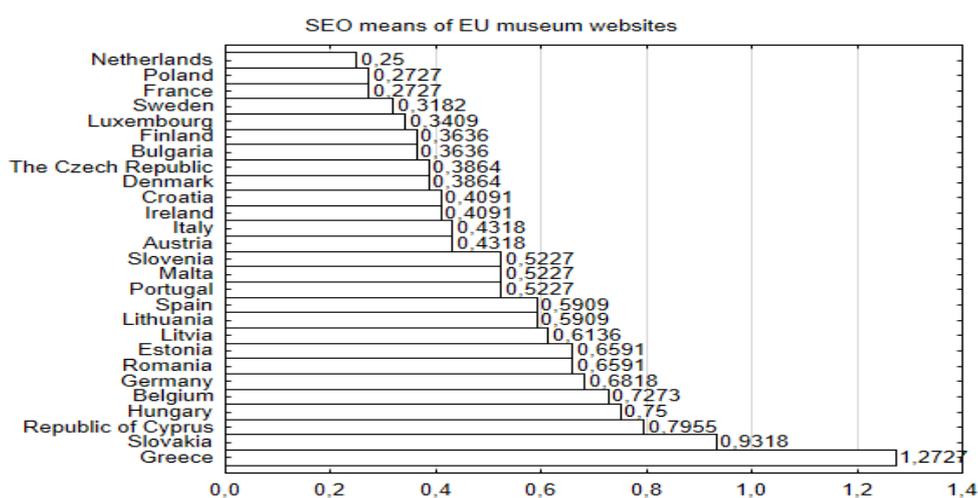


Fig. 5. Order of website successfulness of the selected national EU museums in the SEO

For the purposes of examining the common features of websites, the cluster analysis will be used. It allows us to mutually model similar groups, also according to the distribution of results multiplicity (“passed”, “passed with a warning”, “failed”) regarding the performed SEO tests. Based on the simple non-standardized Euclidean distance (d), it is possible to identify four pairs of national museum websites (France and Poland, Lithuania and Spain, Malta and Portugal, Austria and Italy), which are in accord not only with the overall SEO result (Figure 5), but also within the distribution of partial results ($d = 0$) (Figure 6). The limit value $d = 2,4495$ creates two multiple website clusters in the observed file, which, however, do not

include the accomplished results of Slovak and Greece websites due to a high number of tests, in which the selected national museum websites failed or passed the test with warning of existing failures within the SEO. Therefore, it can be stated that the increased attention ought to be devoted to eliminating the warnings.

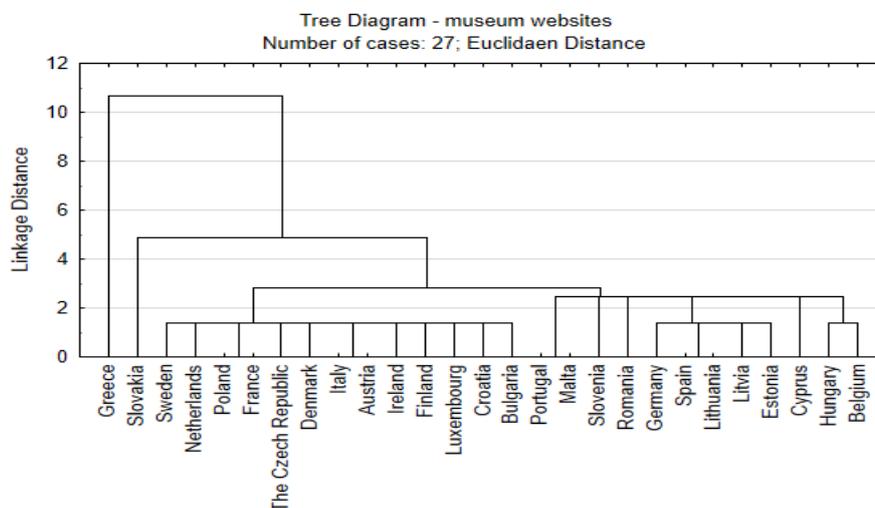


Fig. 6. Cluster analysis of websites of the selected national EU museums in the SEO

5. CONCLUSION

Informing the public is a necessary condition for preserving the interest in museums in the form of visiting its permanent exposition and exhibitions or their cultural and educational events. Museum websites should not be only user-friendly and appealing, containing interesting and up-to-date content, but also visible within the organic search. It is necessary to increase the awareness of SEO. The research results provide answers to the three research questions focusing on this matter. 21 most frequent Slovak museum website problems are identified as far as the visibility within the organic search is concerned (*Q1*). The findings reveal that existing differences that are factorized by the type of a founder and territorial administrative subsuming are statistically not significant in Slovakia (*Q2*).

Comparing the selected national museums in the EU does not seem to be favourable for Slovakia (26/27), which points out to an urgent need to solve the detected problems by performing the SEO analysis (*Q3*). Knowing the current state is considered to be a necessary precondition for other measures concentrating on its correction and improvement. Procedures which can be applicable to the organic visibility website analysis of other cultural institutions in Slovakia or abroad can be thought of as an added value.

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