The Quality of Local Government Websites from The Technical SEO Perspective

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Abstract

The website is the foundation of electronic administration. A website that has been search-engine optimised has a better potential to reach users. The purpose of the paper is to assess the degree of search engine optimisation of local government websites in Lesser Poland. The research covered 182 websites. The website quality was measured with selected automatic testing tools. Each test gave a final synthetic score. The scores were aggregated with zero unitarisation. The investigated websites scored 1,007.5 technical SEO points in total, which is about 55% of the available points. The websites demonstrated a significant potential for search engine optimisation (in the employed research design). A significant variance in technical SEO attribute scores urges in-depth analysis of results offered by each tool. The synthetic technical SEO score identifies websites in need of in-depth quality analysis or an SEO audit. Such an analysis will pinpoint trouble attributes requiring optimisation. A large number of relatively easy to fix errors and technical flaws suggests that municipalities do not audit their websites. Insufficient knowledge regarding weak points of municipal websites can hinder the development of e-administration. The research approached the websites from two browsing perspectives, desktop and mobile. Such a design facilitated a comprehensive investigation of technical attributes of the websites. The results were presented as statistics and in spatial terms.

Keywords: website quality, e-administration, quality audit, optimisation.

Introduction

The website is the e-administration hub for all levels of e-service provision. Its sites offer components that facilitate information flow between the citizen and administration, such as interactive forms or scripts. Public administration websites are developed in various ways and provide diversified e-services (Manoharan and Carrizales 2011, Cegarra-Navarro et al. 2012, Fietkiewicz et al. 2017).

As e-administration developed, its models of e-services grew more numerous. Most of them consist of four levels of maturity, presence, interaction, transaction, and integration (Layne and Lee 2001, Andersen and Henriksen 2006, Coursey and Norris 2008, Shareef et al. 2011). Moreover, in most cases, the framework for the models are the citizen – service and operations – technology relationships (Lee 2010). At the basic level, e-administration merely informs and presents. Information about the office and its services is displayed on a website. The customer is just a passive recipient of content that was prepared for them. In the one-way communication model, information comes with electronic forms that can be downloaded, printed, and filled in, or filled in and printed if they are interactive. In the transaction model, customers can search for information as well as download and send completed forms online (two-way communication). Ultimately, e-administration should follow the integration model and the personalisation model. The integration model

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provides for completion of all activities necessary to handle official business online. It further offers an electronic way of certification of the arrangements made, for example, with a digital document, such as a permit or certificate. In the personalisation model, the customer is offered services tailored to their needs and situation. Thanks to data processing algorithms, services are automatic and provided proactively.

To exploit the potential of digital technologies in e-administration, one needs hardware infrastructure, software, organisational and legal changes, and a way of making sure e-services meet the demand. Moreover, activities are necessary to improve the public interest in e-services and present their advantages. The primary benefits of e-administration are the speed of business handling and no queues (Wolniak and Skotnicka-Zasadzień 2012). The technical quality of websites used to provide the services and their general accessibility for people with disabilities, mobile devices, and search engines are just as important (Galvez and Youngblood 2016).

Search engine website optimisation (SEO) is usually a personalised commercial service. Its quality depends mostly on the experience of the SEO auditor or interactive agency. A website that has been search-engine optimised has a better potential to reach users with its message. It applies to public administration websites as well. The purpose of the paper is to assess the degree of search engine optimisation of local government websites in Lesser Poland.

This paper is organised as follows. The second section describes the essence of SEO with a particular focus on technical SEO and its impact on the quality of a website. Section three describes the methodological framework for the research. Next, we presented the results in tables and in spatial terms. The paper ends with a discussion and summary.

Search Engine Optimisation

Search engines are an important way of obtaining information on the Internet. Many people use search engines as a starting point for navigating the Web, making search engines a crucial link in connecting content providers and users (Baye et al. 2016, p. 6). Search engines have two primary functions: they build a content index and provide an ordered list of websites (resources, search results). Search engines answer questions. The search engine searches a corpus of documents (indexed resources) and returns results that answer the question.

Website quality verification and determination of popularity and accuracy of results are not done manually. They are decided by algorithms that analyse up to several hundred variables, so-called ranking factors. Many of them are technical. When optimised, they can improve website usability (user experience) and their rank in search results (machine experience).

Search engine optimsation (SEO) is a process of increasing the number of visitors to a website by achieving a high rank in search results returned by a search engine (Moreno and Martinez 2013, p. 564). The higher a website ranks in the search engine results pages (SERPs), the greater the likelihood of users visiting the site. Search engine optimisation is a process of improving a website's position so that the webpage comes up higher in the search results of major search engines (Curran 2004, p. 202). SEO is a process that manipulates website characteristics and incoming links to improve a site's ranking in the search engines for particular search terms. Because of the importance of high search engine rankings and the profits involved, search engine optimisers look for tools, methods, and techniques that will help them achieve their goals (Malaga 2010, p. 3). The practice of search engine optimisation can significantly increase a website's search rankings, driving more traffic to the website, and thereby increasing revenue. The three primary SEO strategies are Content, Link Building, and Social Sharing (Zhang and Cabage 2017). Moreover, search engine optimisation has been considered one of the most important techniques in Internet marketing (Tsuei et al. 2020).

In general, the process of SEO can be broken into four main steps: (1) keyword research, (2) indexing, (3) on-site optimisation, and (4) off-site optimisation. One can distinguish between technical SEO and search experience optimisation (SXO) (Figure 1).

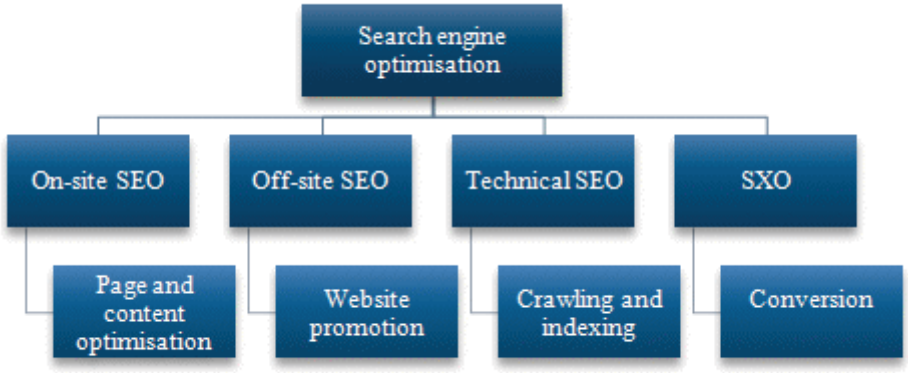

Fig. 1: The scope of website search engine optimisation

On-site optimisation is a process of developing or making changes to a website to improve its search engine rankings. Search engines return the most relevant documents determined by complex algorithms that adopt a plethora of criteria or ranking factors continually changing over the last decade (Mavridis and Symeonidis 2015).

There are a lot of on-site factors that are considered in determining a site's ranking for a particular term (Malaga 2010, p. 11). Some of them are technical and hence belong to technical SEO. Search experience optimisation (SXO) is a process aimed at improving the experience related to the presentation of a specific website in search results. Moreover, search experience optimisation recognizes that it is the user experience, not search engines (machine experience) that ultimately determines SERP position and rank.

Some of the main on-site factors used by search engines to determine rank include the title tag, meta description tag, bold text, keyword density, and the constant addition of relevant, unique content (Malaga 2010).

Technical SEO

Technical SEO focuses on the improvement of technical attributes of websites. The perfected technical side of a website enhances both machine experience and user experience. Technical SEO is part of on-site SEO and supplements activities belonging to off-site SEO to amend site visibility. A technical SEO audit includes such operations as the verification of the robots.txt file and sitemap, verification of the structure of URLs (Uniform Resource Locators), including breadcrumbs, and measurement of website performance and usability on mobile devices. A sitemap presents information on sites and other pieces of content (files, resources) that comprise the website and their relations, which facilitates indexation of individual sites. The robot.txt file contains information for search engine crawlers regarding indexable resources (Gudivada et al. 2015). Technical SEO is also about security (for example, Secure Socket Layer certificates, SSL) and website indexing in search results.

A technically well-developed website has a carefully built link profile, Especially internal links and outbound links. A large number of bad links hinders user experience and machine experience and may contribute to worse ranks in search results (Król and Zdonek 2019). Technical SEO concerns optimisation of metadata as well (title tag, meta description, meta keywords, favicon). Furthermore, it identifies and eliminates duplicate content, optimises internal links and URLs, optimises anchor texts and descriptions of images (alt tags), and optimises headers (header tags) (Tsuei et al. 2020). Technical SEO attaches great weight to website conformity to the standards of the World Wide Web Consortium (W3C), including code syntax, and Web Content Accessibility Guidelines (WCAG) for accessibility to people with disabilities (Król and Zdonek 2020a). Technical SEO effort focuses particularly on improving website performance, including the load time. Performance optimisation includes file compression or code minification (Giannakoulopoulos et al. 2019). Things technical SEO strives to avoid is embedded objects, such as iframes or Flash. It rather tends to

optimise websites for mobile use instead. Optimisation of all these factors affects website quality and may improve its search results rank (Berman and Katona 2013, Zhang and Cabage 2017).

Materials and Methods

The research involved 182 websites of local government units of Małopolskie Voivodeship, Poland (Figure 2). The study included all municipalities of the province. Their technical SEO quality measurement was conducted with eight web applications and the Lighthouse plugin (Table 1).

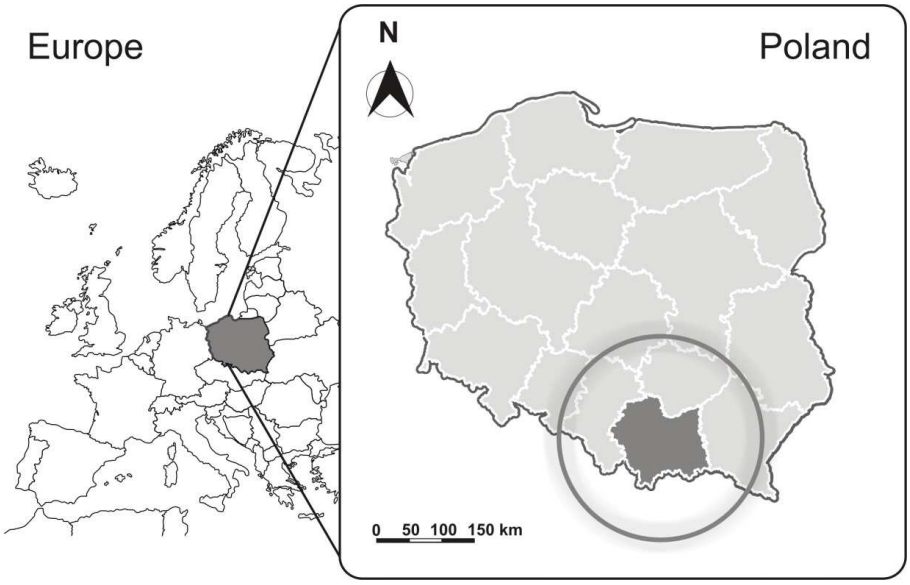

Fig. 2: Małopolskie Voivodeship, Poland

The research was informal, quantitative, and carried out under normal use conditions. The total number of unique tests amounted to 1,820. We have selected free tools available under a thin client framework. It means that the entire infrastructure the test application requires is on the service provider's end and tests are performed on a client device in a web browser window. Each test was concluded with a final score aggregated from individual technical SEO tests. The final scores were positioned in various ranges and resulted from the aggregation of multiple tests (Table 1).

Table 1: Test applications and scope of tests

Item	Test application (Application type)	Scope	Score range
1.	SEO audit (online)	SEO analysis, analysis of the most frequent keywords, backlink analysis, number of sites indexed by Google	0–5
2.	ZadroWeb SEO Auditor (online)	Page Authority; Domain Authority; Google Page Speed; SEO stats: meta title, description, keywords, heading tags, img alt tags, site map, inline code; URL stats	0–100
3.	Website Grader (online)	Website tests: performance (including page size, page speed, minified JavaScript and CSS, image size), mobile, SEO, security	0–100
4	Blink SEO Audit (online)	HTML structure and metatag analysis, website load time analysis, security analysis, and semantic analysis	0–100

5.	Seobility SEO Checker (online)	Meta information, page quality, page structure, link structure, server parameters, external factors	0–100
6.	Sitechecker (online)	SEO stats: description tag, headings, title tag, alt tag, etc.	0–100
7.	Ionos SEO Checker (online)	Search engine visibility, content (link, page title, headlines, page descriptions), backlinks audit, mobile tests	0–100
8.	Foxy SEO Checker (online)	SEO stats: title tag, description tag, keywords tag, headings, alt attribute, text/HTML ratio, XML sitemap, robots.txt, embedded objects, iframe, etc.	0–100
9.	Lighthouse (Chrome plugin)	Mobile mode measurements. Google Developers. Content best practices, meta tags, alt tags, other.	0–100
10.	Lighthouse (Chrome plugin)	Desktop mode measurements. Google Developers. Content best practices, meta tags, alt tags, other.	0–100

1) https://www.pozycjonowanie.pl/audyt-seo; 2) https://zadroweb.com/seo-auditor; 3) https://website.grader.com; 4) https://audyt.blink.pl/; 5) https://freetools.seobility.net/en/seocheck; 6) https://sitechecker.pro/pl/; 7) https://www.ionos.com/tools/seo-check; 8) https://www.seofoxy.com/seo-checker/

The research approached the websites from two browsing perspectives, desktop and mobile. Such a design facilitated a comprehensive investigation of the technical attributes of the websites (Figure 3). The tests followed the cross-validation model with the test tools chosen to complement each other (Król and Zdonek 2020b).

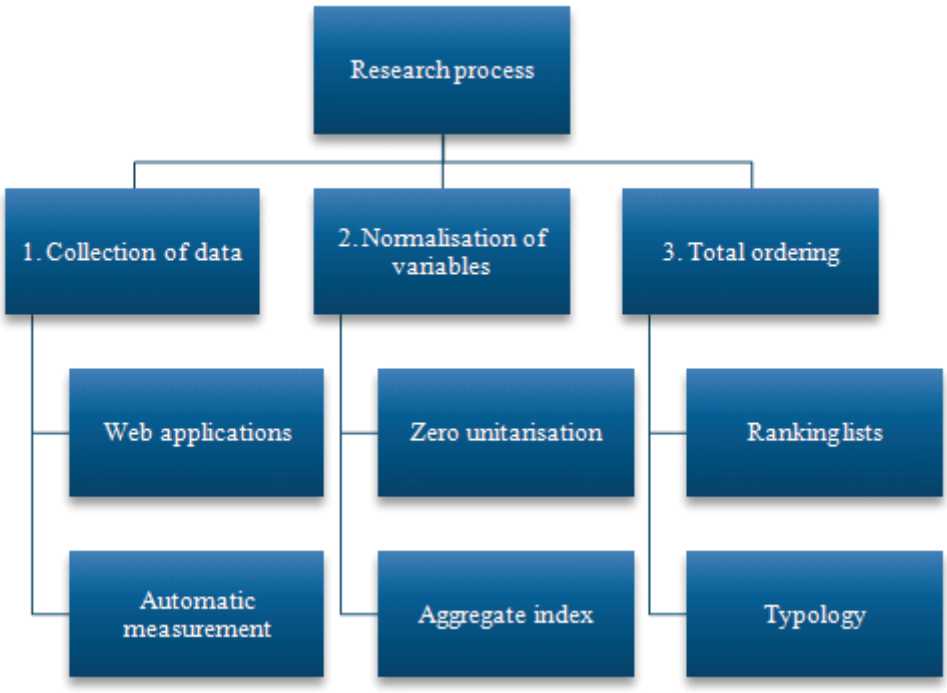

Fig. 3: Diagram of the research process

Each website was described with ten different quality indices. The scores were normalised and aggregated with zero unitarisation so that the websites could be juxtaposed. Zero unitarisation is recommended for multidimensional comparative assessment (Jarocka 2015).

Normalisation was performed with Equation 1. Normalised variables lie in the (0,1) interval. We then added up all the normalised variables to obtain the aggregate index. It means that each website we tested could earn up to 10 points.

$$zij = (xij - mini\{xij\}) / rj \quad (1)$$

where $zij \in (0,1)$. and:
zij – a normalised characteristic;
$zij = 0 \Leftrightarrow xij = mini\{xij\}$;
$zij = 1 \Leftrightarrow xij = maxi\{xij\}$;
xij – the value of the characteristic before normalisation;
mini{xij} – the minimum value of the characteristic before normalisation;
maxi{xij} – the maximum value of the characteristic before normalisation;
rj – the range for the j-th variable.

The normalisation of diagnostic characteristics is an important stage of comparative analysis of multivariate objects. The idea behind a multidimensional comparative analysis is to build a synthetic index that facilitates the total ordering of objects. Here, the term normalisation means unification, standardisation of values of characteristics regarding a specific criterion. The main objective of the transformation is to conform to the addition postulate by rendering characteristics of different measures comparable (Jarocka 2015).

We then used QGIS to visualise the results in spatial terms. Finally, we classified the municipalities to respective types (using the technical SEO aggregate index). We used the equal interval classification method to this end (objects are divided into types delineated by equal intervals). The typology was based on the technical quality of the websites.

Results

A website in need of complete optimisation reached 2.77 points out of 10, which was the smallest technical SEO score in the study. A website that has been search-engine optimised scored a little over 8 points out of 10 (Table 2).

In total, the websites had 1,007.47 technical SEO points out of 1820, which is about 55% of the maximum number of points. The websites demonstrated a significant potential for search engine optimisation of a little over 44.5%.

Table 2: Selected technical SEO statistics

Quality index	Numeric value	Percentage (%)
Minimum	2.77	27.69
Maximum	8.06	80.64
Range	5.29	52.90
Maximum score	1,820	100.00
Measured score	1,007.47	55.36
SEO potential	812.53	44.64

About 45% of the websites needed a comprehensive search engine optimisation (Table 3). The websites usually scored about 5 points for technical SEO attributes and were classified to types III and IV (in the employed research design). Websites classified to type II scored slightly better, from 5.4 to 6.8 points. Only 11.5% of the websites scored high.

Table 3: Quantitative summary of websites classified with the technical SEO index

Website type	Type IV	Type III	Type II	Type I
Technical SEO quality index	2.5–4.099	4.1–5.417	5.417–6.741	6.741–8.064
No. of municipalities	11	71	79	21
Percentage (%)	6.04	39.01	43.41	11.54
SEO summary	Websites requiring search engine optimisation		Websites (relatively) search-engine optimised	
Number of websites	82.00		100.00	
Percentage (%)	45.05		54.95	

The websites could score up to one point in each test. Therefore, each test tool could award up to 182 points (for the set of investigated websites). Each test application performed a different set of tests both as regards the number of tests and the scope of tested attributes. The websites scored the best in technical SEO measurement by Lighthouse (both desktop and mobile mode). The worst scores were awarded by Ionos SEO Checker (Table 4). A significant variance in technical SEO attribute scores urges an in-depth analysis of the results.

Table 4: Technical SEO potential according to each test application

Item	Measuring tool	Total for measurement (normalised); max. 182	Percentage (%)	SEO potential (%)
1.	SEO audit	122.60	67.36	32.64
2.	ZadroWeb SEO Auditor	87.33	47.98	52.02
3.	Website Grader	83.65	45.96	54.04
4.	Blink SEO Audit	94.73	52.05	47.95
5.	Seobility SEO Checker	105.80	58.13	41.87
6.	Sitechecker	98.97	54.38	45.62
7.	Ionos SEO Checker	35.99	19.77	80.23
8.	Foxy SEO Checker	121.79	66.92	33.08
9.	Lighthouse mobile test	127.05	69.81	30.19
10.	Lighthouse desktop test	129.56	71.19	28.81

The spatial distribution of the website quality results for the municipalities of Małopolskie Voivodeship demonstrated that large urban municipalities, often tourism destinations, such as Kraków, Krzeszowice, Zator, Muszyna, or Tuchów, boasted better-designed websites (Figure 4). Moreover, municipalities situated near large tourism destinations such as Kraków, Łącko, Bukowina Tatrzańska, or Limanowa also scored high.

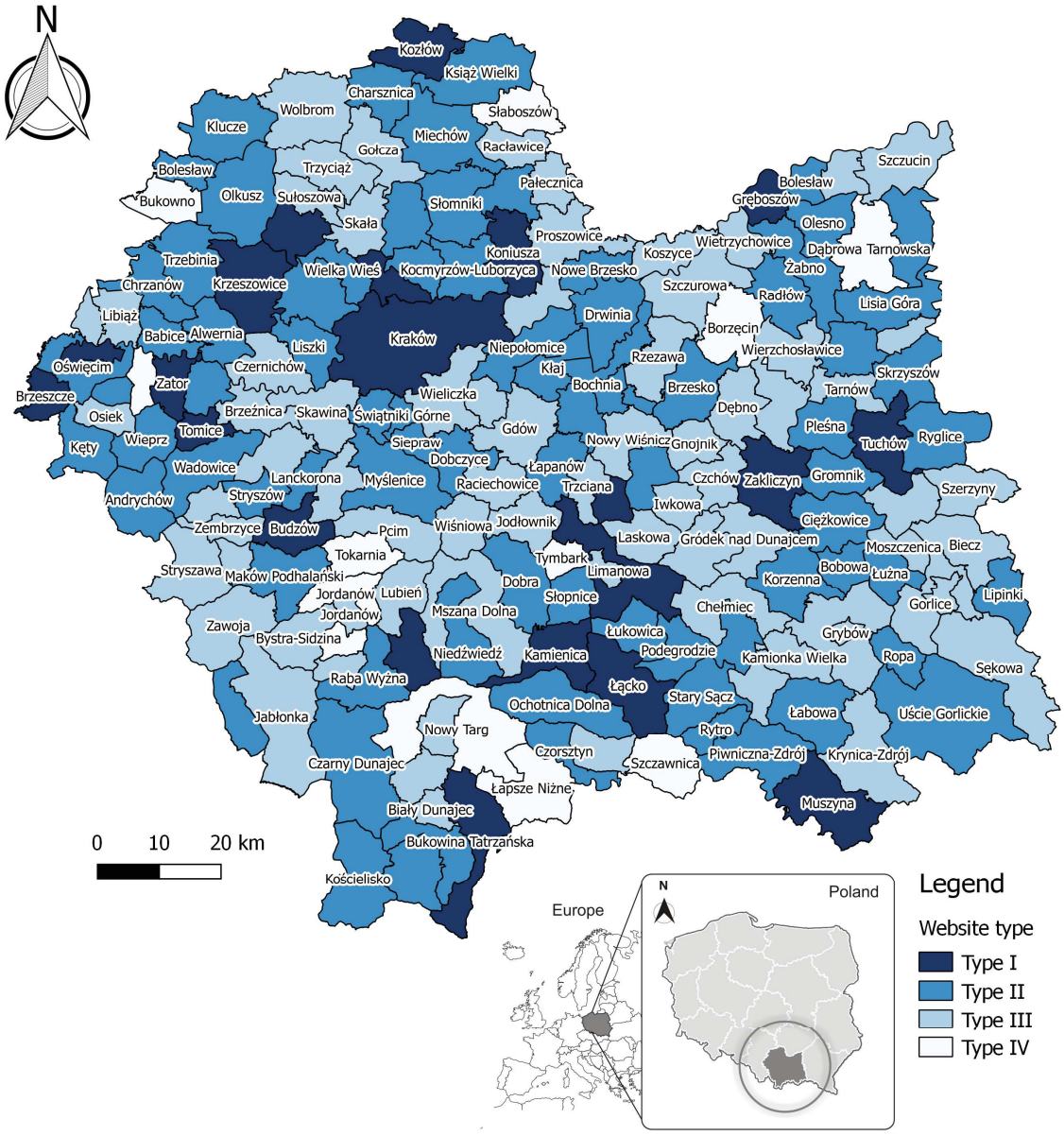

Fig. 4: Typology of municipalities in Małopolskie Voivodeship regarding website optimisation. Source: own research

There were relatively few websites with the lowest scores. The synthetic technical SEO score identifies websites in need of an in-depth quality analysis or an SEO audit that will pinpoint trouble attributes in need of optimisation.

Conclusions

Websites of local government units classified to type I (6.7 to 8 technical SEO points) were usually performance-optimised; their load times were short. What is more, they were optimised for use on mobile devices. It was possible to browse them comfortably on smartphones, tablets, and similar equipment. Websites of this type usually had a complete set of metadata. They had no objects advised against, such as iframes or Flash objects. Type I websites had a well-

designed profile of external links and usually a significant number of quality inbound links. Type IV websites, the ones that reached the lowest technical SEO scores, required a thorough optimisation or redevelopment. Note that these websites scored poorly in all the tests, which indicated the reliability of the assessment.

The research investigated the technical attributes of websites. Nevertheless, it is people who are behind the quality of websites. Many of the identified 'SEO flaws' could be easily fixed. With no qualified personnel and a quality assurance system in place, the implementation and development of e-services can be significantly hindered or even impossible. SEO is a process, and each website is dynamic if only because of new content. Hence, every website has to be reviewed regularly and corrected in terms of technical SEO attributes.

Websites of local-government units in Małopolskie Voivodeship exhibited a relatively high degree of search engine optimisation. An in-depth analysis of selected websites indicated that it was often just minor details that required improvements, such as meta information, which can be done by the municipal IT department. A large number of relatively easy to fix errors suggests that municipalities do not audit their websites. Insufficient knowledge regarding weak points of municipal websites can hinder the development of e-administration.

The results indicate that public administration websites are not given sufficient attention. Their fate depends on the strategy of the unit, knowledge about e-services, and the attitude towards databases and IT systems. What is also necessary is to implement a quality management system for both e-services and the website (or web application). An internal control system with a checklist can be useful to ensure the quality of websites and web applications. Efficient, functional, and convenient websites contribute to the perception of the office as customer friendly and helpful.

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