



## THE REACH AND THE TRENDS IN THE USE OF THE MAP SERVICE FOR THE LOCAL SPATIAL DEVELOPMENT PLAN OF TOMICE MUNICIPALITY

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### Summary

Users are primarily interested in the comfort of use and the range of map service in terms of its functionalities. Publishers, in turn, monitor usage statistics in order to optimize the operation of their websites based on the analysis of these statistics. This also applies to municipal map apps. The present work's objective is to analyse the reach and trends in the use of the Internet application presenting the local spatial development plan (eMPZP). The monitoring covered the map service of the Tomice municipality – in the Małopolska Region (*Województwo Małopolskie*), Wadowice district (*Powiat Wadowicki*), Poland – which is available on the municipality's server at the Internet address <https://www.tomice.pl/mpzp/>. The data was collected in the period from January 1, 2013 to May 1, 2023. Selected website usage indicators were analysed. In a period of just over 10 years, the eMPZP application was displayed 31,713 times, of which 25,009 (78.86%) were unique views. The largest number of users was recorded in Poland, i.e. 13,044 (83.52%); followed by the United States, i.e. 565 (3.62%) and the United Kingdom, i.e. 434 (2.78%). Most users found the eMPZP application using search engines and direct links. In conclusion, it was demonstrated that map service usage statistics could be useful for municipal authorities, as they help to understand how the service is used, by whom it is used, and what the users' preferences are. In addition, it was shown that eMPZP still fulfils a number of selected functions, despite the fact that in 2019 it was replaced by a geoportal (<http://mpzp.tomice.pl>). Accordingly, it is recommended that the so-called automatic redirection be set, sending the users to the current geoportal using specific HTML tags.

### Keywords

information management • decision-making process • user monitoring • usage statistics • map service • Google Analytics

### 1. Introduction

Over the past decade, the presentation of geodata in a web browser window has undergone significant changes. There has been an on-going and dynamic development of interactive online maps that allow users to conveniently and intuitively browse geospatial informa-

tion, which is the kind of information that was obtained by interpreting geospatial data [Edler and Vetter 2019, Król 2020]. The latter data, in turn, concern spatial objects related to the Earth's surface. Today, users can use advanced analytical tools to process and analyse geospatial data, allowing for a more accurate and precise understanding of geographic space and making better decisions on these grounds. Contemporary interactive maps enable users not only to display information, but also to edit it and to add new information, for instance in the form of the so-called points of interest (POI). Importantly, no programming skills are required to do that. Editing selected map elements is possible through the graphical user interface (GUI). However, before the spread of geoportals – that is, technologically advanced Internet platforms providing geospatial information – spatial data used to be presented in the browser window in the form of graphic (raster) files, various static or dynamic applications that would improve raster browsing (map viewers), and the so-called mashups [Król and Szomorova 2015, Król 2016, 2019, Gotlib 2019]. A mashup is a combination of two or more different sources of information or functionalities that are not originally related to each other. These connections create a new, coherent and often more valuable functionality or information [Król 2018, Yu et al. 2023]. Mashups are often created in the context of websites and web applications, where various web services and APIs (Application Programming Interface) are integrated in order to generate new value for the users [Karnatak et al. 2012, Almarimi et al. 2019]. However, regardless of the technology, most map services are created with users (recipients) in mind, while their publishers remain on the other side of that process. Users are primarily interested in the comfort of use and the scope of functionalities of the map service [Topaloglu et al. 2013]. Publishers, in turn, are concerned with monitoring usage statistics with the view to optimizing their websites, based on the analysis of that statistics [Serrano-Cinca and Muñoz-Soro 2019]. These activities are part of the concept of information management.

Information management is the process of organizing, controlling, storing, processing and sharing information in an effective and purposeful way. This concept includes information technologies as well as people, processes, and procedures that help in managing information in the given organization [Koivisto and Hamari 2019]. Information management includes the use of tools and technologies, such as for instance database management systems (DBMS), content management systems (CMS), and document management systems (DMS), in order to ensure the efficient processing and sharing of information.

Wrong decisions are most often the result of underestimating information or the lack of information [Zdonek 2006]. The effectiveness, range and trends in the use of websites, including geoportals, can be learned by monitoring the users. This allows the organization to better target optimization activities, and to improve the decision-making process, for instance in terms of better support for the website on the Internet, including in social media. Such activities are common in the e-commerce industry [Wang et al. 2020], as are quality audits in the field of search engine optimization (SEO) [Serrano-Cinca and Muñoz-Soro 2019]. Less frequently, monitoring of usage statistics is carried out within local spatial development plans published in the form

of geoportals [Król and Prus 2017, Król 2018]. Usability (UX) testing using heuristic evaluation is more common [He et al. 2012, Resch and Zimmer 2013, Blake et al. 2017]. Therefore, there is a certain research gap that should be filled. The objective of the work is to analyse trends in the use of the Internet application presenting the local spatial development plan, as illustrated with the example of Tomice municipality (eMPZP). The following research questions were posed in the work: What information does the monitoring of the eMPZP application provide? How can it be used by the municipality's authorities? The further part of the work has the following structure: the second section describes the methodological issues of the research, with particular emphasis on the usage indicators of the tested website. The fourth section presents the results of the research, including demographics, geolocation, and usage statistics. The presentation ends with a discussion, summary, and practical recommendations.

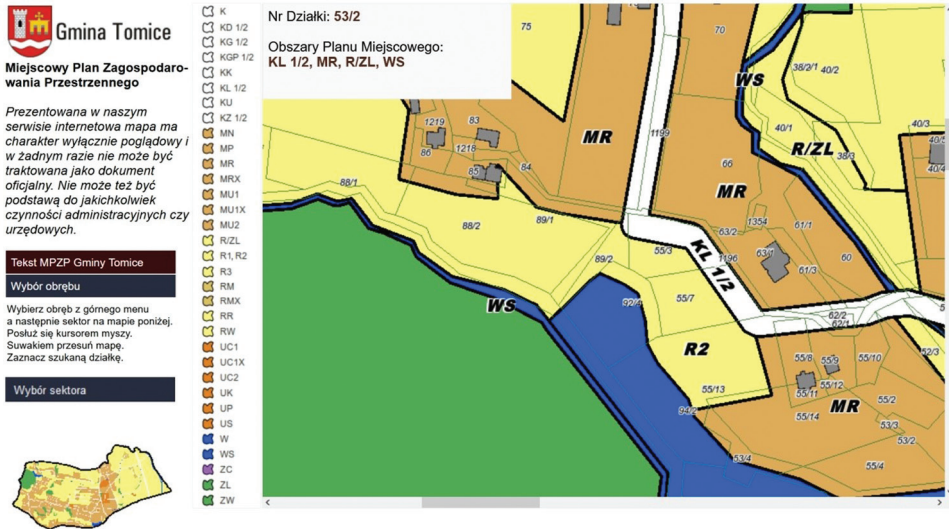
## 2. Material and methods

Website visit statistics are obtained using various analytical tools that collect information about website traffic. One of the most popular tools for analyzing website traffic is Google Analytics [Pakkala et al. 2012]. This tool uses a unique code embedded within the structure of the website, which makes the website identifiable and facilitates the collection of data on user activity. The information collected by the analytical tool includes, among others: the number of visits and unique visitors, time spent on the website and on its individual pages, geolocation, software and devices used by the visitors, and sources of access (entry) to the website [Vecchione et al. 2016]. All this data is processed and then presented in the form of reports and charts on an interactive dashboard. Data analysis helps publishers understand how the users operate when making use of the website, and what changes should be made in order to increase that website's effectiveness [Fang 2007].

The monitoring covered the map service, which presents the local spatial development plan of Tomice municipality (Małopolska region – *Województwo Małopolskie*, Wadowice district – *Powiat Wadowicki*, Poland), which is available on the municipality's server at the Internet address <https://www.tomice.pl/mpzp/> (Fig. 1). The data was collected over the period from January 1, 2013 to May 1, 2023. Selected website usage indicators were analysed, including:

- 1) demographic data (age and gender) and geolocation data, data on the browser and operating system;
- 2) the total number of page views of the website, including repeated visits to individual pages;
- 3) the number of unique page views, i.e. the number of sessions with at least one view of the specific page. A unique page view is counted for each combination of page URL and page title;
- 4) the average time spent on the website, i.e. the average time spent viewing a specific page or screen, or a set of pages or screens, by the users;

- 5) bounce rate, i.e. the percentage of sessions during which the user “sees” only one page and does not interact with it. A bounced session has a duration of 0 seconds;
- 6) average page load time, i.e. the average time in seconds needed to load pages from the sample set, beginning with the moment of initiating the page view (e.g. clicking a link on the page), and ending with the completion of loading in the browser.



Source: screenshot from <https://www.tomice.pl/mpzp/>

Fig. 1. Internet application of the eMPZP for Tomice municipality

The website presenting the local spatial development plan for Tomice municipality was created in 2012 based on the jQuery JavaScript library. The application was designed so that the users, in addition to viewing the map, would also be able to obtain text information on whether a given land plot is intended for specific purposes in the local plan. The application was prepared on the basis of raster maps and polygon coordinates created after transforming vector maps using the HTML Image Map Plugin (QGIS) component. The structure obtained in this way was extended with the functionality of highlighting objects on the map using the jQuery Maplight script [Król 2018]. The eMPZP application had been used by the Tomice municipality until 2019, when it was replaced by the geoportal (<http://mpzp.tomice.pl/>). Despite this, the previous, tested version of the website has not been archived and is still available, and features on the top positions of the Google Search Engine Results Page (SERP) after the user enters the keywords ‘local development plan of the Tomice municipality’, which only confirms that the conducted research here presented is purposeful and pertinent.

### 3. Results and conclusions

In the period of just over 10 years, the application of the local spatial development plan for Tomice municipality had been displayed 31,713 times, of which 25,009 (78.86%) were unique views. Users spent an average of 4 minutes and 16 seconds on the website, with a bounce rate of 81.04%. In the analyzed period, the average page loading time was 2.23 seconds. At this point, it is pertinent to devote some attention to the single-level architecture of the application. Raster maps are loaded in the so-called floating frame – the “iframe”. This can be crucial for the correct interpretation of the relatively high value of the bounce rate. This value may result from the technique of the website implementation (the manner of data sharing), and as such it would not reflect users’ dissatisfaction.

The largest number of users was recorded in Poland, i.e. 13,044 (83.52%), followed by users in the United States, i.e. 565 (3.62%) and the United Kingdom, i.e. 434 (2.78%). The largest number of users in Poland was recorded in the following cities: Kraków, namely 4,382 (26.59%), Wadowice, namely 4,299 (26.09%) and Warsaw, namely 1,460 (8.86%). Users most often used the following web browsers: Chrome (7,627, 49.11%) Firefox (4,825, 31.07%), Internet Explorer (992, 6.39%), and Opera (622, 4.00%). The eMPZP application was most often viewed on desktop devices (13,233, 85.14%), slightly less frequently in mobile mode (2,061, 13.26%) and on tablets (248, 1.60%).

In the past, in the period from January 1, 2013 to May 15, 2018, the eMPZP application had been visited by 9,967 unique users who initiated 15,271 sessions and generated 19,115 page views. The greatest interest in the local development plan of Tomice municipality was recorded in Kraków (29% of users) and Wadowice (24% of users). These were followed by: Warsaw, Katowice, and Wrocław [Król 2018]. Therefore, the trend continues.

In the years 2018–2023, i.e. over the period of about 5 years, the number of unique eMPZP users increased from 9,967 to 15,520, which is an increase by 5,553 users (55.7%). During this period, the number of sessions also increased and the bounce rate decreased (Table 1).

**Table 1.** eMPZP usage statistics in the period from January 1, 2013 to May 1, 2023

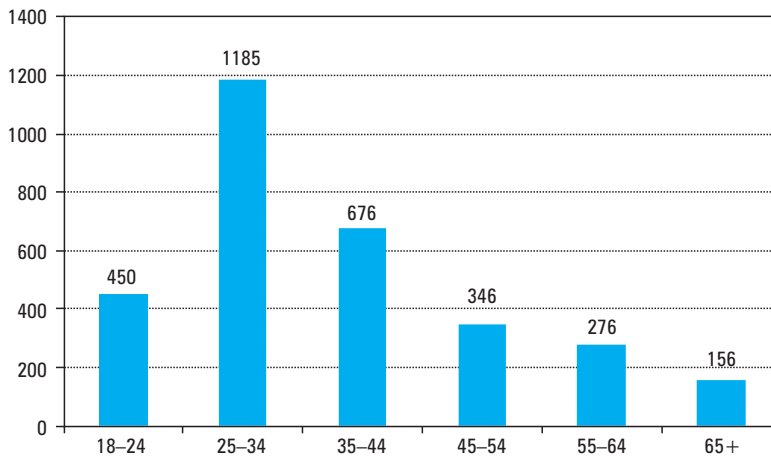
Channel	Number of users	New users	Sessions	Bounce rate	Average time of session
Total / overall in the years 2013-2023	15 520	15 266	24 476	81.04%	00:01:16
Total / overall in the years 2013-2018 [Król 2018]	9 967	n/d	15 271	83.17%	00:01:10
Social	58 (0.36%)	49 (0.32%)	114 (0.47%)	56.14%	00:02:32
Referral	1 642 (10.13%)	1 585 (10.38%)	1 948 (7.96%)	75.77%	00:00:55

Table 1. cont.

Channel	Number of users	New users	Sessions	Bounce rate	Average time of session
Organic search	7 110 (43.86%)	6 495 (42.55%)	11 860 (48.46%)	78.61%	00:01:28
Direct	6 300 (38.86%)	6 403 (41.94%)	9 130 (37.30%)	84.64%	00:01:07
Other	1 102 (6.8%)	734 (4.8%)	1 424 (5.82%)	87.34%	00:01:08

Source: Author's own elaboration based on Google Analytics

The age of users was verifiable for 3,089 (i.e. 19.90%) of all recorded eMPZP users. In this set, the largest number of people declared their age as being in the range between 25 and 34 (Fig. 2). Gender was identifiable for 3,037 users (19.57%). Among the users, we recorded 1,475 women and 1,562 men.



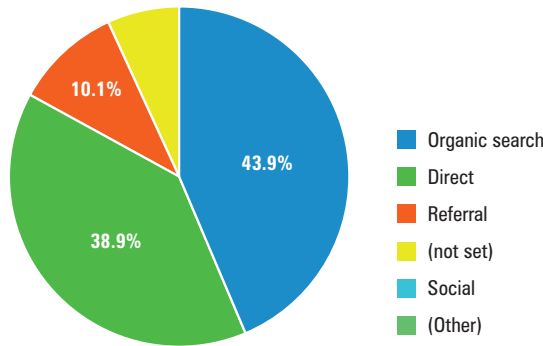
Source: Author's own elaboration based on Google Analytics

Fig. 2. Number of eMPZP users by their declared age

The majority of the users found the eMPZP application by using the search engine (7110). Also a large number of users came to eMPZP through a direct link (6300). Direct traffic means that the user has entered a specific website, e.g. by typing a URL into a web browser window. In addition, 1642 users arrived at the eMPZP pages from referrals, that is, from other websites (Fig. 3).

The eMPZP websites were most often visited by relatively young people, aged 18 to 44, with the largest group of visitors being people who declared their age to be in the range between 25 to 34. However, it is difficult to indicate the reasons for these visits. Admittedly, they could have been varied and might have resulted, for instance, from the desire to know the functional designation of individual areas in the local plan

– for example, whether they were intended for residential, industrial, or agricultural development (with the view to investment plans) – or from the desire to know land topography, the layout of roads, as well as the location of buildings and facilities serving the population and the agriculture.

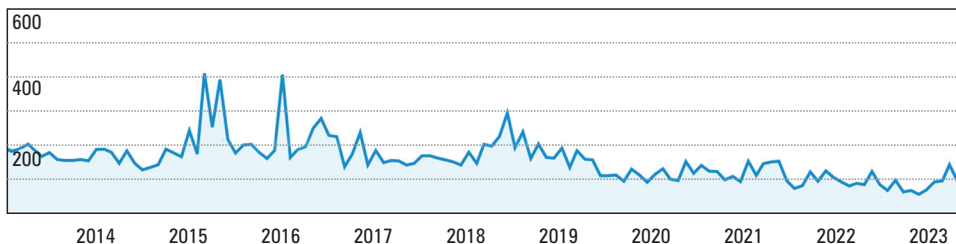


Source: Author’s own elaboration based on Google Analytics

Fig. 3. Sources of acquiring eMPZP users

### 3.1. Trends and projections for eMPZP

Figure 4 shows a slight downward trend in the number of users visiting the eMPZP website over the last 10 years, whereas in selected years, for instance in the 2015–2018 period, there had been months in which a higher number of application users was recorded. Interpretation of these statistics is possible after we follow the history of the website. The municipality officially used the eMPZP in the years 2013–2018, after which the original website was replaced with a geoportal. In the meantime, the municipality’s website had been modernized and the location of the link to the eMPZP was changed – from the top of the upper menu, it was moved much lower down. This resulted in a lower visibility of the link, which could have contributed to a decrease in the number of page views and visits.



Source: Author’s own studies based on Google Analytics

Fig. 4. The number of users of the eMPZP website in 2013–2023

Despite the launch of the geoportal of Tomice municipality (<http://mpzp.tomice.pl>), the eMPZP service has not been archived, and is continues to be indexed by Google and visited by users, although the bounce rate is now relatively high. However, the number of visits may decrease in subsequent years. In addition, the information published on the eMPZP website may become out of date or obsolete. As a consequence, actions aimed at redirecting eMPZP users to the pages of the current geoportal are justified.

#### 4. Discussion

Monitoring usage statistics facilitates a better understanding of the ways in which the users operate within the geoportal. These statistics can help identify performance and functionality issues and make decisions about improving the website, both onsite (within the website) and offsite, i.e. in the environment of the website. For example, geoportal usage statistics can reveal which thematic layers of the website are most often employed by its users, how long the users stay on particular pages, or which functionalities are most often exercised. Based on this data, the content of the website and the user interface can be adapted so that they would better suit the needs of the audience. Geoportal usage statistics can also help identify areas that require further analysis. For example, if users rarely employ certain functionalities or thematic layers, it might mean that these particular areas need improvement or effective promotion. In addition, monitoring usage statistics can help set goals for the future. As a consequence, the usage data can be beneficial and helpful for determining whether the geoportal is meeting its goals (in the so-called goal conversion measurement), what benefits it brings to users and organizations, and what improvements are needed in order to enhance its effectiveness, both functional and technical.

An in-depth analysis revealed that the current geoportal of the Tomice municipality can be accessed by only one hyperlink located within the municipality website (<https://tomice.pl>), and by another one coming from an external website. This means that the municipal geoportal is not in fact promoted. Meanwhile, it is recommended that municipalities should promote their geoportals on the Internet. Through the promotion of the geoportal by the municipality it would be possible to attract the attention of residents, tourists and entrepreneurs who wish to obtain information about the infrastructure and resources available in the municipality. The visibility of the geoportal on the web can also have a positive impact on investors, which can bring financial benefits to the municipality.

The municipality geoportal is a virtual platform where residents, tourists and other users can easily access a variety of geospatial information such as the map of the municipality's area, boundaries of the plots, the zoning plan, information on tourist attractions, and so forth. Promoting the geoportal on the Internet can help raise the awareness on the part of residents and visitors about the available resources and services. The promotion of the geoportal may include, among others: placing a link to the geoportal on the municipality's website and on the websites of friendly entities, advertising the geoportal in the local media and in social media, as well as organizing training sessions for residents and entrepreneurs in order to present the benefits and functional possibilities offered by



the geoportal. Furthermore, the geoportal provides an opportunity to obtain information on the availability of public services, infrastructure, communication routes, and other factors affecting the quality of life, and these can support making better decisions and planning future activities, including investment projects. The municipality geoportal can also be used as a tool to improve communication between residents, municipality authorities and other stakeholders. Thanks to having access to up-to-date information, both municipality offices and municipality residents can react faster and more effectively to the needs and problems related to their surroundings, including those pertaining to spatial planning and development (in other words, this can increase social participation). In addition, improving the visibility of the geoportal in the search results may increase the transparency of the activities of the municipality's authorities.

## 5. Summary and practical implications

Statistics of the use of the municipal geoportal can be beneficial for the municipal authorities, because they could help them to understand how the portal is used, by whom it is used, and what are the preferences of the users. Thanks to this information, the municipal authorities can make decisions regarding further development and improvement of the geoportal to better meet the needs of recipients. Municipal geoportal usage statistics can also be useful for geoportal designers who wish to improve the usability of their projects. Statistics on the use of the municipality's geoportal can also be useful for employees of municipality offices and agencies who deal with spatial planning and strategic development of the municipality. Thanks to information on, for example, popular areas on the map, officials can better understand what the needs of the residents are, and which areas may require special attention.

The eMPZP service of Tomice municipality is still visible in the search results, and despite the launch of the new geoportal, it continues to attract users on the Internet. However, the website is not being updated, and thus it has a limited scope of functionality, which results from the technology in which it had been developed. Browsing the eMPZP application on mobile devices is difficult or downright impossible. This is mainly due to the application's architecture, which is based on a raster map, and the application itself is not responsive, which means that it does not adapt to the screen size of the device on which it is displayed.

The visibility of the eMPZP map application in the search results is not waning. Over the last decade, the website has been gaining new users, although the bounce rate is now relatively high. The current trends of stable, normalized traffic on the web are optimistic. However, technological developments may change this. This applies in particular to modifications in the algorithms of Internet search engines. It has happened in the past that the websites, which previously ranked high in search results, lost their prominent positions as a result of such changes [Kingshott and Keck 2014]. Therefore, in order not to lose the 'audience', which continues to be acquired by the out-of-date eMPZP application, it is advisable that traffic be redirected to the current geoportal of the municipality.

Although the eMPZP application had been developed in Web 2.0 technology [Król 2020] and has not been updated since, it still fulfils certain functions for Tomice municipality. The website was created in accordance with the XHTML 1.0 Transitional specification. Accordingly, we recommend that the so-called automatic redirection to another website be set, namely, to the current geoportal, using specific HTML tags (Table 2).

**Table 2.** Structure of the HTML code that triggers automatic redirection to the current geoportal of the Tomice municipality

```
<head>
<meta http-equiv="refresh" content="5; URL=http://mpzp.tomice.pl" />
</head>
```

By changing the value of the “content” attribute to 0 (zero) for instance, the website visitor will be immediately redirected to the address defined as the value of the URL attribute. A different value will cause the transfer to take place only after some time, for instance, after 5 seconds. The use of the ‘meta’ tag is one possibility. The ‘redirection’ effect can also be achieved through PHP or JavaScript, for example. Such a modification of the eMPZP service will ensure that users who reach the pages of the out-of-date application will be automatically transferred to the pages of the current geoportal. In this way, traffic will be redirected to the benefit of the visibility of municipal services on the web.

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