



## GEOPORTAL 2: NATIONWIDE NETWORK NODE OF SPATIAL INFORMATION – DESCRIPTION OF ITS CHARACTERISTICS AND AN ATTEMPT AT EVALUATION OF SELECTED FUNCTIONALITIES

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### Summary

For more than a decade now, in the EU countries in particular, we observe significant advances in the development of regional geoportals, created by various public administration units. This has resulted, above all, from: legal regulations, an increased demand for geospatial information, and the development of mobile and geo-information technologies.

At present, there are several hundred official mapping services on the Internet, making available databases of geospatial information of varying character. One of these is the map portal called Geoportal 2. One of the distinguishing features of the service is the fact that it provides access to geospatial data with the administrative data status, including land registry data. Despite regulatory limitations related to data processing, the Geoportal 2 is one of the most popular and most frequently chosen specialist map services in Poland. The goal of the paper is to present the Geoportal 2, describe its characteristics, and evaluate selected functionalities available within the mapping service.

### Keywords

nationwide geoportal • infrastructure of geospatial information • Internet cartography

### 1. Introduction

New technologies of creating network applications and their new uses are among the pillars of growth for the electronics industry [Król and Szomorova 2015]. After 2005, levelling of functionality occurred – between web apps (online applications) and conventional software which is installed at the hard disk of the computer. This means that the same operations can be now performed using a web browser as in the applications installed at the computer; and the same design objectives can be achieved in both. Network apps have a further advantage: when launched in an Internet browser, they facilitate individual work as well as – if necessary – collective work shared with other users in the cloud (so-called *cloud computing*) [Filotowicz et al. 2011]. Technological advancement is apparent first and foremost in the prolif-

eration of Internet access as well as in the development of network services and geo-information technologies. Closely related to that advancement is the notion of information society, or network society, in which one of the criteria for proper functioning is an organized and fast circulation of information.

Data of the highest significance to the users usually has its spatial reference, therefore, it can be presented on the map using coordinates, within the defined reference system. Each piece of spatial data, either of the local, regional, or international significance, can be important for the functioning of economic entities, the society, or public administration bodies.

The most frequent web searches concern geospatial information on the natural environment, as well as on the objects and phenomena occurring directly in the area of human habitation, or in its immediate vicinity.

Dynamic growth of geo-information technologies and open access to cartographical resources has translated to common, public use of geo-information images and geospatial data [Dąbrowski and Sawicki 2010]. For more than a decade now, we have been witnessing a significant growth in the popularity of web geospatial data services (geoportals), which perform the functions of navigation and location. This results, among other things, from the growing demand for geospatial information, and the fact that a map remains the most efficient carrier of this information, while also being the most convenient tool for location and orientation in space [Kowalski 2012].

The Internet revolutionised the way of communicating and transmitting digital information which has spatial reference. Various mapping services are most frequently used to search for service points, to acquire address information, to set routes and itineraries, and also to do “virtual” sightseeing or explore various spaces. In addition to the most common functionality pertaining to data presentation, they also perform the role of network tools, which provide analytical and administrative instruments to many users at the same time [Lupa and Leśniak 2014].

## 2. Development of regional geoportals and the EU INSPIRE Directive

For more than a decade now we have been witnessing significant advances in the development of regional geoportals, created by various public administration units. This has resulted, to large extent, from the existing legal regulations, coupled with an increased demand for geospatial information. Adoption, in 2007, of the Directive by the European Parliament and the Council, adopting the spatial data infrastructure within European Community – the INSPIRE [Dyrektywa 2007] – impacted the intensification of building national infrastructures of geospatial information [Rannstig 2009, Rodriguez et al. 2009].

Spatial data infrastructure is a set of technologies, means, as well as political-institutional and economic ventures and projects, which facilitate the use of geospatial information. Spatial data infrastructure can be perceived as building the national resources of geospatial information [Kubik and Iwaniak 2007].

According to the regulations of the INSPIRE Directive, each Member State should provide access to the spatial data infrastructure via the Community Geoportal, created and serviced by the European Commission. Simultaneously, it is possible to create individual, national access points. As defined for the purpose of the INSPIRE Directive, a geoportal is a website or its counterpart, which facilitates access to a number of services (article 11, paragraph 1):

- a) discovery services making it possible to search for spatial data sets and services on the basis of the content of the corresponding metadata and to display the content of the metadata;
- b) view services making it possible, as a minimum, to display, navigate, zoom in/out, pan, or overlay viewable spatial data sets and to display legend information and any relevant content of metadata;
- c) download services, enabling copies of spatial data sets, or parts of such sets, to be downloaded and, where practicable, accessed directly;
- d) transformation services, enabling spatial data sets to be transformed with a view to achieving interoperability;
- e) services allowing spatial data services to be invoked.

Spatial data services should be easy to use and available via the Internet or another, appropriate and publically accessible means of telecommunications [Dygaszewicz 2006].

Over the last decade, national geoportals have been developing dynamically. Not only the number of such portals grows, but also the thematic range of available data and the scope of functionalities are expanding [Dukaczewski and Bielecka 2009].

Most geoportals functioning today make data available via map services, created using techniques and tools, which were developed and standardised by the OGC (*Open Geospatial Consortium*). The most widely used standards include WMS and WFS (*Web Map Service, Web Feature Service*). Another example is the spatial data made available in the Geoservice REST technology (*Geoservice Representational State Transfer*) [Lupa and Leśniak 2014]. Furthermore, mapping services have been evolving: from a static form, in which maps were presented in the JPG or PDF file format [Król and Salata 2013], towards a dynamic form, using solutions such as WMS and WFS [Dukaczewski et al. 2012].

In Poland, we have been observing an increased interest in the sharing of geospatial data and pertinent services, particularly on the part of State agencies, public, and private bodies, following the adoption of the law regulating the spatial information infrastructure [Ustawa 2010], which is a transposition of the INSPIRE Directive. One of the largest projects in Poland, focusing on the development of spatial information infrastructure in the country, is the “Geoportal 2” project implemented by the Główny Urząd Geodezji i Kartografii (Main Geodesy and Cartography Authority). Its main task is to make available – to citizens, entrepreneurs, and public administration – access to State registries of data of the highest quality and reliability [Chojka 2013]. The Geoportal 2 is a venture, which employs the advancements of informa-

tion technology and telecommunications in order to share spatial information in its broadest sense [Preuss and Dygaszewicz 2006].

The goal of this paper is to present and evaluate selected functionalities available within the mapping service of the Geoportal 2, with particular attention to mobile devices and to pointing out possible difficulties a user can encounter when operating the portal.

### 3. Materials and methods

The concept of an audit or – in other words – quality control of manufactured products, in the recent years has gained a new significance and importance, particularly in the computer software industry. Web applications also constitute products, and their quality can be verified through software testing [Prywata 2009].

An attempt to assess some of the functionalities of the Geoportal 2 was made using functional tests, which are also referred to as the black-box testing. This method provides a look at the test application from the outside perspective, from the point of view of the user, without access to detailed information on its construction. Tests are performed on the basis of functional assumptions that should be met by the software according to its documentation. The black-box testing method makes it possible to test a selected portion of the functioning of the entire program, and the test usually describes the system's response to the entered tasks. Testing in this case is understood as a process of launching software in a controlled manner, to determine whether it behaves as expected. The method is based on the specifications and assumptions of the tested cases. In addition, it is advisable for the tests to be carried out by people without programming knowledge, which increases the objectivity of the result.

Functional tests help identify any gaps in software, any incorrect or missing functions, any errors in data structures or in access to a database, any irregularities in the operation of the interface, as well as any performance issues. However, the test does not allow to pinpoint where the error occurs in the programming code [Madiha and Waqas 2015].

Black-box testing was performed using exploratory testing), which provides for observation and recording of the behaviour of applications (outputs) in natural conditions, that is to say, during the implementation of activities or tasks performed by the user (input-output relationship). The exploratory method applies the technique of self-assessment, which is based on self-registration of experiences and observations made while interacting with the studied service. The end result of the study is a report drawn up by the user, which recognizes problems identified during the study.

Tests of the Geoportal API programming interface were conducted according to the principles of design, which provide for the creation of a digital map with selected functionalities:

- presentation of an entered object in a particular approximation, when the application is opened in the browser window;

- location of the object in space on the basis of geographical coordinates (in the form of point, line and polygon with accompanying text information and graphics);
- determining the coordinates of any point indicated on the map and routing between any two objects;
- capturing, dragging and changing the zoom level of the map view.

In the testing of the Geoportal API, attempts were made to assess whether the available documentation and help system make it possible to check the available functionalities of the API, and also, whether programming of maps using the API is accessible to non-specialised users, without the knowledge of geo-information issues. In addition, the scope of functionalities described in the documentation of the Geoportal API has been compared with analogous specifications available within the Google Maps API and Bing Maps API.

The Geoportal 2 was also subjected to usability testing and performance testing,<sup>1</sup> using the PageSpeed Insights application by Google Developers; furthermore, RWD (Responsive Web Design) tests have been conducted. These allowed for the assessment of the Geoportal's usefulness in the setting of mobile applications/devices. Due to a large number of possible types, models and configurations of mobile devices, these tests were performed using network applications which simulate displaying the website on various screens, of any given dimensions.

Responsive Web Design is a designing trend, which involves the development of a website in such a manner that its functionalities are accessible and usable on all devices with Internet access, regardless of the resolution of the screen that a given device has. A characteristic feature of the sites developed using the RWD technique is a smooth shifting in the position of the component objects, including: boxes with content, graphics (which are usually ordered vertically) as well as a dynamically changing menu (grouping items), or hiding selected elements of the website. Verification of the Geoportal's compliance and compatibility with mobile devices has been conducted using the Google Developers compliance test.

Applications to be tested have been chosen with the view to their global recognition and popularity of tools made available to web designers and makers of web-based applications as part of the Google Developers service package.

#### 4. Characteristics of selected functionalities of the Geoportal 2

INSPIRE Directive [Dyrektywa 2007] introduced requirements for the collection, processing and sharing of spatial data. Spatial data has already been processed by many systems, and this form of recommendations was the only an additional element of infrastructure planning and construction. In the case of Polish admin-

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<sup>1</sup> The tests were performed in an automated manner – using network tools (services), whose task is to assess the technical application parameters, e.g. performance, compliance with the stated design standards, consistency of the site structure, the correct syntactic code, etc. The advantages of automated tests include low costs of a single test and a short time of its implementation.

istration, which includes, among others, all geodetic and cartographic services on three levels: central (maintaining a database for the whole country, including orthophotomap, database of general geographical information, register of State borders and State register of geographical names); regional (maintaining databases related to the BDOT10K database of topographical objects on a scale of 1 : 10 000); and local, district level (maintaining spatial BDOT500 database, idem on a scale of 1 : 500) plus the Land and Buildings Registry, the management of such a system a hierarchical one, with geospatial data and reporting sent to the centres of a higher level. At the central level, work was initiated to build a geoportal web service that would store and support geospatial data from many areas and disciplines. Such a venture requires the application of rules and regulations of access set by the INSPIRE Directive and implemented by standard certification bodies: the OpenGIS Consortium (OGC) and the World Wide Web Consortium (W3C).

The Geoportal 2 is a project co-financed from the Operational Programme: Innovative Economy 2007–2013, within the 7th priority axis “Information Society – establishment of electronic administration”. Is a continuation of the “Geoportal.gov.pl” project, implemented by the Head Office of Geodesy and Cartography under the Sectoral Operational Programme: Improvement of Competitiveness of Enterprises 2004–2006 [GUGiK 2015]. The portal provides four mapping applications: the National Geoportal, the specialised Industry-specific Portal, the INSPIRE Geoportal and the Statistics Module.

The Geoportal 2 is an information system on a national scale, which provides spatial data sets held by the public administration. It is one of the most popular – and the most frequently selected by users of official map services throughout Poland. It may be the first source of information for citizens, e.g. when buying a plot of land or for such issues as confirmation of access to public roads, verifying the distance from selected objects, location in relation to forest areas, and others. The Geoportal 2 allows the user not only to find the location of the plot with the specified number, but also to obtain selected informal cadastral information without having to visit the office. Such specific data is not available in mapping services such as Google Maps, Bing Maps or similar.

#### 4.1. The range of services and information offered

The first point of access to geo-portal is a website [Geoportal 2 2015]. It consists of the main menu with links to pages from the so-called “tiles”, which allow, among other operations, to switch between functionalities of the map application and other applications of the Geoportal.

Pages available from the top menu are informative in character; they have been grouped thematically. The “Services” bookmark contains information about the geospatial data services available from the website. The Geoportal 2 is primarily a source of information about:

- The State Register of Geographical Names,
- The State Register of Borders and surfaces of territorial units of the country,

- The Land Registry data,
- Cadastral information,
- Numerical elevation models,
- The General Geographical Database information (BDO),
- The Database of Topographic Objects (BDOT),
- Thematic maps,
- Scans of topographic maps,
- Orthophotomap,
- Basic surveying grid.

#### 4.2. Map applications and statistics module

The Geoportal's mapping application allows the user to view spatial data, including the Land Registry information, cadastral data, orthophotomaps, raster scans and topographic maps; and to search these data sets. The map browser available within the Geoportal 2 allows the use of multiple functionalities including zoom in, zoom out and move the map view. It allows the user to change the presentation of the various thematic layers through their switching on and off, adding other layers from WMS services, changing the order in which they are displayed, or changing their degree of opacity/transparency. Another advantage of the application is the ability to perform measurements directly on the map, in real time, including length or distance [Ślusarski 2012].

The Geoportal 2 also allows the user to search for geographic objects, addresses, land plots, geodetic points, or metadata. The availability of some functions depends on the selected module. One configuration of functionality is available for the National Geoportal, another for the INSPIRE Portal, another for the specialised Industry-specific Portal, and yet another for the Statistics Module. For example, a search function for grid control points is available only in the specialised Industry-specific Portal, allowing the use of filters: kind of grid (all kinds, horizontal, altitude, magnetic, gravimetric), the type of grid (base and fundamental), or the name and number of points.

Content management of the Geoportal 2 map application is conducted by the means of the interface, which is available in 3 modes: simple, extended and full. Maps can be viewed in any composition of layers and at any range. One of the functionalities of the application is to save the user's mapping composition in the defined coordinate system. Setting layer visibility allows the user to customize scale ranges. The functionality of "embed map" enables the implementation of previously defined maps in the structure of any HTML document (*HyperText Markup Language*). So embedded, the map retains all functionalities specific to the base map. Among other functionalities we can distinguish the "measure the surface" tool, which allows measurement of the area marked on the map, and the "measure the distance" tool, which

provides the measurement of lengths on the map. In addition, the tools collected in the “Search” menu allow the user to search for geographic objects, streets and addresses, plots of land, metadata, as well as indexes according to the selected criteria and control points.

Table 1 shows the code, which is generated automatically by the “embed map” module. Its structure, however, is imperfect. Implementation of the map is effected through displaying the map’s resources in the “iframe” (floating box) with defined parameters. The whole thing is embedded in the structure of an HTML document, without defining the specifications i.e. the standard inscription of tags. A fragment of thus generated code, including the contents of the “iframe” tag, can be inserted into the structure of any hypertext document, but in order to meet the current W3C standards, it needs to be modified. Among other elements, the specifications of a hypertext document, and a number of information falling within the “head” category (metadata), needs to be elaborated.

**Table 1.** Sample HTML code responsible for embedding maps in the frame of a hypertext document

```
<html>
<head></head>
<body>
<iframe src="http://mapy.geoportal.gov.pl/imap/imgp/ge
nmap?objectid=2100131&token=B09Vl7FJk1JjtWHRF_
CHvnMB3rNuFU5WN95ArTuXvwfFqw7y2RjxRomp2o7IvhEwMWo8ulofQIEXa73oM4rYiw."
style="width:400px; height:300px; overflow: hidden; "frameborder="0" scrolling="no"></iframe>
</body>
</html>
```

Source: Geoportal 2 [2015], original notation

The Statistics Module is an example of a tool for the cartographical presentation of statistical data using cartograms (colour intensity or monochromatic hatching within the borders of given territorial units) and cartographic diagrams (pie charts, bar charts, etc.), including cartographical research results [Żyszkowska et al. 2012]. It also allows the users to create their own thematic maps. The module is available from the web site of the map service (the “tile” menu). Statistical data can be presented on the map of the State Register of Borders (Państwowy Rejestr Granic), which contains information pertaining to the administrative division of the country [Medyńska-Gulij 2012]. There is a convenient option to import data directly from a Microsoft Excel file.

### 4.3. INSPIRE Geoportal

The website allows the user to view data from the register of INSPIRE services. The Polish equivalent (transposition) of the European Parliament and Council Directive



2007/2 / EC of 14 March 2007, establishing Spatial Information Infrastructure in the European Community (INSPIRE) – Official Journal of the EU L 108 of 25 April 2007 p.1, with later modifications, is the Polish Law on spatial information infrastructure of 4 March 2010 – Official Journal 2010. No. 76, item. 489; changes in 2012: OJ Pos. 951 [Sikora 2014]. The Spatial Information Infrastructure equals spatial data sets described using metadata as well as the associated services, technology, processes and procedures, search indexes, and metadata search [Ustawa 2010]. ‘Search indexes’ option is also available from the Industry Portal. The INSPIRE Geoportal is a joint project between the EU Member States, aimed at building European spatial information infrastructure. Access to spatial data for all Member States is intended to enable carrying out research projects, planning works, measures in the field of, inter alia: environmental policy, agriculture, transport and energy. The so-called “INSPIRE Initiative” encompasses, in particular, the creation of laws and regulations, tools for developing data, metadata and tools for publishing spatial data services, and finally, the creation of infrastructure to facilitate smooth operation of links in the network infrastructure for spatial information between providers of data and services [Geoportal 2 2015].

#### 4.4. Web cartography – API Geoportal

The interest in web cartography results from – among other factors – the availability of geo-information techniques and tools, including programming interfaces called APIs (Application Programming Interface), which allow the users to create their own thematic maps.

One of the services available within the Geoportal 2 mapping website is the ability to implement mapping resources, provided in the structure of any hypertext document. This functionality is implemented through the API service, using the JavaScript library of “iMapLiteApi.” The API programming interface allows, among other things, embedding map resources with marked POIs (points of interest, pins, pushpins, or markers) within any website [Geoportal 2015].

An API programming interface is a set of procedures, protocols and tools for building web applications. The map thus prepared is based on mapping studies provided by the suppliers of geospatial data, with added content, as selected by the user.

## 5. Conclusions and test results

While testing the Geoportal 2 service, we should distinguish between different types of tests: those concerning the website itself, which is an introduction to the various mapping services; and those concerning the services directly, for example, testing of the orthophotomap.

During the actual use of the portal, a number of mapping services were identified, specifically designed for screens of computer monitors. Importantly, these services

were also developed for mobile devices. Quoting Rynkiewicz [2014] in January 2014, 44 per cent of Poles were using mobile devices of a smart phone type, and by the end of 2014, already about 4 million tablets were being used. Analysts predict that the popularity of mobile devices will continue to increase. Thus, in testing performance, usability and responsiveness, mobile mapping services received special attention.

### 5.1. Responsiveness and performance testing

Responsiveness and performance testing of the Geoportal website have shown it to be compatible with mobile devices of varying screen diameter. During the testing, we observed a smooth change of the presentation form of the main text menu, in which items are grouped for smaller display screens. Also grouped are the items related to the selection of individual mapping services. The content, which is presented and arranged horizontally, dynamically changes to a vertical layout. The only drawback may be a distortion of those graphic elements constituting the extension of the selected updates. This does not affect access to essential functionalities of the Geoportal. Therefore, the service can be freely browsed on your mobile phone or tablet. In addition, a separate version of the map browser was developed for mobile devices, which does not differ in functionality from the version designed for the screens of computer monitors.

In the usability (ease of use) test for mobile devices, performed using the PageSpeed Insights application, the Geoportal earned 96 points out of a possible 100. This is a good result, which, together with the RWD test, allows us to conclude that the service meets the requirements stated for RWD technologies. The same applies to the evaluation of mapping services developed for mobile devices. They were given 85 points in the PageSpeed Insights test. The only drawback, which has been identified in the final report from the testing – relating to both the Geoportal site as such, and to the mapping service specifically – is the issue of improving the size of selected elements for touch navigation (on smaller displays, certain elements of the navigation may be less visible and more difficult to use).

During the RWD tests, we noticed one major imperfection of the simulations that had been carried out – no option for touch testing (no simulation available of the touch panel). It is desirable therefore to extend the simulation – from tests carried out by software only to tests using specific equipment.

Performance of the Geoportal (“speed of website operation”), according to the PageSpeed Insights test, is satisfactory, and it amounts to 46 points out of 100 possible ones, for mobile devices (in performance testing, the mobile version scored 53 points out of 100) and 57 out of 100 for desktop computers (desktop test). When we place the results in the table of score qualifications (Table 2), we may infer that the rated sites require considerable improvement. The resulting score in points, however, is wholly synthetic in character, and it should be considered in conjunction with the tests carried out by the users directly, in real contact with the application (user evaluations).

**Table 2.** Table of performance qualification in the PageSpeed Insights test

| Points scale           | 0–19                                   | 20–39                             | 40–59                                       | 60–79   | 80–89 | 90–100    |
|------------------------|--|-----------------------------------|---|---|-------|-----------|
| Development technology | Very poor, website must be redeveloped | Poor, website must be redeveloped | Mediocre, many elements should be corrected | Sufficient, many elements should be corrected | Good  | Very good |

Source: authors' study

### 5.2. Testing selected functionalities

Functionalities were tested based on a scenario, which assumed performance of common tasks, such as searching for plots, measuring distance and area, searching for the location of towns and villages, collection of cadastral data in the form of raster and vector graphics, downloading topographic maps as the orientation map for design purposes, or downloading orientation sketches of landmarks to find the specified location. During functionality testing, some inconveniences were encountered, which – from the point of view of utility of the service – need to be improved (Table 3). The most important deficiencies that were identified included gaps in updating the data relating to the numbering of plots and their characteristics; quality deficiencies and shortcomings of selected maps; and lack of data compatibility between data presented in the Geoportál and data from external registers and databases.

**Table 3.** List of deficiencies/gaps identified during the testing of selected functionalities

| Type of task  | Identified deficiencies or imperfections   |
|---|--|
| Downloading of cadastral data (raster) employing a WMS service using the C-Geo software | Raster graphics of poor quality, lack of image sharpness, image blur, no break points of borders   |
| Downloading of cadastral data (vector) employing a WMS service using the C-Geo software | Does not download – information gap in the desired range, erroneous operation of the program or access authorization issues  |
| Searching for a given plot in the map   | No response if the plot follows the new division – out-of-date information in the portal   |
| Attempt to calculate the area of the plot   | Measures well  |
| Displaying the RASTER module of the geoportál   | Lack of total country coverage with the map in the 1 : 10 000 scale in the “1992” layout, which results in filling-in of the gaps with an older map, in the “1965” layout – this in turn results in the incongruity of the images (markings in the map) for adjacent areas, including the grid |

Table 3. cont.

|  |  |
|--|--|
| Identifying plot number placed in the cadastral layer of the geoportal service with the Land Registry data | Discrepancy in plot numberings – no divisions entered in the map, delayed updates<br>access: 04.01.2015:<br>ID of plot: 120202_5.0003.1222/18<br>Plot no. according to EGiB: 120202_5.0003.1222/20<br>Additionally, the geoportal displays plot area before the division, although such a plot no longer exists in the Land Registry |
| Identifying plot area placed in the cadastral layer  | Discrepancy between plot area in the portal and plot area shown in the EGiB (Land Registry)<br>access: 04.01.2015:<br>ID of plot: 120202_5.0004.2247/4<br>Plot area in the geoportal – 1305m <sup>2</sup><br>Plot area in the EGiB (Land Registry)– 1302 m <sup>2</sup><br>difference – 3 m <sup>2</sup>                             |

Source: authors' own research

### 5.3. Testing the API program interface

Tests of the Geoportal's API service have shown that it is relatively easy to implement. The API enables the application of POIs along with a description of a "pop-up" window ("bubble" or a "floating information window") by activating the function of search for locations based on an address or the given coordinates (Figure 1). A sample of map programming is shown in Table 4 (code created applying "finger coding using an HTML editor"). Project documentation describes how to enter a point in the map, but less advanced users may have problems with entering lines, or polygons. Also, there is no information available on how to generate static maps (the so-called Static API). Creating a map using the API consists of embedding network resources within the previously created HTML hypertext document, and activating specific functions using JavaScript. The code responsible for evoking the map can be freely modified, however, the entire service, in fact, comes down to the possibility of actually applying the POI on the Geoportal map foundations.

The documentation accompanying the API is relatively poor. It lists and describes selected parameters of the map (attributes and their values), which are available within the API. However, it only provides two examples of implementations, and merely one example of programming the configuration file of the map. The documentation does not describe the method of applying linear points or polygons on the map; furthermore, there is no information on how to program a static map (Static API) or how to conduct URL programming (*Uniform Resource Locator*). Also, the documentation fails to mention technical limitations pertaining to the use of the services, for instance: limits to the number of queries to the server, or limits to the number of POIs applied. Furthermore, there is a lack of detailed and dedicated licensing regulations for the use of the API. In addition, the editorial aspect of documentation leaves a lot to be desired.



Source: authors' study based on Geoportal resources [2015]

Fig. 1. Location map of selected water reservoirs in Kraków area, created using JavaScript “iMapLiteApi”

Table 4. Sample map programming using JavaScript “iMapLiteApi” (fragment of programming code with explanation)

|  |
|--|
| Implementation of the Geoportal API “iMapLiteApi” library within an HTML document  |
| <code>&lt;script src="http://mapy.geoportal.gov.pl/iMapLite/js/imapLiteApi-core.js" type="text/javascript" charset="utf-8"&gt;&lt;/script&gt;</code>   |
| Initialising API   |
| <code>function initMap() { ILITEAPI.init({</code>  |
| Sample attributes of the map and their values  |
| <code>“divId”: “iapi”, “width”: 500, “height”: 300, “marker”: [{ “x”: 570531, “y”: 241199, “opts”: { “title”: “Zalew Bagry”, “content”: “Zalew Bagry&lt;br /&gt;&lt;img src='http://www.homeproject.pl/bagry/bagry.png' /&gt;&lt;br /&gt;Zalew Bagry w Krakowie.”, “show”: true, “width”: 360 } } ]</code> |
| Execution <code>initMap()</code> in the event <code>onLoad</code> of the element <code>&lt;body&gt;</code>   |
| <code>&lt;body onLoad=“initMap()”&gt;</code>   |
| Box <code>&lt;div&gt;</code> in which the map will be embedded   |
| <code>&lt;div id=“iapi”&gt; &lt;/div&gt;</code>  |

Source: authors' study

On the pages of the Geoportal 2, API users will not find a step by step tutorial, or any more specific educational materials. This range of available functionality and such manner of presenting services is typical for projects in their initial phase,

their testing phase or during their development. All this results in difficulties when creating maps using the API (in practice, the process is restricted and available to advanced users only). A service shared in this manner will not find a larger circle of supporters. If the project is left in its current phase of development, it is destined to remain but a local curiosity in the shadow of the Google Maps API, the Bing Maps API and many others which are much more accessible.

#### 5.4. Testing the services of sharing geospatial data

In the next step, the services of sharing spatial data were tested. In their range, we identified lack of access to selected functionalities, including:

- downloading spatial data via Web Feature Service (WFS), which lets the user download a portion or all of the individual spatial data set stored in PZGiK (State geodetic and cartographic resources) according to the given criteria (access to the download services is limited, the service can only be used by authorized users),
- downloading Service via Web Coverage Service (WCS), which provides data most frequently in the form of a raster. WCS downloading services, just as WFS downloading services are protected, which is to say, there is no public access to the source file.
- downloading spatial data in the ATOM profile, which makes downloading predefined spatial data possible, according to the INSPIRE themes, without the need to define the parameters of the sets by the user (no public access).

In view of the limitations encountered within selected spatial data resources, the question arises: where do these limitations result from? The Geodesy and Cartography Law [Ustawa 1989], amended in 2014, and the Decree by the Minister of Administration and Digitisation of 6 October 2015 on publishing 2016 fees for the access of State geodesic and cartographic resources [Obwieszczenie 2015] establish and maintain fees for providing materials and data: geodetic, cartographic, spatial databases, reports, and indexes. Article 40a of the Law [Ustawa 1989] lists types of data and entities, for which a fee is not charged, while article 40b p. 1 defines the scope of PZGiK data and material where such fees are applicable.

In the period prior to the introduction of the listed changes in the geodetic and cartographic law, it was possible to download vector data from the Geoportal using the WFS service. This concerned selected categories of data, including: the State Register of Borders, boundaries of plots from the LPIS and others. After the introduction of the regulation, the option to generate answers to WFS questions has been disabled for unregistered users. However, it wasn't stated what criteria must be met in order to obtain the status of a registered user (i.e. a user who is authorized to retrieve data). Therefore, the only data of the Geoportal with open access is that which is included in the format of predefined sets, and which can be downloaded in a GML or SHP format – from the website of the Head Office for Geodesy and Cartography, as defined in Article 40a, paragraph 1.

The Geoportal service, while keeping the requirements to publish spatial data as imposed by the INSPIRE Directive [Dyrektywa 2007] and the Law on Spatial Information Infrastructure [Ustawa 2010], maintained the WMS as the only active service. The latter includes a wide range of data layers, but without the possibility of using the services of searching and selecting vector data.

## 6. Conclusions

The “INSPIRE initiative” is a project, which connects the national geoportal to the spatial information infrastructure in the European Union, thus implementing the provisions of the Law on Spatial Information Infrastructure. It allows sharing of spatial data between Member States of the European Union, by creating a Europe-wide platform for this purpose.

Many commercial map services with a diverse range of subjects are available on the Internet. What distinguishes the Geoportal 2 service among them is the fact that it enables the sharing of spatial data sets with the status of administrative (official) data, including the Land Registry data. At this point it is worth noting that both the Geoportal site and its mapping services available have been developed with mobile devices in mind – as the use of such devices for browsing the Internet becomes widespread. It is a serious advantage of the portal that it allows also generating simple spatial queries, and a wide range of spatial services and data including specialised data. While using the resources of the Geoportal 2, we should remember, however, that the map presented in the service is for illustrative purposes only, and that it cannot be treated as an official document. It cannot be the basis for any administrative actions or official procedures. Without a prior written consent, neither the map, nor any part thereof, can be used in any reproducible systems, or replicated by any means: photographic, mechanical or other.

The Geoportal 2 is not a finite and closed product. It continues to develop, evolve, and adapt to the changing legal requirements. The data shared therein is constantly updated, and the range of services available is expanded. Furthermore, in terms of its expansion and utilization, numerous training courses, workshops and conferences are organized. Although the project is being carried out primarily at a national level, co-operation within the EuroGeographics group is dynamically developing. The EuroGeographics is an international association of members of European cadastral and cartographic organizations, dealing with topics related to the construction of European spatial information infrastructure.

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