The Future of Geoportal Components: An evaluation for Turkey

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Introduction

Nowadays, information systems define the framework of the processes of data whose quality, accuracy and continuity are the requirements for the efficient operation of these systems. According to Hilbert and Lopez, 1,000,000,000 gigabytes of data was stored between 1986 and 2007 (URL 1). Although large quantities of data continue to be produced with the development of new technologies, only reliable, intelligible and common data can be used in official transactions. In this context, the scope of the data production and its usage become important within this complex structure. In data production stage, the most important factor is the credentials of the data that is metadata. Also, usage of the data is defined within the legal framework such as copyrights perspective. Data user is informed as far as the information given by the data producer. At this point; Portal structure which is an intermediary between the producer and user of the data, becomes essential item to exchange data in a reliable structure.

In this context, data is the most important component in the field of Geographic Information Systems as well as in many other fields. Especially data sharing according to the needs and purposes is an absolute necessity. Spatial based decision makers are in need of accurate data and data producers are responsible for producing data used in decision making process. Not only establishment of the Geoportal is sufficient, but it should have a comprehensive framework and respond to the user needs.

Around the world, countries or organizations design Geoportals and implement some properties on it. Although some of these properties resemble each other, they are differentiated based on the standards, user needs and also future needs of the technological infrastructure.

On the other hand; standards and technological perspective should be compatible with the user's requirements and their expectations from Geoportal. In this point, it can be stated that Geoportals have basic features and additional features can be added depending on the interoperability and in order to get maximum benefit from them.

Along this scope; main aim of this paper is to determine the present and near future Geoportal components according to the technical requirements and user needs. The other important issue is that the outcomes of this paper can be used as the basis for establishing the new Geoportals or modifying the existence ones.

The key point of the paper is to define the relation between the technical perspective of the Geoportals and the user needs. It is very important that the convergence of the technical

perspective and the user needs about the Geoportal features are mapped. For achieving this issue, a survey is created and conducted on the employees of public institutions, private sector and academics provided that they are the main contributors and decision makers of the Geoportal systems. The scope of the survey is limited to Turkey. In the formation process of the survey; world examples, technical requirements and technological perspective of the future needs are used as the bases of the questions. In this point, the answers are interpreted and overall assessment is given based on sector and experiences.

Basic Concepts And Approaches Of Geoportal

Geoportal, in general, provides the general framework required to access geographic information and accessibility criteria via both intra and internet. According to the Open Geospatial Consortium (OGC, 2004), Geoportal is "a human interface to a collection of online geospatial information resources, including data sets and services" (p. 1). Maguire and Longley (2005) explain the Geoportal as "gateways to geographic content and capabilities" (p.2).

Geoportals provide a single media for presenting a different combination of data or systems. Geoportal works on a web based platform and runs on both intranet and internet infrastructure. This situation leads to the necessity of using certain technological approaches. In this scope, Service-Oriented Architecture (SOA) stands out as an essential tool for the solution of working stable systems.

Data should be produced or shared in an adopted and understandable way for the community in each country. According to Nebert (2004) "Spatial Data Infrastructure (SDI) provides a basis for spatial data discovery, evaluation, and application for users and providers within all levels of government, the commercial sector, the non-profit sector, and academia and by citizens in general" (p.8). Moreover for achieving this; Global Spatial Data Infrastructure Association (GSDI) emphasizes the necessity of standardization for sustainable and reliable data access, and also its usage in spatial based data and services (Nebert, 2004).

Besides establishing the spatial data infrastructure and creating metadata to manage the spatial data, INSPIRE Directive tries to achieve the integrity of spatial data. In the fourth paragraph of the Directive, the superior aim is explained as follows "the infrastructure should assist policy-making in relation to policies and activities that may have a direct or indirect impact on the environment" (INSPIRE Directive, 2007, p.1). On the other hand; managing and gathering information from different parts of the European Union with a pre-defined standard as a spatial basis is a necessity for the continuity of its structure. In fifth paragraph, creation of the spatial data with common standards and checking its compatibility are expressed as duties of member states. (INSPIRE Directive, 2007).

World Examples

Besides the technical and theoretical framework, government organizations or research bodies create and publish their own Geoportals depending on their needs. Although these Geoportals have similarities, they also differ and provide their own particular features. Main aim of analyzing the world examples is to understand how the existing Geoportals are designed and operated based on their capabilities, technical infrastructure or perspective. In this framework; Geoportals are examined in terms of their feature properties or spotlights.

Table 1. Comparison of Geoportal Components of the World Examples

Subjects	INSPIRE Geoportal	Geo Platform	GEOSS Portal	Geo Portail	Turkey Geoportal
Main Management Screen	✓	✓	✓	✓	✓
Metadata Editing and Validation Interface	✓	✓	✓	o	o
Data Download	✓	✓	✓	✓	✓
Support Different Data Format	✓	✓	✓	✓	✓
Standardization in Data and Services	✓	✓	✓	✓	✖
Data Grouping According to Themes	✓	✓	✓	✓	✓
Data view with Web Map Viewer	✓	✓	✓	✓	✓
Search Data with Area Selection	✓	✓	✓	o	o
Support Spatial Based Web Services	o	o	o	o	o
Catalog Service Support	✓	✓	✓	✓	✖
Print and Printing Layout Design	✖	✖	✖	o	o
3-Dimensional Data Visualization	✖	✖	✖	✓	✖
Mobile Application Support	✖	✖	✖	✓	✖
Account and Group Management	✓	✓	✓	✓	✓
User Data Store	✓	✓	✓	✓	✖
API Support	✖	✓	✖	✓	✖
Geo Rights Management	✓	o	✓	✓	✖
E-Government Integration	o	o	✖	o	✖
Online E-Commerce Marketplace	✖	✓	✖	✖	✖

(✓ = Available, o = Not Fully Available, ✖ = Not Available)

Survey Part

In the survey part; questions are prepared in line with the above indicated literature review, analysis of world examples, projected components and recent technological developments. Main aim of this survey is to question the consistency of components of Geoportal with the user needs. In order to achieve this, it is important to receive the opinion of users working in different sectors. Users from various disciplines can reflect their experiences and needs based on their point of views. It is also important to reach more people from different areas of expertise in order to sustain consistent results. It is essential to obtain user opinions and combine them with standards and best practices for efficient use of Geoportals.

In order to ensure the reliability of the survey, survey questions were sent to people particularly specialized in this subject. In public sector, information systems professionals who work in Geoportal projects or information technology areas; in private sector, technical people in the field of information systems; in academics those working within the Geographic Information Science are targeted.

In this framework; this survey was sent to the relevant divisions of 19 universities, 28 private companies, information technology departments or departments which have done Geoportal oriented works in Turkey. Survey was also shared in social networks LinkedIn and Facebook. Survey began on March 17, 2014 and stayed open until it reaches 100 participants. It took nearly 3 weeks and it was completed on April 3, 2014.

General Survey Questions and Results

36 people from public institutions, 25 people from the private sector, 37 people from the academia, 1 person from the freelance labor and 1 person from the non-governmental organizations have participated in the survey and evaluated the questions. Freelance labor and the non-governmental organization participants are excluded from the study because the participant number does not enable common assessment. Thus survey evaluations are done based on the feedbacks of 98 people from public institutions, private sector and academia.

General Questions are the important indicators for getting reliable and sustainable results. Implementation of the survey on experienced users, professionals and people who are interested in this area enables more robust evaluation of the results.

The first question is asked to determine experience of the participants in the field of Geographic Information Systems. According to the survey results,; 10.20% of the respondents have 1-3 years of experience, 13.27% have 3-5 years of experience, 27.55% have 5-10 years and 48.98% have more than 10 years of experience in the field of GIS.
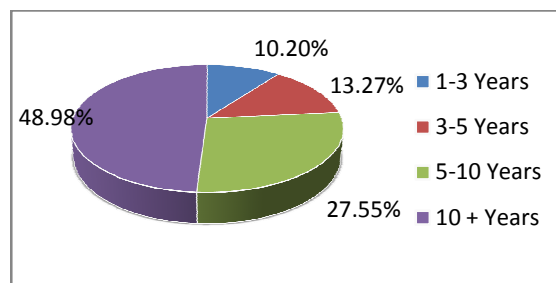

Figure 1. Participants Experience in the Field of GIS

Due to thenature of the subject, it is important to reach the experienced users in GIS. According to these results; 48.98% of survey participants have more than 10 years of experience and 76.53% of survey participants have more than 5 years of experiencein the field of GIS.

In the second question, sectors they are working in are asked in order to determine the participant's sector distribution. It is important that especially the public sector, private sector and academia are represented in the survey results.Public sector is both users and the decision maker of Geoportal. Private sector generally provides the technical infrastructure and also may be the user of the Geoportal. On the other hand Academia provides their academic perspective.The survey results show that 37.76% of participants are academicians, 36.73% work in public institutions and 25.51% work in private sector.In survey logic; recommendations are prepared mainly depending on the decision makers and the academic perspective.

Third question aims to understand previous Geoportal experience of the participants. Survey result shows that 25.51% of the participants do only research

10.20% only project, 32.65% both project and research and 31.63% of the user do not have a direct relationship with Geoportal. According to survey results; 68.36% of the participants have direct relationship with Geoportal.
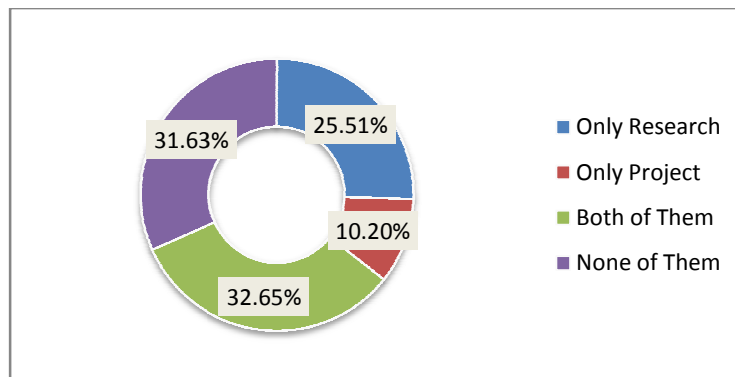

Figure 2. Users Relation about the Geoportal

According to the survey results, following results are obtained.

Table 3. Survey Questions and the Average Values

No	Survey Questions	Average Score
1	Geoportal should have "Data Download Ability"	4.54
2	Geoportal should have "Data Download Ability in Different Formats (for raster, vector, database)"	4.39
3	Geoportal should have "Standardization in Data Themes both	4.72

	National and International Level (e.g. INSPIRE)"	
4	Geoportal should present Metadata Information	**4.57**
5	Geoportal should have "Interactive Data View within the Web Map Viewer"	**4.60**
6	Geoportal should have ability to "Search Data with Selecting Area from Map"	**4.63**
7	Geoportal should have support "Thematic Mapping and Analytics on Data"	**4.09**
8	Geoportal should support "Print and Printing Layout Design "	**3.61**
9	Geoportal should display "External Web Map Services (WMS)"	**4.26**
10	Geoportal should provide "Web Map Tile Services (WMTS) Support"	**3.78**
11	Geoportal should provide "Web Coverage Services (WCS) Support"	**3.64**
12	Geoportal should provide "Web Feature Services (WFS) Support"	**4.00**
13	Geoportal should provide "Transactional Web Feature Services (WFS-T) Support"	**3.51**
14	Geoportal should provide "Web Processing Services (WPS) Support"	**3.57**
15	Geoportal should provide "Catalog Service for the Web (CSW) Support"	**3.70**
16	Geoportal should have "GeoRSS Support"	**3.95**
17	Geoportal should have "3-Dimensional Data Provision and Visualization"	**3.36**
18	Geoportal should have "Mobile Application Software Version"	**3.87**
19	Geoportal should provide "Accounts and Groups Management Support"	**3.66**
20	Geoportal should have ability to "Store User Data"	**3.74**
21	Geoportal should provide "Application Programming Interface"	**3.58**
22	Geoportal should be accessible to "Non-Governmental Organizations or Associations"	**4.15**
23	Geoportal should be accessible to "Private Sector"	**4.13**
24	Geoportal should provide "Online E-Commerce Marketplace for Data Selling Support"	**4.02**
25	Geoportal should provide "Geo-Rights Management Perspective "	**4.17**
26	Geoportal should support "E- Government Integration"	**4.39**

Evaluation and Conclusion

Analyses of responses coming from different group of users are an important issue for the survey. Different sector groups have different expectations of the Geoportal and thus they would have different attitudes towards the survey questions.

Public Sector mainly focuses on the administrative and the political side of Geoportal. Especially; conformance to the national and international standards and e- government integration questions are located at the top ranks for public sector. On the other hand; 3-dimensional data provision and visualization, most of the web map services and other current technological trends are located towards the bottom ranks.

Private Sector assesses mainly based on the managing, accessing and searching of the spatial data. According to the survey results; conformance to the national and international standards, metadata information and selection process of data are high rated questions. On the contrary; especially the web map services that are capable of data editing and making spatial analyses and 3-Dimensional data issues are rated towards the bottom of the list.

Academics give the most importance to usage and access of data with download capability. Academics regard the data download and different data format download ability as valuable. On the other hand; some web services, API and account and user management functions are evaluated as the least important features for the Geoportal. It is unexpected that the metadata information is not located at the top of the list and it is located at the 6th rank.

When responses from all sectors are considered all together; "Standardization in Data Themes both National and International Level (e.g. INSPIRE)", "Search Data with Selecting Area from Map" and "Interactive Data View within the Web Map Viewer" abilities are the common features considered as most important for the Geoportal. On the other hand; "Transactional Web Feature Services (WFS-T) Support" and "3-Dimensional Data Provision and Visualization" are evaluated as the least important components for Geoportal by all three different sectors.

From the initial startup phase, the responsible organizations should implement certain features in the Geoportal. Most important issue is the management of the metadata information by the Geoportal. They should provide interface for viewing or publishing the metadata. In addition to this; accessibility of data and service via Geoportal with its map functions through the map view, making basic queries and using thematic functions interactively are essential for effective usage of Geoportal. Providing Geo Rights and data download ability are also important for Geoportals. Moreover; Geoportal accounts and groups management function supports its management capabilities. These can be considered as the basic features that each Geoportal should have.

On the other hand; some issues stand out to improve the existing Geoportals. First of all; standardization in data themes becomes an important issue for interoperability. Many different GIS data extensions and types are constantly being created. Therefore; support for different data extension and data type is an essential feature in developing the existing Geoportals. In addition to that; print operations via Geoportal can be important when delivering projects within the regulation. Storing the user data and instantaneous spatial information with GeoRSS are critical features to increase the interactive usage of Geoportal.

In recent years, the importance of spatial based web services is increased and they are started to be widely used. Especially; WMS, WFS, WMTS, CSW are supported by many service providers. In addition to that; studies on WCS, WPS, and WFS-T are gaining momentum. Available Geoportals can work on spatial based web services to meet the user needs. Moreover; public institutions, private companies and non-governmental organizations need reliable data for their projects. Thus different sector groups can be supported in Geoportals.

Geographic information is also affected by the technological developments. Thus E-Government Integration, Application Programming Interface Support, 3-Dimensional Data Provision and Visualization, Mobile Application Software Support and Online E-Commerce Marketplace for Data Selling Support are also the highlighted topics. These components can be considered for advanced Geoportals.

The aim of the survey is not only to receive user opinions about Geoportal components but also to inform the users about the Geoportal features that they are not aware of. In addition to this; the research and survey results can be used as a road map in the Geoportal preparation process or to improve the already existing ones.

As a result of this study, Geoportals should be designed considering the following principles;

- It should be in a network base structure (Internet and/or Intranet Base),
- It should manage metadata,
- It should be managed by single and authorized source with up to date information,
- It should protect rights on data
- It should contain interoperability approach
- It should take into account national and international standards
- It should be responsive to user needs, at least contain basic Geoportal Components

Considering the future of Geoportals, it is necessary to monitor that Geoportals are compatible with the new technologies in order to ensure their sustainability. Data is still growing exponentially.

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