Starting a spatial open data initiative for Turkey

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Key words: Open Data; Spatial data, Spatial Open Data, GIS, Open source

SUMMARY

The core of Open Data is releasing government's accurate and updated data in accessible and usable forms to the public to use it freely. The emerging of this phenomenon helped communities gain several benefits in several aspects such as raising citizen's awareness, increasing government's accountability and transparency and provide new job opportunities for the society. These benefits encouraged other governments to implement such initiative, especially for spatial data. Istanbul Metropolitan Municipality made a decision to start such initiative in its efforts to make Istanbul a smarter city. Applying such relatively new phenomenon compels investigating the spatial data releasing mechanism to assure maximum sound benefits. This study investigates the main spatial Open Data principles that identify this data from other data types and illustrates the standards, recommended data domains, categories and data formats the governmental spatial data should be published with. The paper identifies Turkey's current status and upon that concludes the research by identifying the proper steps required to implement a successful initiative.

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1. INTRODUCTION

The Open Data (OD) is a new world-wide phenomenon. Governments in several countries make their data accessible to the public by publishing it on the web (Parycek et al. 2014). The main reasons for implementing OD are increasing democratic accountability and the participation and interaction of users, enhancing transparency, delivering citizen self-designed public services, and most importantly stimulating economic growth (Gurstein, 2011, Jaeger & Bertot, 2010, Bertot et al., 2010; Janssen, 2011). Actually, many new studies argue that citizen-government interactions are facilitated through, and indeed depend upon, the opening up of data generated by government and by governments' willingness to accept citizen feedback in the context of service provision which plays a big role in providing smarter communities or cities (Nath, 2011, Goldstein et al. 2013 and Sieber and Johnson 2015). More specifically, OD is considered to be one of the significant pillars that supports information and communication technologies (Laurini 2017). This is referenced to OD being fuelled by web/internet technology that allows for easy sharing and use of data (Linders, 2012).

The spatial data, of all data, is incredibly valuable because it is the embedded and underlying data for so much information. It is considered to be the glue that binds together multiple different data sets and make a truly linked web of data. In fact, it is recognized that around 80% of the database used by the public administration contains some kind of geographic reference (postal codes, etc.) (NoguerasIso, 2005). The value of spatial data is recognized highly by both government and society, but the effective use of it is inhibited by poor knowledge of the existence of data, poorly documented information about the data sets, and data inconsistencies (Official Journal of the European Union, 2003). Some governments and institutions are still making efforts to determine the best spatial open data policies that balance financing needs with open data principles. This happens because governments have long collected information, including geospatial data, with which to support planning, decision-making, and service provision for their departments, but not for the purpose of sharing it with its citizens (Janssen, 2012). Citizens, also have most of their spatial data through a third party and not directly from the government. Successfully opening such data to the audience imposes setting clear criteria and researching the optimum methodology, principles, and tools by which governments can share their data to assure maximum benefits for their citizens.

Well known two OD world indices, namely being Global Open Data Index (GODI) and the Open Data Barometer (ODB), enable governments to evaluate their current OD status by identifying and assessing their deficiencies and track the impact of their implemented solutions. They both assess each country based on implementing OD principles and standards, which are explained in details later in this study. Both indices display Turkey's data portals to be in middle ranks compared to other countries, 45th and 40th according to GODI and ODB respectively

(WWWF 2016 and Lämmerhirt et al. 2017). This alarmed relative authorities in Turkey, especially Istanbul Metropolitan Municipality (IMM), and encouraged them to develop their portals to enhance their status and assure maximum benefits from OD by implementing the OD principles and standards with collaboration from all relevant stakeholders.

This research sheds a light on the initial steps Turkey needs to take, the principles it needs to adapt and the standards its data should be published with, in order to implement a successful spatial OD initiative.

2. BACKGROUND

2.1 Main Principles of Spatial OD

Governments collect their data in their own system then store it in their own repositories. For that, the data to be exposed is not some single pre-existing dataset but consists of many disparate datasets from different agencies or authorities, drawn from different legacy systems in different formats. Applying the previously provided definition of OD is simply too lax for government to open their collected data (Tauberer, 2014). That is being, collecting any or all datasets from their sources and opening them as digital data to be freely used, reused, and redistributed by everyone does not necessarily mean an implementation of OD. For instance, not all released data types and formats are useful for citizens. Once these core data sets are shared between data users, each user does not have to develop the core data by oneself and can avoid duplicated efforts of core data development (Nobert 2004). As a result, providing a simple and reliable OD infrastructure involves more than the release and aggregation of those datasets (Davies 2011). Essential qualities of those higher principles that make government data open are significant to be provided. Several studies and reports (Tauberer 2014; International Open Data Charter 2017; Smart Cities Council 2015; Ubaldi, 2013) identified the significant principles in details. They are summarized as follows:

1. Information is not meaningfully if it is not available on the Internet for a free or minimum cost.
2. Data is primary, meaning that data is shared as collected at the source, with the finest possible level of granularity, not in aggregate or modified forms.
3. Data is timely, meaning that data is made available as quickly as necessary to preserve the value of the data.
4. Data is accessible, meaning that data is available to the widest range of users for the widest range of purposes.
5. Data is analyzable, meaning that the most critical value of open government data comes from the public's ability to carry out its own analyses of raw data, rather than relying on a government's own analysis.
6. Data is non-proprietary, meaning that data is available in a format over which no entity has exclusive control.

7. Data is non-discriminatory, meaning that Data is available to anyone, with no requirement of registration.
8. Data is license-free, meaning that dissemination of the data is not limited by intellectual property law such as copyright, patents, or trademarks, contractual terms, or other arbitrary restrictions.
9. Data has a license permanent, meaning data should be made available at a stable internet location indefinitely.
10. Data is available through bulk downloads, meaning that data can be reached and downloaded as a whole at once without restrictions.
11. Data is available in safe file formats, meaning that government bodies publishing data online should always seek to publish using data formats that do not include executable content.
12. Data should be trusted to use, meaning that published content should be digitally signed or include attestation of publication/creation date, authenticity, and integrity. Data also should contain metadata containing all needed information.

These principles are the base by which several world open data indices, i.e. GODI and ODB, rank governments OD initiatives. The failure to provide any of these principles for any type of data means that this data is not classified as OD.

2.2 Standards and Formats

Principles of OD helps in identifying the criteria by which data can be shared with citizens. However, unrelated data systems from different governments sectors typically are not designed to talk to each other. Each system generally has its own proprietary format for storing data. And, in general, the systems store data only in that format; they do not export to a universal format. Often there isn't a universal format. Solving this occurs by implementing OD standards, which enable software to interoperate through open protocols and allow the exchange of data between data stores and software through open data and document formats. In this paper, standards for internal processing within hardware (including telecommunications hardware) are out of scope. In this research, open standards that identify the criteria of selecting data formats, which can be implemented in both open source and proprietary software are explained as follows (Tauberer 2014; International Open Data Charter 2017; Ubaldi, 2013):

1. The Government needs to share appropriate information and data across and beyond government boundaries to provide efficient services to citizens, businesses and delivery partners.
2. In selecting open standards for government IT specifications, the Government removes barriers to competition, which makes it implemented by a diverse range of suppliers.
3. The standards are enablers for change, giving services the freedom to evolve according to changing user needs, expectations and technology innovation.
4. Decisions are based on the most economical solution for the public sector as a whole and costs are sustainable, to ensure that it spends taxpayers' money more carefully and avoids unnecessary investment.

5. Effective selection of standards for government IT specifications is a result of pragmatic and informed decision making, taking the consequences for citizens, users and government finances into account.
6. Government IT procurement, specifications, implementation plans and agreed exemptions from the open standards policy are transparent, providing the opportunity for challenge.

Accordingly, citizens, businesses and other stalk holders must be able to interact with government officials and services, or those working on behalf of the government, sharing appropriately formatted, editable spatial data. Officials within government departments also need to work efficiently, sharing and collaborating with such data. This profile recognizes that changes in technology and service delivery will, therefore, mean that data formats become less important as collaborative editing and transactions increasingly become an online experience. However, documents formatted in office productivity software are still prevalent amongst users of government information and the formats used by the government should meet user needs. W3C encourages the use of formats that can be used by the widest possible audience and processed most readily by computing systems. Source formats, such as database dumps or spreadsheets, used to generate the final published format, are out of scope (Lóscio et al., 2017). This document is concerned with what is actually published rather than internal systems used to generate the published data. According to Stewart (2001), Berners-Lee perhaps best known as the inventor of the World Wide Web, developed a 5-star deployment framework for open data that includes costs and benefits associated with each level as follows in Table (1):

Table 1. 5-star deployment framework for open data

Number of stars	**Description**	**Format example**
1 (*)	Data available with open license but not machine readable	PDF
2 (**)	Data available and machine readable in proprietary formats	XLS
3 (***)	Data available and machine readable in non-proprietary formats	CSV, SHP
4 (****)	Data available using open linked formats	RDF
5 (*****)	Data available and linked with other relevant data	Linked RDF

Taking into account this framework, governments shared their data in the best format available. Accordingly, several spatial open formats with at least 3 stars are recommended to spatial data based on their category (Tabular Data, Vector Data, Spatially-enabled databases, Raster, Styling and Compressed data). The recommended formats according to its categories are found in Table 2. The corresponding data in each domain is published according to its category. Each department or office responsible for its data domain is responsible for updates to their data tables based on their internal data governance model.

Assuring that data is published according to the previous framework and according to the spatial OD principle and standards forced portals to publish them in the certain formats. According to European Data Portal (2017), the most used data formats are CSV and HTML. The following most frequent distributions are ZIP and JSON. Most data formats are or are related to a spreadsheet, which enables to analyze the data more swiftly. Moreover, according to International Open Data Charter (2017), Executable content within documents poses a security risk to users of the data because the executable content may be malware (viruses, worms, etc.). Even with anti-virus software installed, malware is spread easily through file formats that contain natively executable code. In many cases, the best protection for a user is to simply not open files that may contain executable content. Governments should not ask a user to choose between their security and access to government information, and so open government data should avoid these formats.

Table 2. Data extensions and formats according to their categories.

Data category	**Explain and examples**	**Data extensions**
Tabular Data	It is a flat file that conforms to a predefined schema. The schema defines the characteristics of a fixed number of columns, including the column name and data type.	GPX, CSV, JSON, RSS, HTML, RDF, TIN, WKT
Vector Data	Geographic/Geospatial data are usually organized as a collection of features that define a layer. Layers can be overlaid on top of one another, allowing visualization of spatial relationships, spatial queries, and analysis.	SHP, GML, KML, KMZ, SVG, GML
Linked spatial data	A directed, labeled graph data model for representing information in the Web.	RDF
Spatially-enabled databases	Datasets that enable advanced spatial queries	GML, PostGIS, SpatiaLite
Rasters and base maps	Base maps, Pictures or online map viewer	JP2, JPEG, JPEG 2000, PNG, TIFF, GeoTIFF, BMP
Styling	Used for specifying the way features will be symbolized and labeled by keeping styling or portrayal information separate from the data encoding.	SLD
Compressed data	Compressed spatial files or folders with multiple documents	GZ, ZIP

2.3 Spatial Open Data Domains

Even though opening all data is required and useful for the society, certain data domains are identified to be the most shared and have most positive effects on OD initiatives. On the other hand, spatial data are considered to be embedded in most data and within most data domains. UK Guidance Sharing or collaborating with government documents (2011), WWWF (2016) and Lämmerhirt et al. (2017) identified certain domains which contain spatial information/datasets as described in Table (3). The availability of these domains is considered one factor in evaluating OD initiatives in each country in GOID and ODB indices. Providing such datasets require contacting various departments in the governments/city. Since most of the datasets have mutual attributes with datasets from other domains, assuring that provided data are consistent with others is considered to be significant. Inconsistent datasets undermine the credibility of the OD initiative and blow up the government's efforts.

Table 3. Open data domains and their details

Domain	***Details***
Geo-National Statistics	General statistics collected from authorities about each district.
Administrative Boundaries	The mapped zone (GIS) of designated permitted land use in the city.
Air and water Quality	Information about the current properties and pollution found in air and water
Property Deeds	The recording of property sales, mortgages, and foreclosures.
Weather Forecast	Enough forecasting is provided for weather
Business Listings	A directory of all licensed businesses in the municipal area, including key information such as name, address, contact information, and business type.
Code Enforcement Violations.	Building code inspection data surfacing reports on particular properties from code enforcement officials.
Construction Permits	Locations of issued construction permits.
Crime	City crime data.
Property Assessment	Data about assessed property values.
Public Buildings	Locations of city-owned buildings.
Transit	Timetables (schedules), locations of stops, and real-time location information of all municipally run or commissioned transit services (buses, subway, rail, tram, etc).

3. TURKEY'S CURRENT STATUS

Before Turkey starts its national Geo-portal/platform designing, the relative authorities should evaluate its current status and determine its deficiencies to build a successful roadmap. This is done via evaluating the implementation of spatial OD principles, standards and formats in its relevant domains. By doing so, the government can assert correct implementation of spatial OD

to reap its benefits. Several departments and authorities already use portals in Turkey to share their spatial data with their citizens. However, these portals have several deficiencies that deprive their status of becoming spatial OD portals. Table (4) shows the current status of essential spatial domains of Turkey. It shows the status of 8 main principles and the available formats in each domain. The study investigated these principles because their status could be comprehend online, nevertheless, the remaining principles, which determine whether the shared data is open or not, should be investigated in further studies. According to the used principles, none of the shared spatial data is considered to be OD. This happens because none of the domains satisfies all principles which is the main constraint to be considered as an OD. Moreover, some spatial data are not available or not collected yet, (i.e. Code Enforcement Violations, Construction Permits, Crime, Property Assessment and Public Buildings) and most of the available collected spatial data is not up to date. More importantly, data authorization/license is not provided except for the Geo-National Statistics and Weather Forecast domains. The reason for that is the national Turkish law number 4736 (Site 1), which restricts distributing any collected data to any governmental institution for free. This national law is considered to be the biggest obstacle to a spatial OD initiative in Turkey. On the other hand, Turkey considers most of the spatial open formats in sharing its data. Some portals use XLS, doc and DBF formats to share its data which are not recommended because they are not free and are used with certain property programs. However, most datasets provide at least two data formats for each data set, which provides users more options to use the data. On the other hand, even though PDF is recommended as an OD format, it is not recommended as a spatial OD format. This is because data in PDF is not considered to be analyzable spatial data.

TABLE 4. OPEN DATA DOMAINS AND THEIR DETAILS FOR TURKEY'S PORTALS

Domain	**Provided data source institution**	**License-free**	**Analyzable**	**Downloadable at once**	**Timely**	**License permanent**	**Free of charge**	**Accessible**	**Non-discriminatory**	**Available formats**
Geo-National Statistics/National Map	Turkish Statistical Institute	√	√	√	×	√	√	√	√	XLS, ZİP, CSV, doc, HTML
Administrative Boundaries	General Command of Mapping	×	√	√	×	√	×	√	×	DBF, SHP, TİF
Air and Water Quality	• Air Quality Watch Center • Minister of Forest and	×	√	×	√	√	√	√	√	CSV, HTML, XLS, PDF

	Water Works									
Property Deeds	Geoportal for parcel query	×	√	√	×	√	√	√	√	JSON, KML
Weather Forecast	Turkish State Meteorological Service	√	×	×	√	√	√	√	√	-
Business Listings	Turkish Trade Registry	-	-	-	-	-	-	-	-	-
Code Enforcement Violations	From all municipalities	-	-	-	-	-	-	-	-	-
Construction Permits	From all municipalities	-	-	-	-	-	-	-	-	-
Crime	Ministry of Justice	-	-	-	-	-	-	-	-	-
Property Assessment	From all municipalities	-	-	-	-	-	-	-	-	-
Public Buildings	From all relative authorities	-	-	-	-	-	-	-	-	-
Transit	From all municipalities	×	√	√	×	×	×	×	×	XLS, GTFS

4. DISCUSSION AND CONCLUSION

The importance of OD generally, and Spatial OD specifically, is significant in several domains but the expected economic benefits are proven to be the highest. Several important properties distinguish spatial OD from any other data which can be summarized in five points being; accurate, accessible, analyzable/readable in a machine, free or minimum cost, has no limitation on use. Turkey has to work on developing several aspects and domains to make a successful spatial OD initiative. Developing a framework to publish the open data is a very important process from the start. Choosing the data types to be first released and viewing options are important steps because it is going to be the community's first experiment. The data types should be released based on users' needs not on availability. The citizens have a trust issue with releasing such data; they are concerned with hiding their activities and identities. For Turkey, opening the spatial data faces a serious problem of providing the OD license by changing the constitution and the policy of the government departments. If this is achieved, the data use license and policy are important to be announced in the right media platforms for the audience. The data right of use open data should be clear to allow users to do whatever they want with the shared data. In Turkey, some of governmental departments share spatial data but they are not considered to be spatial OD. The government should direct authorities there to adopt a spatial OD policy for their data by considering the aforementioned spatial OD principles and

standards to assure maximum use and benefits from such initiative. Moreover, Turkey did not collect data for public use in several domains such as Code Enforcement Violations, Construction Permits, Crime, Property Assessment and Public Buildings. Furthermore, most domain have old shared data. Authorities should find a mechanism to make their data more up to date. The government should provide in the recommended formats and with more than one option for each dataset. The government should focus on more linked open formats such as RDF for tabular tables. For pictures base maps and similar documents, more than one resolution should be provided as well.

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BIOGRAPHICAL NOTES

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