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A data-driven approach to assess the potential of Smart Cities: the case of open data for Brussels Capital Region

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Abstract

The success of smart city projects is intrinsically related to the existence of large volumes of data that could be processed to achieve their objectives. For this purpose, the plethora of data stored by public administrations becomes an incredibly rich source of insight and information due to its volume and diversity. However, it was only with the Open Government Movement when governments have been concerned with the need to open their data to citizens and businesses. Thus, with the emergence of open data portals, these myriad of data enables the development of new business models. The achievement of the benefits sought by making this data available triggers new challenges to cope with the diversity of sources involved. The business potential could be jeopardized by the scarcity of relevant data in the different blocks and domains that makes a city and by the lack of a common approach to data publication, in terms of format, content, etc.

This paper introduces a holistic approach that relies on the Smart City Ontology as the cornerstone to standardise and structure data. This approach, which is proposed to be an analytical tool to assess the potential of data in a given smart city, analyses three main aspects: availability of data, the criteria that data should fulfil to be considered eligible and the model used to structure and organise data. The approach has been applied to the case of Brussels Capital Region, which first results are presented and discussed in this paper. The main conclusion that has been obtained is that, besides its commitment with open data and smart cities, Brussels is not mature enough to fully exploit the real intelligence that smart cities could provide. This maturity would be achieved in the following years with the implementation of the new Brussels' Smart City Strategy.

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Keywords: Smart city; Open Data; Intelligence Layers; Methodology; Brussels

1. Introduction

In the broad sense, the public sector is the source of an enormous amount of data created or collected as part of its duties, e.g. schedules for public transport, government statistics, catalogues of libraries or museums, maps, information about government revenue and spending, public tenders, etc.

This data, challenged by the Open Government Movement which arose in the mid 20th century, had a major shift in the first decade of the 21st century [1,2] leading to enact specific laws to promote opening public data. This is the

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case of Vancouver, which Committee of Council on Planning and Environment states that *"the City of Vancouver will freely share with citizens, businesses and other jurisdictions the greatest amount of data possible while respecting privacy and security concerns"*. Or that of Portland, Oregon where *"the Council of the City of Portland directs the Bureau of Technology Services to develop a strategy to adopt prevailing open standards for data, documents, maps, and other formats of media"*. Since then many other city governments have enacted similar laws as San Francisco (2009), New York City Council (2012) or New Zealand (2011).

In the case of Europe, the principles to provide and re-use public sector information were introduced by the Directive on the reuse of public sector information 2003/98/EC [3] of the European Commission. The European Commission has largely promoted initiatives to open public data to citizens both at European Union and Member State level. These provisions apply in the Brussels Capital Region since the adoption of Brussels Ordinance of 6 March 2008 [4] concerning the transposition of Directive 2003/98/EC of the European Parliament and of the Council of 17 November 2003 on the re-use of information from the public sector. Since them, both Belgium and Brussels Capital Region (henceforth BCR) has invested in the development of open data portals to offer their data openly.

This paper presents the methodology for a city holistic approach and that will be the basis for the analytical tool. This methodology is then applied to the case of Brussels Capital City based on the landscape of the open data portals that are currently providing relevant data for that purpose. Finally, future challenges and opportunities of open data for BCR are discussed.

Nomenclature

BCR	Brussels Capital Region
CSV	Comma Separated Values
GeoJSON	Geospacial JavaScript Object Notation
GIS	Geographical Information System
JSON	JavaScript Object Notation
SCO	Smart City Ontology

2. Methodology for a city holistic approach

Governments hold very rich data. Much of this information is published and available for re- use by others [5] since the creation of open data portals. Governmental data is thus collected from the different databases and sources where they are stored and published as datasets. Their publication enables the combination of datasets in an interoperable architecture. While individual datasets are valuable, by integrating data from multiple sources, the integrated data are often more valuable that the sum of the parts [6]. The biggest challenges and opportunities lie in connecting these disparate datasets to create new sets for analysis, and to discover interesting patterns and relationships [7], and it is there where interoperability plays a key role to reap all the benefits from the myriad of existing datasets in internet.

The fulfilment of this objective is conceived in the form of a data-driven approach, which has led to the 3-steps methodology shown in Figure 1, that transforms raw data into intelligence by linking and merging datasets, and that will be used to provide answers to two main questions:*"Is the existing data sufficient to cover the three layers of intelligence in smart cities? And if this is not the case, What is the real intelligence of the data stored therein?"*. The first two steps of the methodology, *Identification* and *Filtering* respectively, are concerned with the dataset container, i.e. file or database table where the dataset is stored, while the third focuses on the dataset content.

Identification aims to find relevant data that could contribute to the fulfilment of the business needs and that is usually stored in the form of raw data in various formats, such as files or tables in a database. The fact that data is identified does not entail that is immediately available, instead, data could have usage restrictions or could not be disclosed by the provider. The main outcome of this step is a list of available and re-usable datasets expressed in the form of an indicator, called **Availability**, that measures the number of these datasets. Availability could be calculated either with absolute measurements, such as number of datasets or MBytes of data, or with relative measurements, such