

Brazilian Government Open Data: Implementation, Challenges, and Potential Opportunities

Kellyton dos Santos Brito¹³

Marcos Antônio da Silva Costa²

¹Pernambuco Rural Federal University

²Federal Ministry of Prosecution

Recife, Brazil

ksb@cin.ufpe.br

msilvacosta@mpf.mp.br

Vinicius Cardoso Garcia³

Silvio Romero de Lemos Meira³⁴

³Pernambuco Federal University

⁴Recife Center for Advanced Studies and Systems

Recife, Brazil

vcg@cin.ufpe.br

silvio@meira.com

ABSTRACT

Technological advances and real-time worldwide communications hold great promise for transforming the efficiency and effectiveness of public services through the ease of publishing and access to government public information or through the offer of new kinds of services. In this paper, we describe two initiatives, *Rio Inteligente* (Smart Rio) and *Cidadão Recifense* (Recife Citizen), which are based on Brazilian open-data repositories from the cities of Rio de Janeiro and Recife and deliver services for citizens and tourists, mainly (i) a health-unit finder based on user location and (ii) an online vaccination card. Based on the development experience of these two similar applications that use completely independent open-data repositories, this paper discusses the current state of Brazilian open-data initiatives, their challenges and difficulties, and draws some considerations towards a framework to build applications based on government data.

Categories and Subject Descriptors

J.1 [Computer Applications]: Administrative Data Processing – Government.

General Terms

Measurement, Documentation, Experimentation.

Keywords

Open Data, Open Government, E-Government, Digital Society.

1. INTRODUCTION

In the current information era that is based on real-time worldwide communication, the increase of the capacity for both governments and citizens to publish and consume data is changing the ways in which governments operate, how and what the public sector provides, and ultimately how governments interact and engage with their citizens. This new context, also called “Open

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Government” has been described as “*the use of technology—especially the collaborative technologies at the heart of Web 2.0—to better solve collective problems at a city, state, national and international level*”[1].

To take advantage of this new context, many governments around the world have been making efforts to benefit from Web technologies. The Open Government Partnership (OGP)¹, for example, is concrete proof of that. It was launched in 2011 by eight founding governments (Brazil, Indonesia, Mexico, Norway, the Philippines, South Africa, the United Kingdom, and the United States), and rapidly grew up to 63 countries endorsing the Open Government Declaration.

Different governments launches distinct approaches to achieve their goals. For example, in February 2014, the U.S. government has six current commitments and launched an open-data portal containing nearly 89,000 datasets; the United Kingdom also has six current commitments and a portal with about 13,000 datasets; and the Brazilian government has 22 current commitments and an open-data portal containing about 200 datasets.

Although literature shows that it is possible to take advantage of e-government and open-data initiatives [2-7], some challenges ranging from cultural to technological [8-11] have to be considered in order to actually achieve the goals of open government. Primarily, the use of information and communication technologies (ICT) remains largely focused on supporting reporting functions[12], overlooking the wide opportunity to employ ICT to improve the effectiveness of strategic planning and aid management as well as to promote public health[7]. In addition, the challenges are bigger for developing countries[9, 13].

In this context, this paper describes two applications, *Rio Inteligente* (Smart Rio) and *Cidadão Recifense* (Recife Citizen), launched as websites. Both applications are based on independent government open-data repositories, from Rio de Janeiro and Recife cities, and focus on healthcare basic services: to help citizens and tourists in finding the nearest health units according to their needs and to build an online vaccination card to remind people when it is time to get vaccinated. The applications were developed to participate in application contests promoted by Rio de Janeiro and Recife city halls. Then, based on the development experience, this paper also analyzes and discusses the current state of Brazilian open-data initiatives, their challenges and difficulties,

¹ <http://www.opengovpartnership.org> (Retrieved: 02/15/2014)

and draws a few considerations towards a framework to build applications based on government data.

The remainder of this paper is organized as follows: Section 2 briefly presents the Brazilian open-data initiative and the scenario of application contests; Section 3 presents the applications, including their functionalities and architecture; Section 4 presents a discussion about the challenges and difficulties of developing applications using Brazilian open data; and section 5 presents concluding remarks.

2. BRAZILIAN TRANSPARENCY AND OPEN DATA

Brazil is one of the founding governments of the Open Government Partnership, launched in 2011. The partnership declares *the ultimate goal of improving the quality of governance as well as the quality of services that citizens receive* and the governments' commitment to (i) increase the availability of information about governmental activities; (ii) support civic participation; (iii) implement the highest standards of professional integrity throughout its administration; and (iv) increase access to new technologies for openness and accountability.

In its first Action Plan for the OGP, Brazil undertook 32 commitments that were partially implemented but produced many important benefits, such as the creation of the Open Data Portal, the organization of a nationwide conference on transparency (CONSOCIAL), and the implementation of the Brazilian Access to Information Law. For its second plan, Brazil used a broader participation process and developed a bolder action plan, with 52 commitments—19 of which were proposed by Civil Society Organizations (CSOs)—and the involvement of 17 government bodies.

The Brazilian Open-Data portal was launched in 2012. In January, 2014, it listed 240 datasets and 2109 resources. In addition, some cities and government agencies created their own portals, such as the Federal Chamber of Deputies, Federal Senate and cities such as Rio de Janeiro, Recife, São Paulo, and Belo Horizonte.

To promote the use of this data, hacker marathons and application contests are being financed by federal or municipal governments, such as the National Parliament Hackathon (<http://camara.leg.br/hackathon>), RioApps contest (<http://rioapps.com.br>) in Rio de Janeiro, and Cidadão Inteligente (<http://cidadaointeligente.rec.br>) in Recife. Applications presented in this paper were developed to participate in the RioApps and Cidadão Inteligente contests, which are briefly described in the next subsections.

2.1 Recife Application Contest

The Recife application contest, Cidadao Inteligente² (Smart citizen), was launched in July 2013, in the same month of release as the city open-data portal. Its objective was to incentivize developers "*to build applications or conceptual projects that enhance life in Recife.*" Developers were instructed to use Recife's open-data portal³, which contains 31 datasets. Applications could be sent until December 2013, and city hall committed almost US\$15,000 in two categories: conceptual projects and developed apps.

² <http://cidadaointeligente.rec.br> (Retrieved: 02/15/2014)

³ <http://dados.recife.pe.gov.br> (Retrieved: 02/15/2014)

The contest only accepted applications from Recife citizens, and had two phases: first, it was a public call for projects, then, a full day workshop. When submissions closed, a total of 34 conceptual projects and 23 applications had been submitted. Then, a committee evaluated all projects and chose the five best projects and applications according to the criteria: (i) utility, (ii) innovation, (iii) use of government data, (iv) scope, (v) usability and (vi) technical viability. Then, developers presented their projects and applications in the workshop, and the committee selected best projects.

After final committee evaluations, Cidadão Recifense received first prize. The complete list of projects can be found on the initiative's website.

2.2 Rio de Janeiro Application Contest

The Rio de Janeiro application contest, RioApps⁴, was launched in August 2013, and its objective was "*to create software applications that improve the city and the lives of its residents, businesses and tourists.*" Developers were encouraged to use the results of a previous contest, Rio Ideias⁵, which collected ideas with the same objective of the application contest, and to use Rio de Janeiro's open-data portal, RioDatamine⁶, containing 46 datasets. Applications could be sent until January 2014, and city hall committed to pay almost US\$40,000 through thirteen prizes, including one "popular choice" category.

When submissions were closed, a total of 264 applications from 16 categories had been submitted. Cidadão10 (Citizen10) received first prize, and Cidadão Recifense did not receive any prize. The complete list of projects can be found on the initiative's website.

3. THE APPLICATIONS

Rio Inteligente (<http://rio.cidadaointeligente.com>) and Cidadão Recifense (www.cidadaointeligente.com) were developed to be submitted to the RioApps and CidadaoInteligente contests, described in the previous section. Both were developed using specific open-data portals from Rio de Janeiro and Recife cities. The applications' cores are the same, but the Recife application has a few more functionalities, such as budget analysis and some education functions, because since the Recife portal contains fewer datasets than that of Rio de Janeiro, its data is more complete. In addition, it is important to note that the Recife application was developed first but that some minor improvements, such as English translation and visual improvements, could not be deployed due to a contest restriction that applications cannot change until final judgment. The applications are responsive and fully compliant with mobile devices. The first page of the Rio application on a desktop is shown in Figure 1. The first page of the Recife application on a Smartphone is shown in Figure 2.

3.1 The Applications

The applications' main functions are based on health assistance: (i) health-units finder and (ii) online vaccination card. Although, as previously mentioned, the Recife application has more functionalities, such as budget analysis and education functions.

⁴ <http://rioapps.com.br> (Retrieved: 02/15/2014)

⁵ <http://ideias.rioapps.com.br> (Retrieved: 02/15/2014)

⁶ <http://riodatamine.com.br> (Retrieved: 02/15/2014)

But, to maintain analyses consistency only the health functions will be described in this paper.

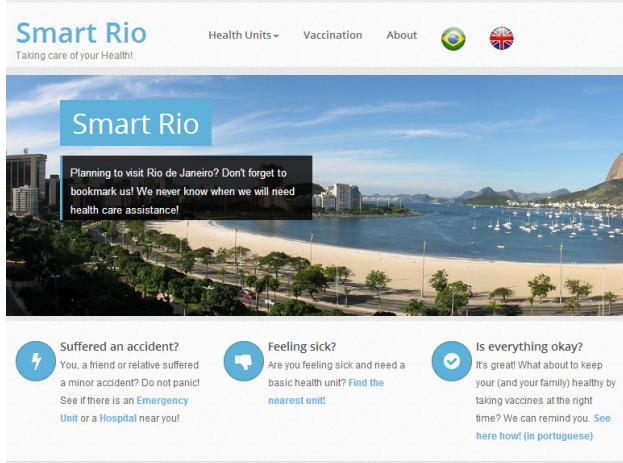


Figure 1. First page of Smart Rio on a desktop (in English)



Figure 2. First page of Recife Citizen on a Smartphone (in Portuguese)

3.1.1 Health-units finder

Based on the current citizen or tourist location, the app shows all health units nearby so that the user can find the closest one. On top of that, in order to help the user find the best one according to his/her needs, the app allows the user to filter the results by unit types like Hospitals, Emergency Unity, Family Clinics, Psychosocial Care, Rehab, and Workers' Health, among others. The menu containing the options is shown in Figure 3.

After the desired health unit (or all of them) is chosen, a map centered on the user is shown with the nearest units displayed along with a list of all health units of that type. By clicking on one health unit, a route is traced from the user until it and further information are shown. This page is shown in Figure 4. By clicking on the "More options" link or in the unit list, detailed information about that health unit is shown on another page.

This functionality is important to both local citizens and tourists. In general, citizens know only a few options for health units, mainly the ones that they are used to going to and that are near to

their homes. But when a user needs a specific type of healthcare, such as rehabilitation or occupational, more often than not they will simply ask someone. In addition, for tourists, the app is important because in general they do not know where to find a health unit in case of an emergency, and language barriers may also present a challenge.

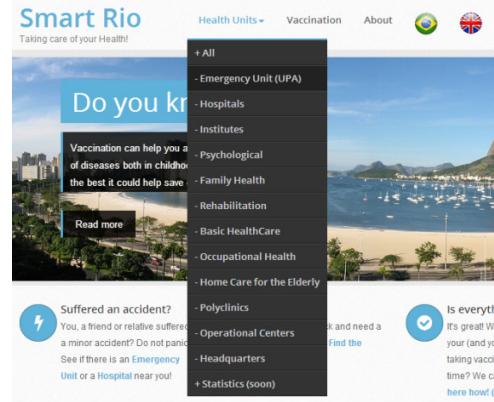


Figure 3. Smart Rio menu options

3.1.2 Online vaccination card

Vaccination is a well-known method to prevent many diseases, to improve citizens health in general, and to reduce costs of public health[14-16]. The Brazilian government has a public vaccination program, which includes vaccinations for children, adults, and elderly persons, and all people should have vaccination cards containing their vaccination schedules. But the implementation of vaccination cards still has some problems because the card is hard paper, and, due to the time lapse between vaccinations (in some cases 10 years), in general people lose their cards. As a consequence, in most cases people only get vaccinated as children[15, 17].

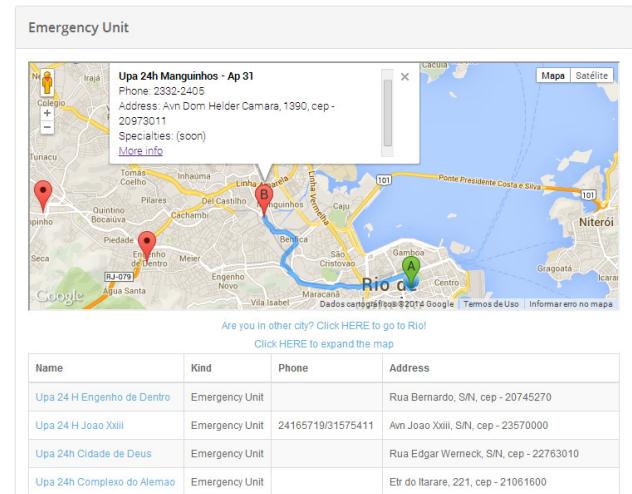


Figure 4. Health-unit finder and route

Both developed applications implement an online vaccination card in which users can enter information regarding their names, birth dates, and e-mails, and the application will generate a vaccination schedule and automatically send near dates by e-mail. The application then automatically sends e-mails (only in Portuguese) to users reminding them when it is time to get vaccinated again in addition to allowing them to log on to actively

check their schedules. It is important to note that it is possible to register many people with the same e-mail to allow, for example, parents to control the vaccination schedules for their entire family in a centralized way. An example of the schedule presented is shown in Figure 5, and an example of a sent e-mail is shown in Figure 6, both in Portuguese. The creation of an international version of this functionality was not prioritized, due to the fact that, in general, tourists do not participate in the Brazilian vaccination program.

Calendário de Vacinação: Kellyton Brito (clique para expandir)					
Kellyton Brito					
Nascimento:	01/05/1982	Idade:	31 anos	E-mail:	kellyton.brito@gmail.com
Cadastrado em:	14/01/2014				
Idade	Vacina	Proteção	Dose	Data Prevista	Status
Ao nascer	BCG	Formas graves da Tuberculose	Dose única	01/05/1982	Muito antigo
Ao nascer	Hepatite B	Hepatite B	1ª Dose	01/05/1982	Muito antigo
2 meses	Vacina Pentavalente (DTP + Hib + HB)	Difteria, Tétano, Coqueluche, Influenza tipo B (Meningite, Pneumonia) e Hepatite B	1ª Dose	30/06/1982	Muito antigo
2 meses	Vacina Inativada contra a Poliomielite (VIP)	Poliomielite ou Paralisia Infantil	1ª Dose	30/06/1982	Muito antigo
2 meses	Vacina Oral Rotavírus Humano (VORH)	Gastroenterite causada pelo Rotavírus	1ª Dose	30/06/1982	Muito antigo

Figure 5. Vaccination schedule

3.2 Application Architecture

The application is composed of three basic components: the extractor, the analyzer, and the presenter, as shown in Figure 7.

3.2.1 Extractor

The extractor is the most important component of the application's architecture. It is responsible for retrieving all data needed by the applications.



Figure 6. Vaccination reminder e-mail (in portuguese)

For the Rio de Janeiro application, there is a single dataset called "Health Units" on the Rio de Janeiro open-data portal. This dataset is accessed by a REST API, allowing only GET methods. The result is in JSON format, and some details can be used to filter results, such as the neighborhood, search-over name and description, and location and radius, to find units near a specific point. To access the API, an OAuth registry process is needed, and

all access tokens expire after six hours. Vaccination information is not available on Rio de Janeiro datasets, so information from the Recife datasets was used, due to the fact that vaccination policy is the same in all Brazilian states. It is important to note that there is no information about portal update policy and that the Frequently Asked Questions states that the "*system guarantees the existence of information in their databases, but does not guarantee its updating.*"

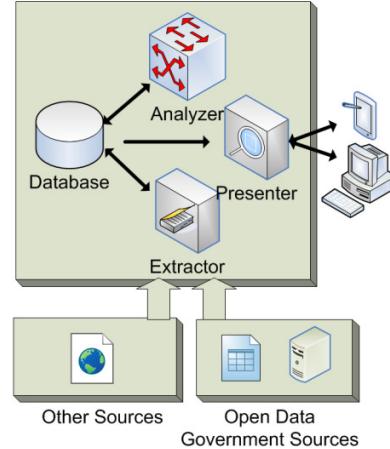


Figure 7. Applications High Level Architecture

For the Recife application, the city open-data portal published almost all data as comma-separated value (CSV) files. Every unit health type (hospital, rehabilitation, psychological, etc.) has its specific downloadable file that includes basic information and latitude/longitude position, and there are differences among file contents. For example, some files contain "health specialties" while others do not have this field, and in one case the order of fields is different. Similarly, vaccination data such as the schedule and vaccination units are also downloadable as CSV files. There is no need for any kind of registration to access data, and instead of there being information about update policy, all datasets show the last update date. At the time this paper was written, most health datasets had been last updated four months prior.

3.2.2 Analyzer

This component is responsible for analyzing raw data gathered by the extractor and generating information to be shown to the user. In addition, it generates a vaccination schedule based on user information and is also responsible for dispatching reminder emails to users.

3.2.3 Presenter

This component is responsible for generating pages and presenting information to users. It shows both the information stored on the application's database and maps and routes from the user to the health unit, using Google Maps JavaScript API.

The presenter component was developed using JAVA technologies combined with *Play!* framework. This combination allows the application to receive and process requests and to dynamically generate responsive pages using a Tweeter Bootstrap template and a few lines of JavaScript code. The Extractor and Analyzer components were also developed using Java technology.

4. DISCUSSION

Assessing the effects of this kind of initiative is a challenging endeavor[18]. In this section, we discuss major challenges facing the applications' development and potential opportunities.

- **Difficulty of governments to provide useful websites based on their data:** Since 2009, Robinson et. al[19] argued that it would be preferable for governments to provide reusable data rather than websites as the core of their online publishing responsibilities. They also argue that private actors, either nonprofit or commercial, are better suited to deliver government information to citizens and can constantly create and reshape the tools individuals use to find and leverage public data. Thus, this experience agrees with Robinson. Both Rio de Janeiro as well as Recife have city portals with dedicated areas to healthcare where it is possible to get information about health units. But applications presented in this paper were only developed due to the evidence of two items: (i) it is very difficult to locate this information on the websites and (ii) the information presentation is almost useless. On the Rio de Janeiro portal⁷, a no-intuitive access to three menus is necessary after entering the city hall site. In addition, information presentation has some problems: it is impossible to know which health unit is nearest to the user, and the site is not prepared to be accessed by mobile devices. In addition, the Recife portal⁸ has the same problems: four steps into no-intuitive menus are required, and only a list containing names, neighborhoods, addresses, and phone numbers of all health units is shown. Hence, it is very difficult for the population to find the health unit that best suits their needs.
- **Multiple and decentralized data sources:** Although a national open-data portal exists⁹, the Rio de Janeiro and Recife health datasets are not integrated on that. It is important to note that the national portal also has a resource with the basic health unit information of all Brazilian cities, but it has some problems: (i) incompleteness because it contains only information of about 14% of health units (37,691 of 265,858), because they publish only data pertaining to basic attendance, not including hospitals, emergency, and specialized units; and (ii) published information is limited, and municipal portals have more data about the same health units than the national portal.
- **Lack of standards for data publishing:** In addition to the variety of data sources, each publisher chooses what and how to publish. There is no compliance with the national repository and no standard among cities or even within the same portal or government agency. As an example, some data from Rio de Janeiro are published as CSV tables, some as Web services. The same data about hospitals are published as Web services by Rio de Janeiro and as CSV tables by Recife. In addition, on

Recife datasets, data fields of hospital files are different than the data fields of basic attendance units.

- **"Zombie" data:** In some cases, data are not "live" but are only dumps of databases in a downloadable format. Even if accessed through an online API, there is no guarantee about source updates. None of either used open-data portals nor national portal explicit data update policy. At the time this paper was written, Recife health data was last updated four months prior, and Rio de Janeiro's portal FAQ says that the "*system guarantees the existence of information in their databases, but does not guarantee its updating.*" The authors have verified that with best efforts, some datasets are updated daily. They can be useful and understood as live data, but developers cannot build real-time applications from them, enabling a new kind of very-useful applications. For example, if someone needs emergency healthcare it is useful to know where the nearest hospital is, but it would be much better to know the location of the nearest hospital with vacant beds at that moment.
- **One-way data:** Governments tend to publish one-way data from the government to the population. Applications can show such data, but the most useful applications, online services with people returning data to government, is still limited. For example, it is good to know where the nearest hospital with vacant beds is, but it would be much better to be able to start the hospital check-in process before arrival. On the other hand, it would be useful if people could rate attendance or send feedback about it.

Considering these challenges, we believe that in order to provide a better environment that promotes the use of government open data to deliver better applications and services for their population, governments should (i) consider Robinson's argument and provide reusable data rather than providing websites as the core of their online publishing responsibility and (ii) develop or adopt a framework that allows a single point of data access in a standard format, through a live online API, and allow citizens to insert and share their own data back to the government.

On the other hand, this framework can be developed outside the government, just by the citizens, in a bottom-up approach. For that, it is necessary to incorporate a generic software architecture that allows easy integration of data sources and publishing data through an online API. Then, the crowd can explore the variety of government data sources and create independent extractor components pluggable to the main architecture. Thus, this data would be reused to build user-friendly applications.

5. CONCLUSION AND FUTURE DEVELOPMENTS

This paper described two initiatives based on Brazilian open-data repositories that deliver services for citizens and tourists, such as a health-unit finder and an online vaccination card and reminder. Both applications were developed to participate in application contests promoted by the Rio de Janeiro and Recife city halls. Based on the experience acquired during the development of these initiatives, this paper also analyzed and discussed the current state of Brazilian open-data initiatives as well as their challenges and difficulties, such as (i) the difficulty of governments to provide useful websites based on their data; (ii) the multitude and decentralization of data sources; (iii) the lack of standards for data publish; (iv) the predominance of "zombie" data; and (v) the one-

⁷ www.rj.gov.br

⁸ www.recife.pe.gov.br

⁹ dados.gov.br

way nature of data. In the end, a few considerations towards a framework to build applications based on government data were discussed.

Despite the existence of many studies pointing to the advantages and challenges of government open data, and in some cases under the government point of view[5, 20, 21], it is still difficult to find an analysis from the perspective of independent developers. Thus, the authors believe that this work contributes as a valuable resource for developers and entrepreneurs who aim to build applications that deliver services for the general population. Moreover, it can be used as feedback to the Brazilian government about its open-data policy.

Future work includes defining and developing a framework to revive and reuse government open data, to refactor both applications according to defined frameworks, and to perform analyses and comparisons about application versions.

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