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ANALYSIS OF THE OPENNESS LEVEL OF GOVERNMENTAL DATA IN THE BRAZILIAN TRAFFIC AREA

ANÁLISE DO NÍVEL DE ABERTURA DE DADOS GOVERNAMENTAIS DA ÁREA DO TRÂNSITO NO BRASIL

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ABSTRACT

The study aimed to identify the level of data openness of the state transit departments in Brazil (DETRANs). Two assessment instruments were used: Berners-Lee's (2010) Five Star Scheme and the 15 Open Data Principles proposed by Opengovdata (2007). Based on them, a methodology for structured analysis was built, and used to analyze three sets of data: related to the National Driver's License (CNH), to vehicles, and to traffic violations. Results indicate a low level of openness, a lack of standardization, and the absence of specific regulations to stimulate or oblige the publication of traffic data in open formats.

Key-words: Open Government Data, Drivers licences, vehicles, traffic violations, DENATRAN, DETRAN.

RESUMO

O artigo teve como objetivo identificar o nível de abertura de dados governamentais dos departamentos de trânsito dos governos estaduais (DETRANs) no Brasil. Foram usados dois instrumentos de avaliação: o Esquema de Cinco Estrelas de Berners-Lee (2010) e os 15 Princípios de Dados Abertos do *Opengovdata* (2007). A partir deles, construiu-se uma metodologia para análise estruturada, aplicada a três conjuntos de dados: os da Carteira Nacional de Habilitação (CNH), os de veículos, e os de infrações de trânsito (multas). Os resultados da análise indicam: baixo nível de abertura de dados e de qualidade das iniciativas de abertura; ausência de padronização de abertura dos dados de trânsito; e ausência de regulamentação específica para estimular e/ou tornar obrigatória a publicação dos dados de trânsito em formato aberto.

Palavras-chave: Dados governamentais abertos, CNH, veículos, infrações de trânsito, DENATRAN, DETRAN.

1   INTRODUCTION

There are more than 90 million vehicles circulating in the Brazilian roads (BRASIL, 2015). According to the country's Ministry of Health (DATASUS, 2016) there were 44,098 deaths in Brazilian traffic in 2014. Add to these statistics the social and economic problems and losses that arise, such as congestion, hospitalization and medical expenses (WHO, 2013).

In 2010, the United Nations (UN), through the World Health Organization (WHO), launched the *Global Plan for the Decade of Action for Road Safety 2011-2020* (WHO, 2013), whose objective is to support the development of national and local plans to increase traffic safety. Following the international trend, Brazil joined as a signatory to the global agreement and developed its National Plan for Accident Reduction and Road Safety for the decade 2011-2020 (BRASIL, 2011a, 2011b).

The analyses and proposition of policies to address many of the traffic safety issues presented by the WHO Plan calls for large volumes of data to be available, with intensive use of information and communication technologies (ICTs). The effective actions in this sector, however, are still far from ideal: in addition to a scarce governmental tradition of data availability, there is also a limited use of technologies. As a result, governments still maintain information black boxes, with low levels of data transparency (RODRIGUES & SANTOS, 2015).

The use of Open Government Data (OGD) can contribute to greater access to data on transit to society. Besides the possibility of improving the formulation and implementation of public policies, such data can also be used to reduce fraud and corruption, including by external control agencies. For example, in identifying abnormal patterns of behavior in administrative regions, such as increased issuance of vehicle document or national driver's license (NDL), it would be possible to identify the occurrence of possible irregularities and their causes and to support decision-making for the necessary measures.

Despite their potential, OGD applied to traffic are still not a significant object of academic research in Brazil. To illustrate, we can cite the ANPAD Annual Meeting, which, in the period between 2010 and 2015, had only five papers presented on the topic.

The objective of this article is to identify the level of government data disclosure of state transit departments in Brazil (DETRAN). The article also intends to contribute to advance the knowledge in the field towards analytical models capable of surpassing the limits of the purely descriptive analysis, since it is understood that the results of the research can contribute to formulate strategies and actions to reach levels of excellence of the open data in Brazilian traffic.

This article presents, besides the present introduction, the following structure: contextualization, methodological approach; review of the

literature on benefits, risks and challenges for OGD from the perspective of the analysis of open government data initiatives; discussion of the results of structured analysis of open government data portals for transit; and final considerations.

2 CONTEXTUALIZATION

Although the availability of data in open formats is the subject of a relatively old discussion (ATTARD et al., 2015), it was from the late 2000s that this discussion gained space on the governments agenda. In 2003 the Public Sector Information Directive (PSI Directive), an EU guideline for the opening of data from member countries, initiated in the region the implementation of the public sector Public Information policy, completed in 2013 (JANSSEN et al., 2015). The PSI Directive aims to regulate the use of public data in the European Union to improve the exchange of information between national states and reduce costs in the delivery of public policies, as well as other benefits of transparency and interoperability between data and European systems.

In 2009, following the open data movement that brought together agents from the technical sector, civil society, academic and business sectors, the United States government launched a memorandum of transparency and open government (OBAMA, 2009). In this memo, the use of the open format for government data was encouraged (COGLIANESE, 2009), and the movement gave strength to the initiative to create the American open data portal: data.gov. In mid-2010, other English-speaking countries (Australia, England and New Zealand) also initiated their national policies for accessing public data on the web and created portals that made public information available in different formats, including open formats, accompanying the United States. In a parallel move, a group of countries including Brazil launched in 2011 the "Open Government Partnership - OGP" (MCDERMOTT, 2010), which aimed to create a more transparent, accountable and responsive governance environment to the citizens, through the opening of the government and its data. Currently the OGP has 69 members, whose governments commit to partnership objectives through regularly published and civil society audited action plans (LEE & KWAK, 2012).

In 2013, the G8 Political Forum also created an action to open data in open formats. This action was known as the G8 Open Data Charter (ODC), and was based on five principles monitored by national action plans and the opening of high value data (ATTARD et al., 2015), namely:

1. Open data by default;
2. Quality and quantity;
3. Usable by all;
4. Releasing of data for improved governance; and,
5. Releasing of data for innovation.

In Brazil, open government data is usually understood in a manner similar to that disseminated internationally, as the "provision, through the internet, of information and government data for free use by society" (AGUNE et al., 2010). Open government data have been used in Brazil not only by society (RIBEIRO & ALMEIDA, 2011), but also by governments, both in the executive (MATHEUS et al, 2014a) and legislative branches (BORTOLATO, 2013).

After some pioneering experiences in state governments, the first groups of open federal government data were opened from Brazil's entry into the OGP in 2011. In the same year, the Federal Government launched its open data portal: dados.gov.br, together with the Law on Access to Information (BRASIL, 2011c). In this way, Brazil created a legal framework to open data actively, that is, by the government's own will, as well as passively, responding to requests for access to information (PEDROSO et al., 2013).

To improve the articulation of initiatives and encourage the efforts to publish OGD, the Ministry of Planning, Budget and Management instituted, through Normative Instruction number 4 of April of 2012, the National Open Data Infrastructure (INDA), Defined as "a set of standards, technologies, procedures and control mechanisms necessary to meet the conditions of dissemination and sharing of data and public information in the Open Data model" (NEVES, 2013).

From that moment, the publication of open government data came to be a public service rendered to the citizen (MIRANDA, 2011) and, therefore, ceased to be thought of as a mere liberality of government to improve relations with society. With this, it became the object of claim as a right (VAZ et al., 2013). For example, during the first National Conference on Transparency and Social Control (I CONSOCIAL), in 2012, the opening of government data was one of the most voted proposals among those presented by representatives of civil society (BRASIL, 2014).

3   METHODOLOGICAL APPROACH

In this article, we adopted an approach based on structured analysis of the web portals of the Traffic Department (DETRAN) of each state and the Federal District. The structured analysis of portal content consists of automated or non-automated inspections in selected portals to verify the existence and objectively analyze the level of implementation of certain previously established requirements, either from the application of instruments already established in the literature, or of instruments specifically designed for the portals under study. It is a widely-used approach in the research on Internet portals (ESCHENFELDER et al., 1997, VAZ, 2007, PINHO, 2008, KARKIN & JANSSEN, 2014).

The applicability of this approach to the present study derives from the fact that the practice of publishing open government data normally

relies on some kind of open data portal, in which data is presented with complementary information and instructions for its download.

In this study, the structured analysis of the portals used two instruments: The Five-Star Scheme (5EDA) by Tim Berners-Lee (BERNERS-LEE, 2010) and the Open Data Principles (15PDA) of OpenGovData (OPENGOVDATA, 2007). These two models synthesize theoretical expectations about the structuring of open data, and are presented in the next section. The structured inspection of the portals was performed between 04/21/2016 and 07/10/2016 and focused on the content analysis of the portals, not being part of the scope of the research usability analysis.

To carry out this study, as a first step, a literature review was conducted in the set of journals of the A1, A2 and B1 strata of the Brazilian Qualis-CAPES system (division "Administration, Accounting and Tourism"). The keywords searched for (in portuguese) were *data*, *government* and *open*, both independently and in conjunction with *traffic*. The objective was to identify the state-of-the-art of the subject and not to overlay previous research on the subject. There was a low number of publications on open government data and none of them dealing with open data on Brazilian traffic. To complement this research, the Google Scholar search engine was used, using the first two pages with the same keywords, since, after the second page (about 25 articles), it was identified that there were repetition and articles out of scope.

As the number of results in Portuguese was low, it was decided to extend the search also in English, with "open government data". The Government Information Quarterly (GIQ) was considered for this search and the research was supplemented by Google Scholar, taking the first two pages of results (20 scientific articles) with the keywords in English.

Articles dealing with Linked Data were included in the research in English, since they treat semantically the same object, despite different nomenclatures. GIQ was considered, because it is currently the place of greatest concentration of open data work due to its scope, with 8 articles identified, one of which is about the collection of international articles used in the e-Gov Reference Library (EGRL). Google Scholar was considered because it informs the most cited articles, including non-academic citations. As the subject has greater relevance among practitioners than in the academic world, which is verified through the low number of publications in Brazil, it was decided to use this approach of search of references.

The legislation on the subject, basically the Brazilian Transit Code (BRASIL, 1997), establishes the competences and responsibilities of transit agencies. From these competences and responsibilities, it was possible to identify the three groups of data whose opening is the object of this research: those related to National Driver's Licenses dataset, to vehicle registration, and traffic infractions (traffic tickets):

- National Driver's Licences: 1) Driver category enabled; 2) Year of first authorization; 3) City of registration; 4) Sex; 5) Municipality; 6) Exams (theoretical-technical or practical).

- Registration of vehicles: this group refers to the data contained in each vehicle's mandatory document, including: 1) type of vehicle; 2) year of manufacture; 3) engine power; 4) number of passengers (capacity); 5) licensing fees; 6) Tax on the Ownership of Motor Vehicles (IPVA); 7) the municipality where the vehicle is/has been registered; 8) change of characteristics.

- Traffic violations, including: 1) quantity 2) type of infraction; 3) severity; 4) municipality; 5) month/year.

As a second step, the structure of the portals of the DETRANs (of the states and of the Federal District) was analyzed. The objective of this step was to identify the level of data openness in a quantitative and qualitative way. The first stage of this step was to analyze whether the data existed on the Internet. The second phase, identify what was your level of openness. The parameters to evaluate the level of openness were based on two previously used methodologies of analysis (VAZ et al., 2013). For the fifteen principles and the five-star schema, each of the three data groups was analyzed independently in each DETRAN. For each of the principles was added a point if the principle was met by the publication of the data, having a minimum of zero points and a maximum of fifteen points.

4 BENEFITS, RISKS AND CHALLENGES OF THE PUBLICATION OF ODG

Open government data (OGD) is the term used to describe any data that has been created by the public sector and can be freely used, reused and distributed to anyone, with the sole exception of assigning reference to the data generator (UBALDI, 2013).

The literature points out that open government data are potential for a range of benefits such as transparency of public acts, improved governance and monitoring of governments by citizens, economic growth, new forms of entrepreneurship and social innovation (UBALDI, 2013).

Using open government data, it is likely that actors other than government, such as organized civil society, academics and businessmen, can collaborate to improve the results of public policies, using these data in spaces of dialogue between government and society.

For example, open government data can allow instance databases (city, state and union) to be freely exchanged and, when recombined, can generate new information (JANSSEN et al., 2012). This would facilitate the creation of dashboards (control panels) for public policy decisions, including in real time (JANSSEN et al., 2015). On the other hand, these decision-making progresses from a decision-making process based on

impressions and tacit knowledge of the manager or public servant to a decision-making process based on technical-scientific empiricism and real data (JANSSEN & HOVEN, 2015) allowing po

Policies based on evidence. The probable consequence of this exchange is a better quality in the implementation of public policies, with greater chances of success and better results. In the case of traffic this can mean reducing traffic accidents, reducing the number of fatalities or combating fraud.

Below is a systematization of the visions presented in the literature on the benefits of OGD in the public sector, civil society and the private sector. Views of the literature on the benefits of OGD were organized in three dimensions, adapting to the original classification of Janssen et al. (2012). Table 1 presents the performed systematization.

Dimension	Identified benefit	References
Policy and Legal	1. Increased Transparency 2. Increased citizen participation 3. Increase of citizen trust 4. Citizen Engagement 5. Reduction of information asymmetry 6. Improvement in public sector planning 7. Legal opening for use by companies and for journalists	JANSSEN et al. 2012 DAVIES & BAWA, 2012 JANSSEN et al., 2015 UBALDI, 2013 MATHEUS et al., 2014c VAZ et al., 2010
Economics	8. Incentive to economic growth 9. Incentive to innovation 10. Encouraging the creation of journalistic material based on data 11. Encouraging more open and connected scientific research 12. Improvement of planning in the Private Sector 13. Improvement of old products and services 14. Increased efficiency and potential synergy between systems, departments, companies and governments	JANSSEN et al. 2012 DAVIES & BAWA, 2012 UBALDI, 2013 ATTARD et al, 2015
Technical and Operational	15. Ability to reuse data 16. Unnecessary duplication of data 17. Improvement of Public Service Delivery 18. Ability to solve problems by third parties (company, companies, etc.) 19. Decision-making through data analysis 20. Easy access for creating dashboards and business intelligence 21. Creating new databases from a combination of others. 22. External validation of data. 23. Reduction of data losses	KALAMPOKIS et al, 2011 JANSSEN et al. 2012 DAVIES & BAWA, 2012 UBALDI, 2013 ATTARD et al., 2015 VAZ et al., 2010

Table 1. Benefits of Opening Government Data
Source: elaborated by the authors

The analysis of the literature on the benefits of OGD shows that these go beyond the mere transparency and publicity of data held by state organizations. Their contribution is highlighted from the point of view of improving the quality of public decisions and the impact of civil society on them. But the benefits reach other dimensions of public action, such as its economic and institutional aspects.

Although the literature is generous in pointing out benefits with the opening of data, on the other hand, it points out that there are risks and challenges linked to this same process. Janssen et al. (2012) classify these risks and challenges into five dimensions: 1) Institutional; 2) Complexity of the task; 3) Use and Participation; 4) Legislation; 5) Technique. Table 2 systematizes these risks and challenges

As can be seen from Table 2, the main difficulties to be faced by OGD publishing processes are not restricted to technical and organizational aspects, although their relevance cannot be ignored. Aspects referring to the social and political context such as legislation, relationship between the actors and institutional restrictions can negatively affect the opening of government data.

These benefits, risks and challenges of the OGD are underpinned in the main models of analysis of the initiatives of its publication. The analysis of OGD initiatives can occur both from the point of view of data attributes and from their insertion in the context.

In 2010, based on his work on Linked Data, Tim Berners-Lee proposed an instrument to identify the level of data openness maturity (Berners-Lee, 2010). The so-called Open Data Five Star Scheme classifies OGD publishing experiences into five levels, to which an increasing number of stars are associated, according to its complexity, as shown below:

One star: Data is available on the Web, regardless of format, using an open license;
Two stars: Data are provided as machine readable structured data;
Three stars: The format used is a non-proprietary format;
Four stars: The data available have structured URLs that allow their identification and referral.
Five stars: The data offered are linked to other data, publicized by other actors, which allows to provide context.

In this way, it can be said that the Open Data Five Star Scheme provides a maturity level classification of government data-entry initiatives. This maturity is defined by its increasing possibility of comprehensiveness and generation of use results. However, the analysis, in this model, is restricted to attributes of the data itself, and less of the OGD publication initiative.

Identified Risk or Challenge	Identified Risk or Challenge	Identified Risk or Challenge
Institutional	1. Cost-Benefit is not clear or low 2. No identification of value creation 3. Public Sector's aversion to risk 4. Impeding legislation 5. Incomplete open data legislation 6. No resources to publish the data 7. Opening systems based only on data resale 8. Questionable quality of data	JANSSEN et al. 2012 DAVIES & BAWA, 2012 UBALDI, 2013 ATTARD et al., 2015 VAZ et al., 2010
Task complexity	9. Absence of ability to use data 10. No access to data 11. No explanation or documentation 12. Incomplete metadata 13. Information and data overload 14. Data in multiple locations and formats 15. Difficulty in searching 16. Complex data format 17. No user guide or help	KALAMPOKIS et al, 2011 JANSSEN et al. 2012 DAVIES & BAWA, 2012 UBALDI, 2013 ATTARD et al., 2015
Use and participation	18. No incentive to reuse 19. Public sector organizations do not react to reuse 20. Payment for the use of data 21. Records that prevent simple access to data 22. Unexpected costs of use at scale 23. Lack of knowledge about data or open data format 24. Lack of statistical knowledge	KALAMPOKIS et al, 2011 JANSSEN et al. 2012 DAVIES & BAWA, 2012 UBALDI, 2013 ATTARD et al., 2015 VAZ, RIBEIRO & MATHEUS, 2010
Legislation	25. Violation of privacy 26. Data security 27. Without attribution of license or conditions of use of the data 28. Reuse contracts not favorable to presumption of open government	JANSSEN et al. 2012 DAVIES & BAWA, 2012 UBALDI, 2013 ATTARD et al., 2015
Technic	29. Value is not clear 30. Much information to be processed 31. Missing information 32. Difficulty in machine processing 33. Absence of open architecture 34. Absence of metadata standards 35. Legacy systems make it difficult to open data	KALAMPOKIS et al, 2011 JANSSEN et al. 2012 DAVIES & BAWA, 2012 UBALDI, 2013 ATTARD et al., 2015

Table 2. Risks and Challenges of Opening Government Data
Source: elaborated by the authors

A second model, the Principles of Open Data (OPENGOVDATA, 2007), proposes a set of principles that, unlike the previous model, do not present as gradations that identify increasing levels of maturity. Initially, the first eight were proposed, and the next seven were subsequently added. The

fifteen principles (OPENGOVDATA, 2007) state that government open data should be:

1. Complete. All public data is available. Public data is the data that is not subject to valid limitations of privacy, security or access control.

2. Primary. The data is presented as collected at source, with the highest possible level of granularity and without aggregation or modification.

3. Timely. Data are made available as quickly as necessary to preserve its value.

4. Accessible. Data is made available to the widest range of users and to the widest possible set of purposes.

5. Machine processable. The data is reasonably structured in order to enable automated processing.

6. Non-discriminatory. The data are available for all, without request or registration.

7. Non-Proprietary. Data is available in a format over which no entity has exclusive control.

8. License-Free. The data is not subject to any restriction of copyright, patent, intellectual property or trade secret. Sensible privacy, security, and access privilege restrictions are allowed.

9. Online and Free. Information is not significantly public if it is not available on the Internet, at no cost, or at least no more than the marginal cost of reproduction. It should also be findable.

10. Permanent. Data must be made available on an indefinitely stable Internet site and in a stable data format for as long as possible.

11. Trusted. The Associated for Computing Machinery Recommendation on Open Government stated: "Published content must be digitally signed, or include evidence of publication such as creation date, authenticity, and integrity." Digital signatures help the public validate the source of the data they find, so that they can be confident that the data has not been modified after its publication.

12. A presumption of openness. The presumption of openness is based on laws such as the Freedom of Information Act, procedures, including document management and tools such as data catalogs.

13. Documented. Documentation about the format and meaning of the data helps to make the data more useful.

14. Safe to open. The recommendation of the Computing Machinery Association on Open Government (ACM Recommendation on Open Government, 2009) is that "Government agencies that publish data online should always seek to publish using data formats that do not include executable content." This type of content within documents

poses a security risk to data users because executable content may be malware (viruses, worms, etc.).

15. Designed with social input. The public is in the best position to determine which information technologies will be most appropriate for the applications that the public intends to create for itself. Their contribution is therefore crucial to the dissemination of information in such a way that it can generate value.

Since both this set of principles and the Five Star Scheme have different focuses and objects of analysis, they should not be treated as alternative approaches. On the contrary, as we do in this study, they can be used in a complementary way in the analysis of OGD publishing initiatives.

5   ANALYSIS OF RESULTS

Data of the National driver's license datasets were identified as open in 16 of the 27 (59.26%) traffic departments studied. Data sets with the 1-star minimum requirement, i.e. available in any format on the Internet, were considered "open".

Vehicle data presented a data rate of 74.07%, with 20 transit departments out of 27 possible. For the data of traffic infractions, 55.55% were found in open format, that is, 15 traffic departments. It was also identified that 5 traffic departments of the 27 possible (18.52%) do not publish any of the data groups selected for this research. These results allowed the creation of the maps of the opening of data of the transit area in Brazil by the state and national transit departments.
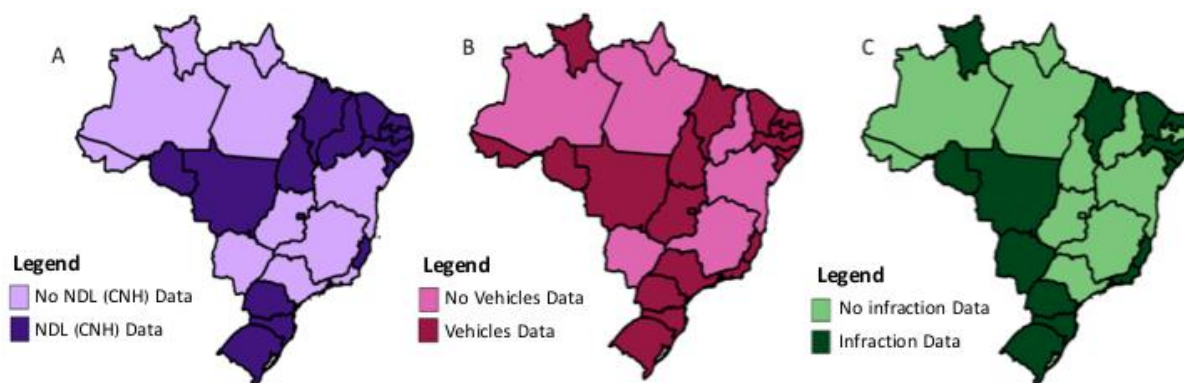

Figure 1. Data openess in Brazil (National Driver's Licenses, Vehicles and Infractions)
Source: elaborated by the authors

In the analysis by the Five Stars Scheme (BERNERS-LEE, 2010), the following results were obtained: for CNH, 11 cases with "0" star (not data publicity), representing 40.74%, 4 Cases with "1" star, representing 14.81% and other 12 cases with "2" stars, representing 44.44%; for the

cases of vehicles, 7 cases with "0" stars (not advertising of data), representing 25.92% of cases, 8 occurrences for "1" star, representing 29.63% of cases, and for "2" stars 12 cases were found, representing 44.44%; for traffic offenses (fines), 12 cases with "0" stars (non-advertising of data), representing 44.4%, 4 cases for "1" star, representing 14.81% and 11 cases for "2" "Stars, accounting for 40.74% of the cases. Considering all cases (3 analyzed areas in 27 organs), 37.04% were found without any star, 19.75% with only one star and 43.21% with two stars. It is observed that none of the cases was classified as 3, 4 or 5 stars, which demonstrates a low degree of maturity of the initiatives of publication of OGD on transit of the Brazilian state governments.
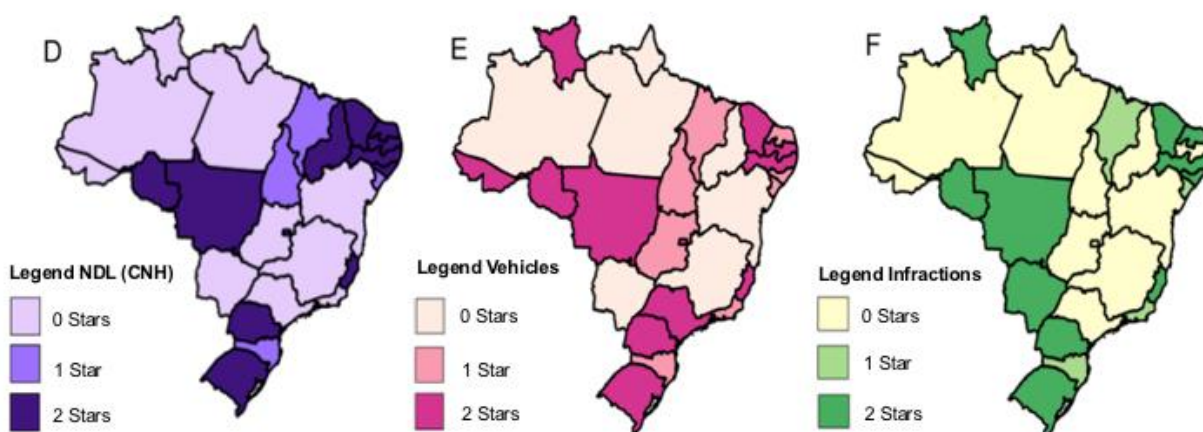

Figure 2. Map of the Stars Scheme in Brazil
(National Driver's Licenses, Vehicles and Infractions)
Source: elaborated by the authors

For the purposes of comparison, applying the same areas of investigation (National Driver's Licenses, vehicles and fines) and using the same rules for the analysis, we have the Federal Transit Executive Branch (DENATRAN) publish data only for vehicles, with an opening level of 2 stars (BERNERS-LEE, 2010). This fact demonstrates that the level of maturity of state initiatives is not behind that of federal initiatives.

The result of the analysis of the service of Open Data Principles, was through a quantification of the principles with service verified in each portal, ranging from 0 to 15 points. The maps below illustrate the situation.
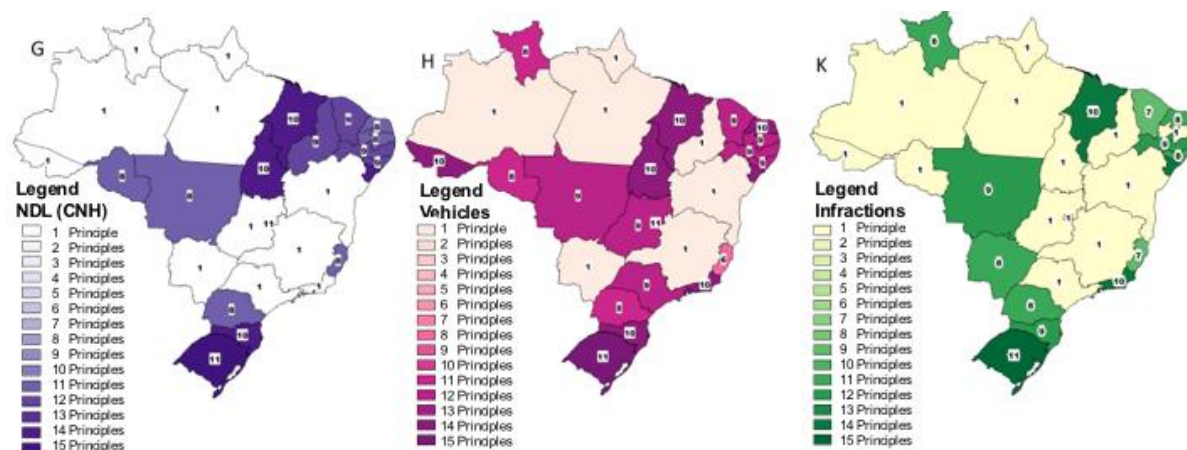
Figure 3. 15 Principles of Open Data in Brazil
(National Driver's Licenses, Vehicles and Infractions)
Source: elaborated by the authors

Complementing the analysis above, Table 3 shows the occurrence quantities of the principles, that is, among all possible occurrences, which are: three data groups (National Driver's Licenses, vehicles and fines) and the 26 states plus the Federal District (27), therefore, 81 possibilities of occurrence.

Principles	Occurrences	Percentage
Complete	48	59,26%
Primary	51	62,96%
Timely	34	41,97%
Accessible	51	62,96%
Machine processable	0	0%
Non-discriminatory	50	61,73%
Non-proprietary	16	19,75%
License-Free	2	2,47%
Online and Free	50	61,73%
Permanent	50	61,73%
Trusted	6	7,41%
A presumption of openness	81	100%
Documented	3	3,70%
Safe to open	51	62,96%
Design with social input	0	0%

Table 3. Compliance of 15 OGD Principles
Source: elaborated by the authors

The results of the structured analysis of opening the data show that the level of openness is low. This can discourage internal reuse of government, creating rework to create reasonable levels of system and data interoperability. Beyond the structured analysis performed here, a poor-quality symptom we could perceive is that none of the analyzed data is accompanied by metadata (computer-readable information about what the data is about), which could facilitate its understanding and use.

Likewise, it is possible to identify that there is a disincentive to the reuse of data by society to promote social control and monitoring of governmental public policies. This also influences citizen participation, reducing the power to co-create public policies based on citizen participation (POLLITT et al., 2007).

6 FINAL REMARKS

This article analyzed the level of government data on transit in Brazil. The structured analysis of the portals of the national and state transit departments allowed to evaluate the level of data openness. With this, it was possible to verify that there are big gaps in the opening of the traffic data. It was noticed that the degree of openness of the data is low compared to consecrated recommendations like those of the Five Stars Scheme (BERNERS-LEE, 2010) and, Open Principles (OPENGOVDATA, 2007).

These results demonstrate that, in terms of transparency and data openness, the same difficulties are repeated in implementing public policies verified in the transit area, leading to low effectiveness results, as already reported by RODRIGUES & SANTOS (2015).

The results of this research allow us to identify two challenges for the current scenario of opening traffic data in Brazil and its potential improvement. These issues make it difficult to compare the performance of the analyzed agencies and a view of the national framework in these areas. From the public management point of view, these gaps reduce the applicability of OGD in the sector, and cause the loss of opportunities to use information to support decision making.

First, there is the challenge of the evident absence of standards in the opening of traffic data by transit departments in Brazil. There were no patterns of periodicity of publication and updating of data, nor were there standards in terms of format and content to be published in the three data groups chosen for the structured analysis of the level of data openness. As pointed out in the literature, without such standardization, it will be difficult to create instruments for monitoring and comparing the initiatives to open transit data in the country.

Secondly, another point adhering to the established literature was identified: there is no specific regulation that encourages and / or requires the opening of traffic data or regulates the way the data should be opened. One can identify a set of actions that would work in response to the gaps noted above.

The first action is the creation of specific legislation or mechanisms for the self-regulation of transit agencies to encourage and / or make mandatory the publication of transit data in an open format. The legislation could also restrain the non-opening of the data, or its publication in an inadequate way, without updating or with a low degree of openness. The inspiration for this normalization may be in Supplementary

Laws numbers 101 and 131 (BRASIL, 2000, 2009), which oblige federative entities to publish financial data.

Secondly, it is possible to raise the possibility of establishing national publication standards, involving periodicity, formats, metadata and content to be opened in each of the data groups (National Driver's Licenses data, vehicle data, traffic violation data), in addition to other relevant data, considering the transactional systems in use (RODRIGUES et al., 2015).

A third type of action concerns the strengthening of legal authorization, to ensure that data is effectively free for reuse, such as the adoption of licenses for data such as Creative Commons CC-BY (free license), for example. This type of measure will provide legal certainty to entrepreneurs and civil society organizations.

Finally, a fourth action would be to create a ranking of open traffic data initiatives to monitor the level of data openness.

It is important that measures to encourage the opening of data consider the demands of the non-governmental actors involved that can carry out, from the OGD, several important actions for the improvement of traffic policies.

At the end of this paper, it is possible to indicate possibilities for future research. If it was possible to exploit OGD in transit from the perspective of supply, the demand perspective, i.e. the standards, conditions and results of the use of OGD by the various potential stakeholders, may be the subject of new work: journalists can use them to create data based news report (MATHEUS et al, 2014c); civil society organizations can reuse them to focus on decision-making processes and monitor public policies (UBALDI, 2013, JANSSEN et al., 2012); and developers and entrepreneurs can create applications and new services (CUNHA et al., 2016) from them. As this set of actions has the potential to improve the lives of the population and to assist the monitoring and evaluation of public policies, as well as to increase the participation of civil society in the decision-making process at all stages of its cycle, these possible impacts can also be verified in future research.

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