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Big Data in the Public Sector

Big data no setor público

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Abstract: There is no doubt that one of the most obvious and far-reaching derivations of the Internet and global interconnection through the network is the enormous volume of information to which we have access. It is in this context that the so-called "Big Data" appears, exposing us to great changes in the different areas of our lives, proposing scenarios that point to open governments, transparency and greater closeness to citizens. However, there are many challenges that this new reality poses on Public Administration and there appears not to be unique strategies or models for its implementation. The aim of this work is to review some of the most important concepts that are involved in this era of Big Data in the public sector.

Keywords: Big data. Public Law. Transparency. Open government. Social big data.

Resumo: Não há dúvida de que uma das mais óbvias e abrangentes derivações da internet e da interconexão global através da rede é o enorme volume de informações a que temos acesso. É neste contexto que surge o chamado *big data*, expondo-nos a grandes mudanças nas diferentes áreas das nossas vidas, propondo cenários que apontam para governos abertos, transparência e maior proximidade aos cidadãos. No entanto, existem muitos desafios que essa nova realidade suscita na Administração Pública e parece não haver estratégias ou modelos únicos para a sua implementação. O objetivo deste trabalho é revisar alguns dos conceitos mais importantes envolvidos nesta era do *big data* no setor público.

Palavras-chave: *Big data*. Direito Público. Transparência. Governo aberto. *Big data* social.

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1 "Towards open and transparent governments"

In recent years, we have witnessed two contemporary phenomena which, apparently, are not connected between them: On the one hand, an explosion of a huge amount of available digital data[1] (from internet, social networks, science equipment, smart phones, surveillance cameras, and many other sources) and information technology used to process[2] them; and, on the other hand, preliminary information from Latinobarómetro[3] shows that the level of satisfaction of population in general with respect to democracy fell to 34% in 2016, from an average of 38% in 2015; while the level of trust in governments fell from a regional average of 33% to 28%. Moreover, 73% of respondents in 2016 perceive that a few powerful groups govern for their own benefit.[4]

The concept of Big Data, then, appears as a possible solution and link between both phenomena. This concept can be applied to all type of data which cannot be processed or analyzed using traditional processes or tools, as a fundamental instrument within the private sphere but also in the public sector, with objectives oriented towards fighting against fraud, guaranteeing public safety, improving health or education, transforming information into knowledge, adding value to improve public services in pursuit of an Administration which is closer to citizens, more transparent and efficient.

Big Data and data analytics can be seen as one of the five disruptive technologies[5] of today's world whose impact in society will be especially noticed in the next few years. As several specialists from private and public sectors, OECD, in its report on "*Open Government Data. Towards Empirical Analysis of Open Government Data Initiatives*",[6] highlights the value of openness of data in the public sector, expressed through five key elements: Improvement of governments´ responsibility, transparency, democratic control; encouragement of citizens'

1 WORLD ECONOMIC FORUM. *Alrededor del mundo hay una carrera para utilizar el big data para mejorar la salud y salvar vidas.* Available at: <https://www.weforum.org/es/agenda/2017/03/alrededor-del-mundo-hay-una-carrera-para-utilizar-esta-informacion-para-mejor-la-salud-y-salvar-vidas>. Last Acess: 15 Mar. 2017.

2 WORLD ECONOMIC FORUM. *Alrededor del mundo hay una carrera para utilizar el big data para mejorar la salud y salvar vidas.* Available at: <https://www.weforum.org/es/agenda/2017/03/alrededor-del-mundo-hay-una-carrera-para-utilizar-esta-informacion-para-mejor-la-salud-y-salvar-vidas>. Last Acess: 15 Mar. 2017.

3 Latinobarómetro is an annual public opinion survey carried out by Corporación Latinobarómetro that involves around 20000 interviews in 18 Latin-American countries, representing more than 600 million inhabitants.

4 INTER-AMERICAN DEVELOPMENT BANK – IBD. *Escúchame cuando te hablo*. Big Data para gobiernos más abiertos. Available at: <https://blogs.iadb.org/gobernarte/2017/01/17/escuchame-cuando-te-hablo-big-data-para-gobiernos-mas-abiertos/>. Last access: 17 Jan. 2017.

5 Big Data, Cloud, Mobility, Social Business and IoT are some examples. GIL, Elena. *Big data, privacidad y protección de datos*. Madrid: Agencia Estatal Boletín Oficial del Estado, 2016.

6 UBALDI, Barbara. Open Government Data: Towards Empirical Analysis of Open Government Data Initiatives. *OECD Working Papers on Public Governance*, n. 22, May 2013. Available at: <http://dx.doi.org/10.1787/5k46bj4f03s7-en>.

empowerment and participation; new generation of competent public employees; encouragement of innovation, efficiency and effectiveness in public services and value creation for economy as a whole.

Big Data in the public sector shows not only its technological dimension, but also a social, economic, political and cultural dimension. Consequently, it broadens horizons to promote a holistic understanding which requires a multidisciplinary approach.

In the light of what has been mentioned in these paragraphs, this paper will focus on Big Data and the significance of its implementation in the public sector, highlighting its advantages in relation to, for example, traditional sectors of social and economic activity, outlining challenges that these changes will pose on Public Administration, all of this in a context of study, research and formulation of public regulations and policies which encourage the development and application of massive analysis of data.

2 Big Data in the public sector: What and why

In order to develop the idea of Big Data in the public sector, it is first necessary to define the concept and, consequently, support one of the approaches given to it.

One classic or general definition could be the one which refers to Big Data as large data sets characterized by the famous 3 Vs from the analyst Doug Laney:[7] *Volume, velocity and variety*, which exceed the capability of the usual software to be captured, managed and processed. Since Laney created this concept more than a decade ago, other Vs were added: Validity, veracity, value and visibility.

Another approach[8] conceives Big Data as information and communication technology; Big Data seems to be an ecosystem which continues to grow, in particular, those open-source softwares like *Hadoop*,[9] which became a technological breakthrough concerning data storage and management, and which are encompassed in the general term of Big Data.

According to the article "*In Perspective*" from Fidelity Worldwide Investment[10] (2012), the English term Big Data designates data sets of a large size, generally

[7] DOUG, Laney. 3D Data Management: Controlling Data Volume, Velocity and Variety. *Meta Group Inc*, File: 949 Addendum, 6 Feb. 2001. Available at: <https://blogs.gartner.com/doug-laney/files/2012/01/ad949-3D-Data-Management-Controlling-Data-Volume-Velocity-and-Variety.pdf>.

[8] MARTÍNEZ SÁEZ, Nicolás. *"La tecnología no es determinista, hay que construirla socialmente"*. 20 mar. 2017. Available at:<http://www.lacapitalmdp.com/la-tecnologia-no-es-determinista-hay-que-construirla-socialmente/>.

[9] According to hadoop.apache.org, "Hadopp is software library which allows distributed processing of process big data sets through sets of computers which use simple programming models." Available at: <http://hadoop.apache.org/>.

[10] FIDELITY WORLDWIDE INVESTMENT. *Big data: an industrial revolution in the management of digital data*. Episode 5. Available at: <https://www.fidelityinternational.com/middle-east/news-insight/21-century-themes/episode5.page>. 2012.

unstructured, which are difficult to manage using conventional database applications.

Moreover, a TicBeat report[11] defines Big Data as "the enormous amount of data which, since some years ago, is constantly generated from any activity;" later in the report, Big Data is conceived as a search for the best way to take advantage of this data avalanche.

However, despite the fact there are diverse accepted concepts on the notion of Big Data, in this article, we will consider the aforementioned definition, just as the Argentine government did last year with the creation of the Big Data National Observatory.[12] The aim of this institution is to promote the use of this key technology in the country. In this sense, state representatives consider Big Data as a "set of data of large volume, high velocity and variety of information" which is generated through the web and through the use of smart gadgets – such as smart phones – and which "demands new processing methods that will impact decision making and optimization of processes".

We have just defined *what* Big Data is, now we will turn our attention to *why* it is necessary to apply Big Data in the public sector. The economist Adam Smith, in his Theory of Moral Sentiments,[13] explained that any form of Government is valued as long as it promotes happiness, so, the results of Public Administration should then be determined taking into account citizens´ wellbeing.

Since remote times, data has been a synonym of utility. In the private sector, companies with large volumes of available data, like *Amazon* and *Facebook*, have obtained huge profits taking advantage of analytics.[14] The correct use and implementation in the sphere of Public Administration of the large volume of data which are part of our present can bring opportunities to traditional sectors of economic and social activity, such as transport, health, education, agro industry and safety.

Institutions in the public sector, just as big companies, also use data in an intensive way. This is why it is necessary to make all this information available in an accessible and easy-to-read way. Here is when the concept of visualization and Big Data comes to play, this is, how to find a way of presenting this information to be able to see results in a clear way.

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11 REDACCIÓN TICBEAT. Big data y su impacto en el negocio. *TICbeat*, 20 Feb. 2013. Available at: <http://www.ticbeat.com/libreriaticbeat/big-data-impacto-negocio>.

12 ARGENTINA. Ministry of Communications, Department of information and communication technologies. *Res. 11-E/2017*. June 1, 2017. Available at: <https://www.boletinoficial.gob.ar/#!DetalleNorma/164755/20170608>.

13 SMITH, Adam. La teoría de los sentimientos morales. *Eumed Enciclopedia Virtual*. Available at: <https://goo.gl/TRkmKQ>.

14 MAROTO, Chema. Big Data y su impacto en el sector público. *Harvard Deusto Business Review*, p. 16-25, May 2017. Available at: <http://xodel.diba.cat/sites/xodel.diba.cat/files/big_data_y_su_impacto_en_el_sector_publico.pdf>.

Key points of the implementation of Big Data in the public sphere are especially focused on guaranteeing data security and privacy, saving public expenditure, looking for actions which help to prevent problems (such as the case of controlled consumption of energy), and, on areas such as health as well. Furthermore, another way of adapting Big Data to the public sector is by looking for improvement actions which favor the development and access for citizens, for instance, through the development of initiatives in areas such as transport, urbanism and education.

So, in order to understand the potential value of Big Data, before focusing on the specific benefits it can bring about in the different areas of the public sector, we will mention very briefly those general benefits it can provide:

- *Encouragement of competitiveness areas*: This implies understanding how to provide a better service through innovation, optimization of operations, reduction of vicious and risky cycles.
- *Speed as a distinctive characteristic*: The analysis of relevant data and different content helps to find new patterns which humans cannot detect at a glance. By using those patterns, time allocated to decision making, processes and any other aspect of administration can be reduced significantly.
- *Appropriate decision making*: The appropriate data flow can bring together decision makers with other parties through new indexes and information.
- *Knowledge of real problems*: Information extracted from social networks facilitates the understanding of those problems which affect citizens the most. The root cause of problems and how to avoid them can be detected as well.

On the other hand, going deep into the specific benefits Big Data can bring about, we can highlight three main areas in the public sector in which the use, management and analysis of data can help to carry out a task in a better way in terms of efficiency and effectiveness.

a) Health: A clear example of how Big Data is applied in such a transcendental sector takes place in the United States,[15] where there are several specialized healthcare facilities which have started to enter data of almost two million people in algorithms designed to identify high risk patients so that physicians can intervene before the patient gets ill. The company can buy data (extracted from public records, loyalty program transactions or purchases made with credit cards) from brokers or other external companies.

[15] KAYYALI, Basel; KNOTT, David; VAN KUIKEN, Steve. *The "big data" revolution in healthcare: Accelerating value and innovation.* McKinsey&Company, Healthcare Systems and Services. Available at: <https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/the-big-data-revolution-in-us-health-care>. Last access: April 2013.

Besides, gadgets or wearables used to measure daily physical activity (such as the number of footsteps a person can walk along the day, amount of calories or sleep hours and quality) are registration sources of data highly demanded by companies – so far, in the advertising and marketing area. But, more frequently, it is health companies the ones which show the greatest interest in recording and studying this type of information.

In this context, the use of data analysis for this specific sector can be beneficial in two main ways. On the one hand, by getting to know patients and their needs better and thus, attaining more efficiency in all the attention process; and, on the other, attaining more efficiency will result in a better service and considerable cost saving in resources and activities.

b) Tourism: Most of studies on tourism are generally carried out on the basis of surveys or interviews to experts developed by involved departments (tourism, energy, government) within public organizations or private companies. This means that, in general, the sector does not have real data from tourists but samplings from part of the population. With the use of Big Data in this area, a new, more innovative, approach consisting of the analysis and study of data based on users´ real actions, and not on surveys[16] can be used.

These studies will then be based on a new type of information oriented to increase knowledge on the objective public of the sector, but with data generated by tourists themselves: Telephone calls, active GPS sensors, intercom between mobile applications, social networks and transactions made with credit cards in store terminals or institutions. Results and conclusions of this type of studies will constitute a new tool for management and decision making for managers of industries related to the tourism sector.

c) Urban management: Cities generate a lot of information of different nature, much more than what any human being or IT system can analyze. Each day, 2.5 trillion data is produced, and only 5% of this data is structured.[17] With the intervention of Big Data, the aim is to adopt the model known as “silo”, which, broadly, implies the capacity to integrate and manage more information in the systems of cities but in an independent way with respect to the rest of the systems run by each institution, city or region.

[16] MAROTO, Chema. Big Data y su impacto en el sector público. *Harvard Deusto Business Review*, p. 16-25, May 2017. Available at: <http://xodel.diba.cat/sites/xodel.diba.cat/files/big_data_y_su_impacto_en_el_sector_publico.pdf>.

[17] MAROTO, Chema. Big Data y su impacto en el sector público. *Harvard Deusto Business Review*, p. 16-25, May 2017. Available at: <http://xodel.diba.cat/sites/xodel.diba.cat/files/big_data_y_su_impacto_en_el_sector_publico.pdf>.

Within the scope of urban management, there is a variety of relevant items such as efficiency and citizens services, safety, event management, traffic and areas of energy.

3 Big Data, Open Data and Open Government

We have previously referred to the big potential Big Data has, especially, to transform government and society. This is why, it is necessary to relate this concept to others which are directly connected with it and among them: *Open Data and Open Government.*

In connection to open data, according to the Open Data Charter,[18] this concept refers to digital data which is available and has the necessary technical and legal characteristics so that it can be reused and redistributed freely. So, in order to understand the triad "Big Data, Open Data and Open Government", it is necessary to bear in mind the collaborative ideology which prioritizes inclusion and citizen participation in government processes called open government.

Consequently, the interrelation between open data, Big Data and open government gives birth to six subtypes[19] of different data with common characteristics which conform a dynamic environment, in constant evolution, and which vary depending on how IT advances and on how administrations invest more resources in data storage and openness.

The subtypes are as follows:

a) Big data, but not open: Purchasing data, clinical information, economic transactions records. This category includes a large amount of macro data, most of it with great commercial value. Managing and reusing this data is very useful for both, the private and the public sector since, thanks to them, commercial patterns, demographic tendencies or epidemiological outbreaks can be predicted.

b) Open government, without open data: The open government movement advocates for citizen participation in the decisions of local, regional or national governments. However, this movement does not always include open data policies, and, occasionally, it does not imply opening data to the public sector.

c) Big Data, open but not governmental: At present, there is a huge amount of data which is not originated in public institutions but in academic,

[18] OPEN DATA CHARTER. October 28, 2015. Available at: <https://opendatacharter.net/>.

[19] "*Datos abiertos, big data y gobierno abierto: diferentes tipos de datos*". Available at: <http://datos.gob.es/es/noticia/datos-abiertos-big-data-y-gobierno-abierto-diferentes-tipos-de-datos>. Last accessed: 21 feb. 2017.

entrepreneurial or private ones, with an open and reusable approach. The publication of findings of scientific investigations such as the case of the search engine Zoonivers or the reuse of social data, such as Weanalyze, are some examples of massive and open data, but which are not public.

d) Government data, but not Big Data: In order to be valuable, government data need not be massive. The publication of a modest amount of public data, such as the schedule of public transport, can have a positive impact in society thanks to the development of new products or value-added services.
e) Open and private data: This category includes data from the private sector which companies decide to open up for their own purposes, for example, to satisfy potential investors or improve their corporate reputation. A good example of this category of open data consists of the hackathones organized by financial institutions based on their own information.
f) Open data, Big Data and open government: The perfect triad. Opening these sets of data can have a huge socioeconomic impact in the government´s environment.

However, regardless of this classification, which is useful to indentify and process data appropriately, the importance of the "perfect triad" lies on the fact that by making data, which is stored in their systems, public, governments will be able to make data available not only to citizens – as an exercise of transparency which helps to generate greater trust in state institutions – but also to entrepreneurs, small and big companies which will be able to use data to integrate them into their own systems and provide more information to their own processes of Big Data, thus facilitating the economic fabric and innovation. This is how data relating to population, transport, environment, health, energy, territory and so on, can be universally accessed.

4 Challenges of modernization

Following the line of the above mentioned, as we have just described the reasons and benefits that Big Data can bring about to public sector, it is essential now to analyze the challenges that Big Data proposes.

One of the current challenges that Public Administration faces is to consider, at a theoretical level, how the long-term planning of its activities should be by including Big Data in the system. This implies thinking about mechanisms to make current decisions with strategic orientation, being able to visualize processes that provide changes during a long period also including the existence of three essential elements: access to information,[20] technological tools and knowledge.

[20] On this subject, see: BELLOCHIO, Lucía. Access to public information in Argentina with particular reference to personal and institutional data protection. *A&C – Revista de Direito Administrativo & Constitucional*,

Accordingly, Big data in Public Administration means leading and turning great amount of data into information and afterwards, into knowledge for it to be applied to different fields of public management, such as taxation, healthcare or security, thus providing the people concerned with value information, so that greater productivity can be achieved. In this context, productivity should be understood not just as reduction of costs but also as the improvement of services quality offered to the citizen.

Another great challenge in this process of rapprochement between state structures and the huge amount of information currently available is to approximate data to processes and reduce response times, simultaneously expanding the ability to gather all kinds of information . In the public sector, progress has been made especially in areas related to standardization and statistical production, in which Big Data is increasingly gaining concrete relevance, despite certain "obstacles" such as the identification of use cases, that is to say, being aware of how, when and what for to use this technology. The combination between the traditional and the new and the formulas that facilitate the adoption of the new seem to be the description of the gradual progress the different areas of the public sector are making.

In the particular case of Big Data, it is important to point out that, whoever generates the data is not necessarily the one who stores it: 70% of the total world data is stored in North America and Europe, which is referred to as digital or informational gap.[21] Thus, some authors[22] argue that this new phenomenon creates a new division of classes or "data-classes" in society: (i) Those who generate the data: The majority of the population; (ii) Those who have the means to collect it: Very few; (iii) Those who have the capacity to analyze it: An even smaller sector of society. There are therefore hierarchies and power relations, because

Belo Horizonte, ano 16, n. 65, p. 39-51, jul./set. 2016; SCHIAVI, Pablo. Régimen jurídico de la acción de acceso a la información pública en el Uruguay. *Revista de Investigações Constitucionais*, Curitiba, v. 2, n. 2, p. 137-168, maio/ago. 2015; VALIM, Rafael. El derecho fundamental de acceso a la información pública en el Derecho brasileño. *Revista de Investigações Constitucionais*, Curitiba, v. 3, n. 1, p. 169-181, jan./abr. 2016; MARTINS, Ricardo Marcondes. Direito fundamental de acesso à informação. *A&C – Revista de Direito Administrativo & Constitucional*, Belo Horizonte, ano 14, n. 56, p. 127-146, abr./jun. 2014; PERLINGEIRO, Ricardo. A codificação do direito à informação na América Latina. *A&C – Revista de Direito Administrativo & Constitucional*, Belo Horizonte, ano 14, n. 56, p. 209-227, abr./jun. 2014; PERLINGEIRO, Ricardo; DÍAZ, Ivonne; LIANI, Milena. Princípios sobre o direito de acesso à informação oficial na América Latina. *Revista de Investigações Constitucionais*, Curitiba, v. 3, n. 2, p. 143-197, maio/ago. 2016; SCHIAVI, Pablo. Información pública en clave de neoconstitucionalismo. *A&C – Revista de Direito Administrativo & Constitucional*, Belo Horizonte, ano 14, n. 57, p. 13-45, jul./set. 2014.

21 MALVICINO, Facundo; YOGUELB Gabriel. *Big Data: Avances Recientes a Nivel Internacional y Perspectivas para el Desarrollo Local*. Interdisciplinario de Estudios en Ciencia Tecnología e Innovación, Buenos Aires, Aug. 2015. Available at: <https://goo.gl/Et2xkF>.

22 MALVICINO, Facundo; YOGUELB Gabriel. Big Data: Avances Recientes a Nivel Internacional y Perspectivas para el Desarrollo Local. Interdisciplinario de Estudios en Ciencia Tecnología e Innovación, Buenos Aires, Aug. 2015. Available at: <https://goo.gl/Et2xkF>.

those who have the means to capture the data, have the power to appropriate the income generated. Consequently, with the aim of not being separated from the world system, inevitably, the challenge of the different States is to enter and conform the new prevailing reality.

Another challenge to achieve the success of the Big Data projects is the necessary cooperation between not only the members of the Public Administrations and private companies, but also with the whole of the society as consumer as well as generator of information. At this point, the concept of collective intelligence appears, which will always seek to guarantee the security and rationality of the processes and to function as an engine of the new uses of Big Data.

Another key aspect in relation to the challenges of implementing Big Data is to know if excessive information could cause "misinformation", and, in this sense, it is worth clarifying that this situation is far from reality. Big Data allows the enrichment of information thanks to the systems that can capture and process precisely large volumes of data, in reasonable time, to extract valuable information, so there would be no problems with this aspect of the system. In addition, directly connected with this issue, the subject of "reliability" of the data of the information appears as a transcendental point to take into account. The Administration and the technology providers must focus on the veracity of the information, since as is known, at present, the sources of information are multiple and very diverse, and there is a greater capacity for cheap storage, which enables continuing producing and saving large volumes of data, from internal and external sources. Therefore, the management of this double dimension of transparency and respect for privacy is one of the biggest challenges that the massive exploitation of information poses today.

Likewise, the generation of knowledge through Big Data is one of the most important and innovative goals. It is necessary to promote a change that allows us to change from having a lot of information to knowledge, and in this sense, technology must contribute to represent information, synthesize it, group it, subject it to reliability criteria, eliminate the erroneous one, process it and show what is really relevant, that is to say, look for relevant patterns. The current trend is to save as much information as possible, while technology should help extract value from the data.

Regarding open data, there is another important issue, which is not very much connected to a technological matter, but has to do with the use that society can make of that information. The generation of business is an important argument to go forward in the opening of data, although Administrations must act with prudence in this sense, since they guard data that requires different levels of protection.

In addition, the usefulness of Big Data as a complement to official statistics provides, especially, correlations and new perspectives. For example, trends,

movements or feelings, in contrast to the real information provided by traditional statistics. Therefore, starting to adopt this type of elements can be one of the first challenges to be undertaken by Public Administration.

Similarly, although it is true that the need to have qualified people is not exactly a challenge, it could be said that it is a concrete and required goal for the implementation of Big Data in the public sector. Today there is a major problem in this regard. Although those who wish to train have information and courses available on the Internet, Public Administrations should focus on training professionals with multidisciplinary profiles and with the skills to address and solve different types of issues that this process may encompass.

5 Social Networks and Big Data for open governments: "Social Big Data"

Currently, there are various forms of innovation such as open innovation or citizen innovation, with the aim of democratizing the processes of access to data and of solving civil society problems. Including and taking into account citizens implies recognizing the transformations offered by open government policies, previously achieving open and public access to data and its construction (management). This is where Social Big Data (or the so-called Big Data social aspects) offers an opportunity for the improvement of public services, such as health, with the additional objective of transcending a commercial approach to get to a closer approach to citizenship.[23] For this reason, it is necessary to understand the social part of Big Data and open data, and its construction, access and availability, as two aspects of the subject addressed, which are independent but at the same time interrelated.

One of the specific objectives of the implementation of Social Big Data in the public sector is the possibility of undertaking commitments and developing public policies on open government that provide the opportunity to improve public services through its three pillars: Transparency, participation and collaboration. So, new social technologies (connectors of social networks such as Facebook or Twitter; web-based communication modes, such as chats and exchange of photos and video as allowed by Instagram and YouTube, among others) represent a new wave of technological innovation with an essential role in the public sector and with the necessary potential to link some of its main properties with the public sector.

[23] BRUSSA, Virginia; CASTILLO, Valeria; RON, Juan Pablo; GERKE, Johanna. Social Big Data: desafíos en los gobiernos abiertos y los procesos colaborativos en la construcción de los datos. El caso del área de salud y su relevancia. In*: Simposio Argentino sobre Tecnología y Sociedad, Sociedad Argentina de Informática e Investigación Operativa* (SADIO), Sept. 2017. Córdoba, Argentina. p. 166-171. Available at: <http://sedici.unlp.edu.ar/handle/10915/64520>.

These features of social technologies can range from the new available capacities to search for information and knowledge resources, the opportunities to link that allow the development of complex and valuable social networks, the possibilities to publish that facilitate the exchange of opinions, experiences and knowledge, the development of information marking that helps people to organize and connect information for effective sharing, to allowing the extension of knowledge in a more effective way within a specific area. All this is materialized in the fact that dissemination opportunities are multiplied with digital social networks through the functions of signaling and collaborative filtering carried out by users themselves and the reception of information in a clear and concrete manner is facilitated.

This new technological generation created by using these social media is based on, at least, three pillars, to understand the new role of this generation of technologies within public administrations.[24] First, through various tools individuals act as active agents in the production of web content, becoming "pro-sumer". This includes a collection of social media through which individuals become protagonists of the creation, organization, editing, combination, exchange, comment and evaluation of web content, as well as in the formation of social networks through which they interact and they link together.[25]

Secondly, when understanding the potential for public organizations that are behind Social Big Data, we must characterize the principle of "crowd intelligence" or "collaborative intelligence". Innovation in the public sector is linked to the public that is beyond the formal boundaries of the organization. The public has the capacity, not only to generate information and content, but also to evaluate them continuously[26] (For example, the contents of Wikipedia are elaborated collaboratively by millions of people unknown to each other and whose contributions are constantly evaluated by the rest of users).

Thirdly, Social Big Data implies a process of increasing disintermediation of activities between individuals and organizations or state agencies.[27] It expresses a transformation in the processes of value creation, since people can carry out many activities that previously required the intermediation of a professional, a company,

[24] CRIADO GRANDE, J. Ignacio. Redes Sociales y Open Government. Hacia unas Administraciones Locales en Red y Abiertas. *Revista Democracia y Gobierno Local*, Madrid, n. 18-19, p. 5-12, July/Dec. 2012. Available at: <http://www.gobiernolocal.org/docs/publicaciones/RDGL_18_19_baja.pdf>.

[25] CHUN, S.A.; SHULMAN, S.; SANDOVAL, R.; HOVY, E. Government 2.0. Making Connections between Citizens, Data and Government. Information Polity. *The International Journal of Government & Democracy in the Information Age*, Amsterdam, v. 15, n. 1-2, p. 1-9, Apr. 2010.

[26] CRIADO GRANDE, J. Ignacio. Redes sociales para unas administraciones y gobiernos abiertos: desafíos para la innovación y la creación de valor público. In: *XVIII International Congress by CLAD on the State and Public Administration Reform*, 2013. Montevideo, Uruguay.

[27] CRIADO GRANDE, J. Ignacio. Redes sociales para unas administraciones y gobiernos abiertos: desafíos para la innovación y la creación de valor público. In: *XVIII International Congress by CLAD on the State and Public Administration Reform*, 2013. Montevideo, Uruguay.

a political party, etc. Consequently, an alteration of the relationship dynamics is created, generating ties with greater horizontality and lower cost.

These three elements suppose a mutation towards a reality in which social networks and open governments become indispensable scenarios, and increasingly present among governments and public administrations. In this way, we are witnessing how social networks become the empirical or practical dimension in which new opportunities for innovation in government action are emerging.

Ultimately, the importance of this group of tools lies in the fact that they allow innovating the relations of governments and their policies with the public, to a certain extent as a result of their high level of social diffusion and their high popularity within public administrations, offering a new scenario for Public Administration and citizens.

However, the idea of Social Big Data does not only imply thinking about launching the use of social networks in conjunction with public policies, but presupposes deliberating their respective strategies of use. Although there is no exhaustive enunciation of them, since the possibilities of implementation can vary considerably, we will mention three types of strategies:[28] Push, pull, and networking.

Push Strategy: It highlights the communicative and unidirectional vision of the use of social networks in public administrations, in the form of extension of web portals. In a more tactical way, the essential reason for using social media is to achieve the representation of the appropriate agency or department in all possible channels. The basic idea is that the extension of the success of social networks such as Facebook and Twitter leads those in charge of communication from public organizations to think that it is necessary to be present in them in order to get closer to where citizens are. In this sense, a growing number of governments and public administrations have accounts in the main social networks or open blogs. This logic of representation implies the consolidation of a push strategy, in which no additional resources are invested to design content specifically for social networks.

Pull Strategy: It involves the audience through the development of some type of interaction, which can be translated into some comments on Facebook, or some retweets on Twitter. In this case, the strategy of presence in social media is aimed at strengthening the commitment, given that traditional web pages do not achieve this dimension. Through this strategy, the need to interact with citizens from a more conversational and interactive perspective is recognized. In this case, the

[28] MERGEL, Ines. *Social Media in the Public Sector: A guide to participation, collaboration, and transparency in the networked world.* San Francisco: Jossey-Bass, 2012.

generation of innovation and public value lies in the opportunity offered to citizens to generate, share or co-produce content and actions, which are then replicated by the web portals of government agencies. In short, it goes beyond a mere representation or generation of specific content for social media and activates citizen participation and commitment.

Networking Strategy: The use of social networks has a highly interactive component, with a significant amount of two-way relationships between public administrations and the external actors with whom they are connected. In this case, public administrations focus, not only on facilitating the development of conversations with the actors of the environment, but also on promoting the generation of networks of interactions derived from the generation of content, the sharing and the co-production of activities, facilitating socialization among the citizens themselves. The creation of public content is aimed at reuse, sharing, recombination and, in this way, innovation and public value are generated, which in this case have a high social content and directly attributable to citizenship. In short, this strategy of presence in social networks involves deepening interaction with the public through the development of a network strategy that increases the influence of organizations through the growing role of the individuals and organizations with whom it is related.

Anyway, regardless of the strategy (s) chosen by each government, the important thing is to highlight and keep in mind that the ideas of open government, Big Data and social networks can be combined to improve and bring the relationship between citizens and Public Administrations closer, generating strong, transparent and progressive bonds.

6 Conclusion

After this brief review of the characteristics, advantages and challenges involved in Big Data and Social Big Data in the public sector, we can say that, nowadays, Big Data seems to be the best source of opportunities for the public sector of all countries. It could be compared to a gold mine for the infinite amount of data that can be used in favor of the population and for the optimization that comes from public expenditure if it is properly used and put into operation.

It is a fact today, that citizens are many but that policy agendas are built by a few. Thus, it is in this context that we should assess the itinerary and scope of possible Big Data projects in the public sector that allow in the future to access and process information held by it. For example, statistical data of the market, industry or sector in which they operate; aggregate information in the field of public procurement; casuistry in relation to the processing of administrative procedures; etc.

Furthermore, it is worth mentioning that the importance of data in this process also lies in the fact that through data analysis it is possible to show how public policy creates public value (which is ultimately its main goal) and in that way, achieving its legalization and the improvement of Public Administration.

In sum, some advantages that Big Data and Social Big Data may offer to the public sector are the following:

- Faster, more timely and highly exact decisions.
- Better public policies, adequate to solve population needs efficiently.
- Interrelationship between stored information and new data in real time.
- Public expenditure streamlining.

There is no doubt that by means of these tools, representative institutions can improve their capacities to actively listen to citizens and nurture their public policy design processes with more information about the concerns and needs of those they seek to serve.

Social networks have begun, progressively, to distribute the public voice. Perhaps it is time for representative institutions to build capacities to listen to it in its new aspects. Generating actionable knowledge from that ocean of information is central to building smarter and more open governments, especially when that data is about the people for whom they work.[29]

The concepts derived from the term open government: Transparency, participation and collaboration that inspire many documents and many articles on the subject would not be possible without these new tools (Big Data and social applications) that are directly related to the promises of a better future. In this sense, it is pertinent to underline the need to consider the implementation and exploitation of the potential derived from social networks and the huge amount of information that currently surrounds us, as the most direct way to reach more open administrations and governments.

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[29] INTER-AMERICAN DEVELOPMENT BANK – IBD. *Escúchame cuando te hablo*. Big Data para gobiernos más abiertos. Available at: <https://blogs.iadb.org/gobernarte/2017/01/17/escuchame-cuando-te-hablo-big-data-para-gobiernos-mas-abiertos/>. Last access: 17 Jan. 2017.

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