Social Inclusion and

THE FUTURE OF WORK

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Impact of Open Data on the Creativity for Innovation

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Impact of Open Data on the Creativity for Innovation

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INTRODUCTION

The advent of new information and communication technologies (ICTs) has led to the emergence of the so-called large database economy (BGE) (Cuquet & Fensel, 2018; Fosso *et al.*, 2018), in which organizations can collect large amounts of information on the behavior of ICT users from their online operations.

This chapter focuses on the study of the impact of open data on the creativity of individuals and organizations, as a scientific study approach in the process of consolidation in the field of social sciences.

This means that the open data generated by governments is a relatively new tool for individuals and organizations, due to the opening made in 2009 by the US government - during the administration of Barack Obama - to make available to the public the information held by the government in an exercise of transparency and access to public information in the framework of the "Memorandum on Transparency and Open Government" (Lee, Almirall, & Wareham, 2015).

Beginning with the U.S. government initiative in 2009, many governments around the world set to work on developing legal frameworks to operationalize open data initiatives according to the information and technological possibilities then available to them, to make public the information that the different operational areas of governments had at their disposal and that could be used by the public for new uses (Kassen, 2018; Lee *et al.*, 2015).

Creativity is another variable that is intertwined for the understanding of the innovations produced by the openness of data produced by governments,

starting from the fact that innovations may have different patterns to a point of reference, but not mean something creatively stimulating or interesting.

Creativity is conceived as an inherent function of man; it is coined from the history of the Bible, in Genesis (creation of the world), to the contemporary approaches that theoreticians such as Joseph A. Schumpeter have given to the management of innovation (Hammershøj, 2017; Schumpeter, 1961). What is certain is that creativity can be approached from different perspectives in reality, especially because it is part of the so-called "Creative Economy" (CE), where value creation arises from the intellectual contribution that people can give to things within organizations (Bolisani & Brătianu, 2018).

For this work, creativity is the whole process of generating new original ideas (which links the concept, as many types of researches point out, to the term innovation) for the solution of problems. Therefore, creativity must possess three key factors (or components) to be considered as such: originality, usefulness, and surprise (Simonton, 2018).

Making use of one of the advantages of the BGE, this work carries out bibliometric analysis using the free access software VOSviewer (Van Eck, & Waltman, 2020), which, by downloading indicators from the scientific database of great prestige in this context, Scopus (Elsevier, 2019), carries out the analysis of semantic variables that make it possible to identify clusters of topics that are mostly dealt with in said repository according to the search patterns of the topics that are described in the methodology of this article.

PURPOSE

This chapter seeks to perform a bibliometric analysis of the good practices documented by the scientific community in the development of applications based on open data between 2008 and 2018, to identify the most solid semantic relationships and their temporal evolution in organizations.

It seeks to contribute by giving a first look at the first period (five years) of scientific documentation of the phenomenon of open data and how individuals and organizations have developed creative concepts to make use of these open repositories of governments around the world, to provide solutions to the absence of information for decision making or the inability to interpret them.

CREATIVITY AND INNOVATION

The raw material of this work is creativity, which has been understood as a series of mental processes that allow the generation of totally new ideas, which in turn, give rise to the creation of value for organizations (George, 2007; Jauk, 2019; Wang, 2019).

However, this term in many of the dissertations of scientists is linked to innovation, by the simple and obvious connotation of the generation of the new, also, as a term linked to the knowledge economy (KE), in which the know-how (knowledge of the matter) is fundamental to generate value in the organization (Hammershøj, 2017).

The economics of creativity (or orange economy) (EC) is a recently emerged technical framework in which "ideas are transformed into cultural and creative goods and services whose value is or could be protected by intellectual property rights" (Benavente & Grazzi, 2017). This framework is very important for today's economy, due to the preponderance of the generation of value from people's ideas and the proliferation of ICTs.

Innovation is, then, all those processes that contribute to the addition of value to products, services or ideas, which can range from the primordial in functionality to the aesthetic and represents a great contribution to economic activity, due to the impact that improvements have on the economic performance of the portfolio of organizations that, for example, in Latin America constitutes the 5.20% contribution that the region makes to the world Gross Domestic Product (GDP) (Benavente & Grazzi, 2017).

According to Keeley and others (2013), innovation can be done in three dimensions: configuration, offer, and experience. The configuration is made up of the business model, the network of contacts to generate value, the operational structure and the composition of internal processes; on the other hand, the offer is what refers to the performance of the product and the system that makes up the product (such as complimentary products) and; experience is everything related to the service around the product, the distribution channel, the brand, and its loyalty.

The scientific community debates the co-occurrence of creativity and innovation as phenomena that influence or are necessary for the competitiveness of organizations today (Derdowski *et al.* 2018; Echeverri, Lozada, & Arias, 2018; Moreno & Munuera, 2014). The nature of these variables leads us to the reasoning about how two phenomena with particular characteristics between them cannot be understood without the interrelation they imply. The dissertation is very necessary to understand the phenomena that imply these variables.

CREATIVITY AND OPEN DATA

This section seeks to compile scientific evidence documenting the use/ development of mobile or web applications on the use that has been given to open data for solving problems of information gaps for decision making of people and / or organizations.

Based on the search made in Scopus and according to the display based on the order of appearance of the results according to the most recent publication date in the first place, was found an interesting application of open data for the solution of the serious problem with the public transport infrastructure in the Italian city of L'Aquila, which was severely affected by an earthquake in 2009 and which, with the help of an application using a georeferenced algorithm made information on local public transportation infrastructure ("infostructure") more accessible to the population and visitors (Falco *et al.*, 2018).

The search also yielded another case of digital inclusion of elderly people in the district of Bremen-Hemelingen (Germany) by generating a map that acts as a mobile digital guide co-created with the information that elderly people shared in their social networks, which allowed the creation of a sensitive app with the capabilities of this population group carried out by the European Project Mobile-Age (Berker, Reins, & Heck, 2018).

Another example of scientific research on co-creation through the use of open data is presented to us by Emaldi and others (2017) through the WeLive platform, which is formed as a quadruple helix (companies, government, citizens and universities) that generates a collaborative ecosystem for innovation through the use of open data.

Lyu and Zheng (2017), conducted an interesting review of the open data policy of the government of Shanghai (China) since its launch in 2014 and how the applications arising from it contributed to the creation of value in society.

The main benefits of the open data in this case and other examples found focused on solving urban problems by attracting talent and investments in the subject (Martínez, López, & Pastor, 2014; Sandoval, Gil, Luna, Luna, & Rojas, 2012).

Creative activity has no limit and can come from different sources, for example, "hackathons", events in which software developers come together to collaborate in the generation of applications that empower discriminated groups by opening access to information that is generally in the hands of a few, for exploitation for the common good. Although its nature has barely been empirically explained at the scientific level, it is now being increasingly researched to inform knowledge of these events (ICEIS, 2017).

In educational terms, the review of scientific literature on Scopus showed a case of creative app development whereby students can learn about economics, society and the environment in a globalized world with data updated in real-time, making Globe-Town.org an application that contributes knowledge on the above topics with very close references to reality (Townsend *et al.*, 2013).

Open data has also had an impact on the creativity with which new forms of business are formulated, since nowadays, multiple business applications for

marketing products and services using platforms based on open information, such as Uber[1], Rappi[2], or Netflix[3] (Alt & Smits, 2014; Wijnhoven, 2014; Vasa & Tamilselvam, 2014).

The search found at a glance a large number of scientific documents whose themes showed a growing application of open data studies in the development of applications for urban development. This is quite likely due to the importance of ICT in urban areas and the ease of accessing and sharing data that exists.

MEXICO: CASES OF DEVELOPMENT OF APPLICATIONS BASED ON OPEN DATA

After reviewing some of the cases of development of applications based on open data, the present work is given to the task of documenting as an interesting contribution, the cases of use of open data for the generation of useful applications for various purposes, for people and organizations.

The first example that is particularly interesting to present in this review of the literature, comes from one of the experimental applications that the National Institute of Statistics and Geography of Mexico (INEGI, 2018) developed to know the mood in —practically— the real-time of a part of the Mexican population, who use the social network Twitter, called: "mood of the twitters in the United Mexican States".

This application of "data science", according to the technical documentation that the institute makes available to visitors to its microsite, consists of the use of non-traditional data sources (such as social networks), of which pre-classified information is collected (according to geolocation patterns), stored, re-labeled (with the help of a semantic relationship algorithm) and re-processed, to be disseminated in an interactive application hosted on the INEGI website (INEGI, 2018; Picazo *et al*., 2017).

This application allows you to know the mood of Twitter users in Mexico in real-time from the INEGI website, which is represented by a point on a graphical plane that expresses the average value between positive and negative twits. Also, the graphical application allows information to be disaggregated by states or in the national conglomerate (INEGI, 2018).

Besides, INEGI has developed other applications with the help of other institutions of the Mexican government (51 at the time of this study), including

[1] Private transport service based on geolocation

[2] Home distribution application for multiple products and services such as food or money

[3] Online multimedia content distribution platform

the climate change microsite[4], and the application for mobile devices for calculating electricity consumption[5], RadarCiSalud for the identification of the closest places to the location of individuals where free medical attention can be received[6], the microsite and applications for mobile devices for the consultation of statistical information in the country,"México en Cifras"[7].

METHODOLOGY

To analyze the objective data of this work, a bibliometric analysis was carried out, which has been used since 1969 since its use was documented by the British scientist Allen Richard, who sought to statistically analyze the bibliography, which implies the identification of patterns of variables through the keywords, words contained in the summaries that keep the scientific repositories, names of authors and the references of the consulted bibliography (Liang & Liu, 2018; Liao *et al*., 2018).

For this research use is made of the scientific database Scopus, particularly with the results of the search between titles of articles, the abstract of them and their keywords based on the combination of terms: "Open Data", "Applications" and "Apps" (contraction widely used the word "Applications"), which yields 47 scientific documents that have been published on the subject in the last five years (from 2012 to present 2018).

Once the database was obtained from the results export function provided by Scopus in CSV format (database format that supports the software used for the analysis), the base information obtained by the bibliometric data analysis software was analyzed using graphic representations: VOSviewer (Van Eck, & Waltman, 2020; Van Eck & Waltman, 2014).

RESULTS AND FINDINGS

Under the methodological approach for analyzing the bibliography using the graphic method of semantic relations using VOSviewer, the database obtained from the search described in the Scopus repository was executed, obtaining the following conglomerates and interpretations, Diagram 1.

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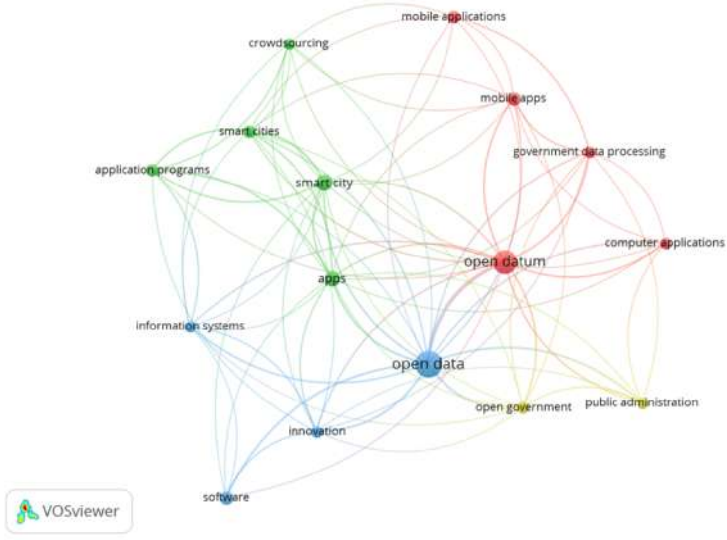
[4] https://cambioclimatico.datos.gob.mx/tab1.html), the application for mobile devices for calculating electricity consumption (https://datos.gob.mx/herramientas/calculo-consumo-hogar?

[5] https://datos.gob.mx/herramientas/calculo-consumo-hogar?).category=web&tag=salud

[6] https://datos.gob.mx/herramientas/radarcisalud?category=movil&tag=salud

[7] https://datos.gob.mx/herramientas/mexico-en-cifras?category=movil&tag=geoespacial), among many other applications

Diagram 1. Network visualization of variable sets in bibliographic records of the terms "Open Data", "Applications" and "Apps" in Scopus between 2012 and 2018.



Source: Own elaboration.

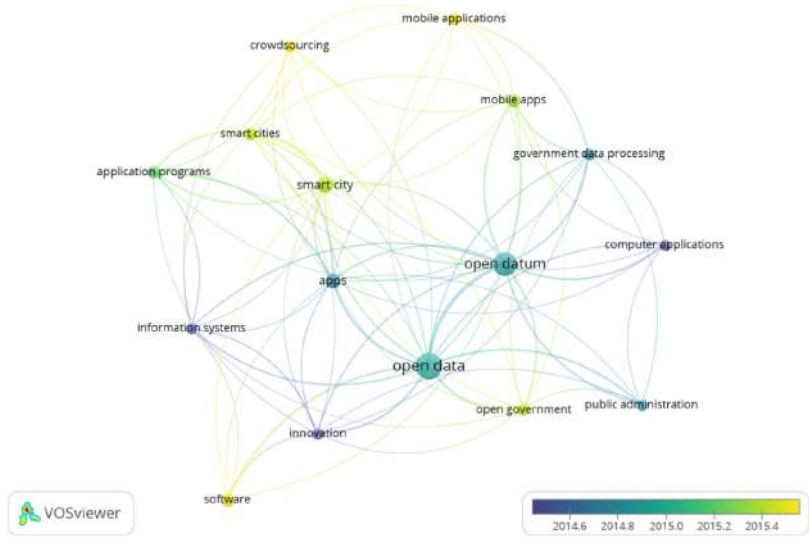
The network of relationships found from the graphical output offered by VOSviewer shows interesting correlations in terms that —can be inferred— relate open data to the social aspect related to government, mainly to the variables of open government, public administration, public data processing, intelligent cities, and innovation. This last term, inherent to creativity, was not included within the bibliometric exploration variables in order not to alter the richness of the search results (see Diagram 1).

From the findings, the terms directly related to creativity from open data (observed as less important variables) are mobile and desktop application development, crowdsourcing, innovation, and software development (see Diagram 1).

Another interesting function of the VOSviewer is the possibility of observing the data from its temporal evolution, which adds to our dissertation the variable time, then, can be observed as the semantic terms of greater persistence in the history of scientific research to the term "Open Data", in a middle term to the "development of applications" and as terms of recent use or

appearance to the "intelligent cities", the "crowdsourcing" and the mobile applications. Innovation remains a present term since the beginning of the scientific documentation of the subject (see Diagram 2).

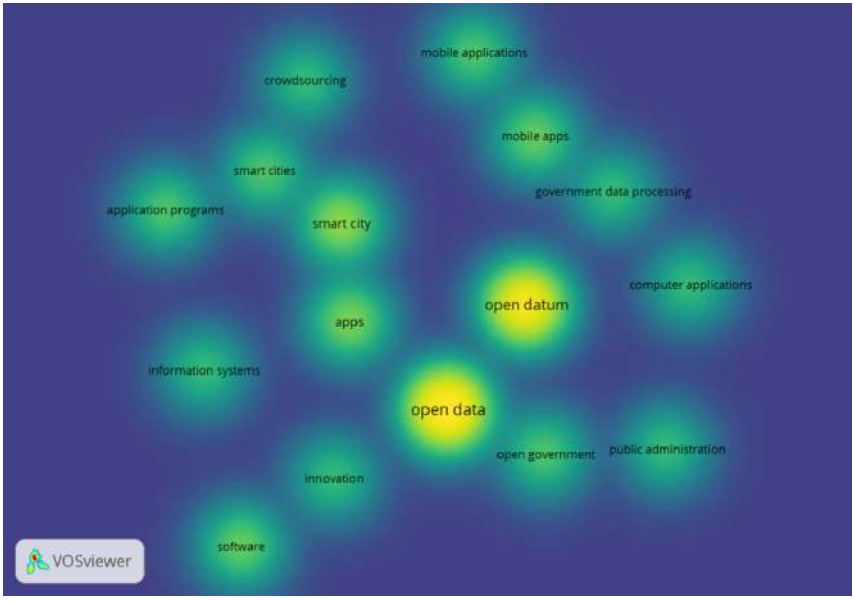
Diagram 2. Visualization of the temporal evolution of the network of variable sets in bibliographic records of the terms "Open Data", "Applications" and "Apps" in Scopus between 2012 and 2018.



Source: Own elaboration.

Finally, Diagram 3 shows the density of each of the variables in terms of the appearance in scientific research work within Scopus, which leaves the main search term —Open Data— as the majority present, followed by the terms discussed above and which appear with relatively lower weights —which does not mean less important— on the map.

Diagram 3. Density display of variable sets in bibliographic records of the terms "Open Data", "Applications" and "Apps" in Scopus between 2012 and 2018.



Source: Own elaboration.

CONCLUSIONS

The importance of this study lies in the realization of a first approach to the early history of open data from the vision of creativity in the development of applications for decision making and problem-solving.

The history can be qualified as early, due to the lack and recently documented appearance of scientific studies in the matter (with only six years of having mentioned the first term with the search variables explained in the methodology).

The undeniable relationship between creativity and innovation is present in the analysis of bibliometric data, this, by the appearance of this last variable within the clusters of topics that were most used in the scientific work on the subject collected.

As noted in the direct review of each of the search results, the 47 documents submitted for analysis by the VOSviewer software as a whole confirm

the prevalence of the term "Smart Cities", due to the boom in open data as a window for solving urban problems.

However, the uses for crowdsourcing, the development of software and mobile applications as variables temporarily considered in the most recent scientific work, could be a consistent indicator of the interest they are taking for the community, although not entirely accurate, due to the short history of the subject in the work of researchers.

The nature of the topic obliges the governmental linkage and its responsibility in the generation of mechanisms that improve the appropriation of open data by the community, for example, with the call made by the government of Mexico through INEGI to promote tools such as the one that allows knowing the mood of the country's Tweeters.

The maturity that open data policies must have in countries in the medium term will be of great importance for the development of the same, due to the opportunities for creative innovation that this will bring to all social sectors, especially the less economically favored and, above all, in a global context that prepares for the Internet of things and a flood of data to understand and exploit strategically.

RECOMMENDATIONS

The study of Open Data is recommended before other variables that may be of interest to the scientific community in terms of semantic analysis, mainly as an element of a retrospective on the direction this phenomenon is taking in its short life of study by scientists.

Issues such as the formats that open government data should adopt as a homogenization measure for the exploitation of these repositories, as well as the social, ethical, and environmental implications that the use of Open Data is having for the societies of the countries, were left out of this study.

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