Impacts of Open Data in Luxembourg and the Greater Region - 2018

Main Findings

Date: 21.06.2018
ISBN: 2-919941-22-4
EAN: 9782919941223

digital luxembourg

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY | LIST

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2 INTRODUCTION

Open Data is grounded on the openness principle, which is designed to minimize the burden on re-users, but it largely deprives data providers of the means to know the re-users, the intensity of the re-use, the modalities of this, as well as the value created from the public assets (because of the free of charge principle induced by the marginal cost). This therefore requires a very broad approach that draws on all available means to capture and analyse the traces of re-use, which implies adopting a methodology taking into account different types of indicators, quantitative or qualitative, at different scales.

For 2018, Luxembourg Institute of Science and Technology (LIST) was mandated to conduct the first evaluation of the economic impact of Open Data in Luxembourg. This document summarizes the methodological guidelines followed for this study.

3 METHODOLOGY TO ASSESS THE ECONOMIC IMPACTS OF OPEN DATA IN LUXEMBOURG AND THE GREATER REGION

The methodology of the evaluation tried to combine the different approaches of the state-of-the-art and to adapt them to the profile of Luxembourg, in particular by envisioning re-use at the scale of the Greater Region, adapting them to the realities of a country to the number of re-users necessarily limited, for country which does not benefit of the mass effect, taking also into account that the local

ecosystem of Open Data is still in phase of emergence and that this was the first analysis of this topic since the 2006 MEPSIR study.

3.1 MACRO-ECONOMIC STUDY

The macroeconomic analysis, a quantitative approach, adapts to Luxembourg the methods already used by other European countries to assess the potential scope of the public data market. These methods are based on ex-ante indicators that provide information on four major types of metrics defined by the report Creating Value Through Open Data[1]: market size and value added as percentage of GDP; number of jobs created; cost savings for the public sector, efficiency gains or productivity gains. First three are quantitative metrics, last one is qualitative.

Ex-ante metrics are estimates based on historical figures, proxy indicators, projections and assumptions. Their particularity is that they are essentially top-down methods that approach the value of Open Data tangentially. Depending on different scenarios, more or less optimistic about the extent of re-use and the gains it allows, minimum and maximum ratios are defined, which lead to estimating a range of values corresponding to the economic value directly related to Open Data.

3.2 QUESTIONNAIRE TO GATHER DATA ON OPEN DATA RE-USERS

The impact analysis at the scale of companies (or even economic sectors), according to an ex-post and bottom-up method, is rare in Europe. Two methods are possible. A rather qualitative approach, based on case studies and a rather quantitative approach, based on questionnaires. The second option was chosen for this study. The most successful model is the study of the re-users (infomediaries) sector regularly conducted in Spain.

Questions shall provide figures on the emergence of new companies, business models, products, productivity gains, as well as figures on increased geographical coverage, customers, turnover, and profitability. These questions are intended to feed a metric aggregating the various figures and should make it possible to get quantified estimates on the share of Open Data in the turnover of companies. In turn, these figures should allow a comparison with the macroeconomic estimates of the share of Open Data in GDP.

These principles have been adapted for the study in Luxembourg. The study tries to gather figures on these issues but, as a first analysis, it also focuses on the identification of the actors, the collection of elements to draw the economic profile of the re-users. In line with the impact matrix, it also analyses the conditions that help or hinder the achievement of impact, taking into account the needs expressed by the re-users and identifying the barriers against a maximised impact. This study was also conceived as a pre-engagement platform of the re-users, with the perspective to set up a working group strengthening links and cooperation between providers and re-users of public data.

3.3 QUESTIONNAIRE AIMED TO REACH CIVIL SERVANTS

Although a quantitative approach of public sector is important and possible, it seemed important to start with the collection of qualitative data. Given the number and variety of relevant administrations, an open questionnaire was preferred rather than conducting interviews. These data make it possible to inform one of the metrics identified by the report *Creating Value Through Open Data*, that is an

[1] https://www.europeandataportal.eu/sites/default/files/edp_creating_value_through_open_data_0.pdf

increased efficiency in the work of civil servants. This indicator is not easy to fill in monetary terms (except the cost savings indicator) but it is an important part of the economic impact, given the public sector's weight in GDP and the fact that the public sector is considered as the main re-user of public data.

The main objectives of this questionnaire are to assess whether changes appear in the frequency and nature of data use, whether new services to citizens are emerging, whether existing services are rendered more efficiently and finally to evaluate culture changes in the work of civil servants. As culture change is a very broad concept, the questionnaire is designed to deal mostly with capabilities related to data literacy.

3.4 LOG ANALYSIS

Generally speaking, log analysis are led following mainly two goals. First, they are used to prevent or detect cybersecurity issues. This objective explains also why they are gathered and stored. Second, they are used to analyse user behaviour with the goal to improve the design or the functionalities of a service.

Log analysis make it possible to evaluate at least the audience - Internet audience is the matter of Web usage mining disciplines. At a slightly higher level of abstraction, they make it possible to understand usage, i.e. user behaviour. At an even higher level of abstraction, one can study some of the impact, or at least the conditions of the impact.

In this perspective log analysis is promoted in several reports written on behalf of the European Data Portal. For example, *The Analytical Report 8*[2] (p. 7) promotes the analysis of the portals' log files as a means to understand user behaviour.

Depending on the service considered, the format chosen by administrators, log files store different kinds of information. Most frequent fields are date, IP address, kind of action and time required to answer.

One purpose of this study is to test if different kinds of logs allow to emit and check more or less precise hypotheses on the understanding of re-users behaviour and on the impacts of the Open. Data. Query (or search) logs, combined with entry pages and even referrers allow to make assumptions on what is sought by re-users and to assess if they find this easily.

Access and downloads logs also allow to assess the audience of public data through their categories (following the thirteen categories identified by the European Data Portal) and their formats.

Logs related to the API make it possible to draw more advanced hypotheses. Their main interest lies in the possibility for public providers to trace directly (at least a large subset) the final use (often the general public). In terms of impacts, Log API allow at least to assess the impact at the very moment of its realization. By this means, depending on the information gathered and stored, it is also possible to gain some insights on the modalities of re-use. Simultaneously, a thorough analysis of a sample analysed the re-use of the API studied allowed to analyse and categorize the re-use of the API, e.g. according for example the enrichment brought by re-users.

[2] https://www.europeandataportal.eu/sites/default/files/edp_analyticalreport_n8.pdf

The biggest challenge remains the issue of the linkage between usage and a quantifiable impact. Insights from API are thus intended to feed the matrix of impacts.

4 RESULTS

4.1 EX-ANTE INDICATORS

The following figures correspond to ex-ante indicators, estimates based on previous figures, indirect indicators, projections and assumptions. Their particularity is that they are essentially top-down methods. It shows a fragile validity and necessarily limited scope. On the other hand, the interest is to express a potential to form a base of comparison, or at least an objective, for bottom-up (and ex-post) approaches better based on the reality of uses and benefits but always more difficult to drive, to generalize the results and particularly in the case of Open Data, whose characteristics prevent the use of certain approaches (such as the elasticity of demand at cost) and which lead to links distended between data producers, re-users and end-users.

Ex-ante studies of the economic potential of Open Data provide highly divergent estimates, between 0.04 and 7.19% of GDP. The table below summarizes the application to Luxembourg GDP in 2020 of the confidence ratios defined in these studies.

Study	**Luxembourg figure (billions of euros, potential in 2020)**
(PIRA, 2000)	0,74% of GDP: 0,4144
(DotEcon/CUPI, 2006)	0,08% of GDP: 0,0448
(MEPSIR, 2006)	0,25% of GDP: 0.1400
(Pollock, 2010)	0,3% of GDP: 0.1680
(Vickery, 2011)	1,1% of GDP: 0.6161
(Bürgi-Schmelz, 2013)	0,35% of GDP: 0.1960
(Deloitte, 2013)	0,39% of GDP: 0.2184
(McKinsey, 2013)	4,26% of GDP: 2.3860
(Omidyar Network, 2014)	1,4% of GDP: 0.7841
Capgemini, 2015)	0,47 % of GDP: 0,263
(Dapp et al., 2016)	1,3% of GDP: 0.72813

The table below gives an estimate of the direct market size of Open Data in 2020, following the ratio of 0.47% of GDP defined at European level. According to this approach, the size of the direct market would increase by just over 200% between 2006 and 2020.

Measures	Values
GDP forecast (billion Euros, 2020). IMF Source[3]	56.010
Direct market size estimate	0.263
Indirect market size estimate[4] (Vickery, 2011) (Shaskespeare, 2013)	0.9205 / 0 .9941

The number of people employed in knowledge-intensive activities in 2016 (132,500 according to the Statec/Eurostat figures), the proportions estimated in the Spanish reports on the infomediaries sector, the low estimate (0,074%) makes it possible to estimate the number of direct jobs at 98, the high assumption (0.082%) at 108 and the average ratio (0.078%) at 103. The following table adopts the high assumption according to the approach of (Carrara et al., 2015): the number of jobs in subsequent years is calculated based on an average annual growth rate of 7.3%. Indirect jobs are estimated according to the ratios of (Vickery, 2011) and (Shakespeare, 2013).

Table 1: Estimates of direct & indirect number of jobs

	2016	2017	2018	2019	2020
Estimated number of direct jobs	108	116	124	133	143
Estimated number of indirect jobs (Vickery, 2011) (Shakespeare, 2013)	378 / 408	406 / 438	434 / 469	465 / 503	500 / 540

One of the only estimates of the savings potential allowed by Open Data is provided by the Danish "Basic Data Program". From 2020, the savings for the Danish government are estimated at 35 million Euros per year. (Carrara et al., 2015) suggest generalizing this figure to other European countries. For this purpose, they calculate the average proportion of public expenditure in relation to GDP for the period 2010-2014 in Denmark and project this percentage of public expenditure on the estimate of the Danish GDP in 2020. This figure is then reported to 35 million estimated savings in the Danish strategy and leads for a ratio of 0.22% of government spending. To extend these results, they apply the percentage of public expenditure savings to other EU 28+ countries, based on both the 2020 GDP growth forecasts (IMF's World Economic Outlook) and the percentage public expenditure for 2010-2014, as given by Eurostat. For Luxembourg, if we consider public expenditure over the period 2010-2014, the average rate is 43.14%, lower than the EU average of 28. If we consider central government expenditure, the rate is 31.48%, above average ratio. Applying the rate of only central government expenditure to constant GDP forecast by the IMF in 2020 (EUR 56.01 billion), there is an expenditure potential of EUR 17.6 billion, for which a ratio of 0.22% would save 39 million Euros.

[3] https://www.imf.org/external/pubs/ft/weo/2017/02/weodata/index.aspx

[4] Deloitte (2013, p. 19) in the *Market assessment of Public Sector Information* defines the indirect value of public sector information as "the benefits accruing up the supply chain to those organisations interacting with and supplying PSIHs (but not directly using or re-using public sector information), and the benefits accruing to those organisations where employees of PSIHs and supply chain organisations spend their wages".

Several factors make it possible to hypothesize a re-use sector with a potential greater than that indicated by the ex-ante indicators alone:

- There is a smoothing of the value created by taking into account an indicator such as GDP, coupled with a geographical smoothing by ratios defined at European level. Limiting the effects of this smoothing would require the consideration of finer factors, such as the maturity and dynamics of the IT sector and other sectors likely to re-use public data. With the highest GDP per capita in the EU 28+ and one of the highest rates of population working in knowledge-intensive activities, it can be hypothesised that Luxembourg based companies have the potential to participation in the re-use market on a European scale larger than the size of the country does allow to calculate.
- This size effect is taken into account by the economic literature. (Adam, 2004) shows how the relatively small size and the very open nature of the Luxembourg economy leads to failure (at least grater differences) of relatively well-established models, such as those that assess the growth potential of a country, and that work quite well for countries such as France or the Netherlands. Same consequences should be drawn for Open Data.

Main results of the ex-ante study in Luxembourg :

- Direct market size (2020) : EUR 263 million
- Indirect market size (2020) : EUR 920 million
- Number of direct jobs (2020) : ± 140
- Number of indirect jobs : ± 500
- Savings for government (national scale, 2020) : EUR 39 million

4.2 QUESTIONNAIRE AIMED TO REACH PRIVATE SECTOR STAKEHOLDERS

The main purpose of this analysis is to assess the economic impact of Open Data re-use, and to gather data on the conditions required for an optimal impact and on the context surrounding this re-use.

The sample (n = 13) is too small and not representative enough to allow the production of figures such as the estimate of the share of Open Data in the turnover of companies. Collected data concerns almost only the technical part of the survey, the respondents do not provide any information enabling the following questions to be assessed: the skills, the customers, the business model of the company, in short everything concerning the economic dimension in the strict sense and, more surprisingly, the competences associated with the use of Open Data. Neither there are not enough answers to identify a trend in the thematic categories of re-used data, which were those used by the European Data Portal.

The very limited sample and lack of answer on economical or organizational issues may be linked to several factors. One root of this is related to the position of respondents inside their organization, where most of them are in charge of operational issues, not of the management ones. Among the lessons learnt, it is also necessary to build a trusting relationship with companies before requesting information that many of them consider confidential. The construction of this relationship of trust could for example involve the formation of a group of re-users engaging private and public actors to maintain frequent interactions about Open Data.

Once put these limits to representativeness, the profile of companies is rather medium-sized (from 50 to 249 employees). Companies surveyed are either based only in Luxembourg, or in one or more of the neighbouring countries, but are not established on a European scale, let alone on a global scale,

which is not consistent with the country's economic profile. Use of Open Data platforms respects this economic implementation: when these companies re-use public data, it is primarily Luxembourg data, to a lesser extent those of the three neighbouring countries. Marginally one can also mention the re-use of data from the United States, Britain and Portugal, mentioned each time by a different respondent.

Answers provide a total of 46 full-time equivalents. Note that the respondents often comment on their answer by placing uncertainty because they wish to specify that they are aggregations, the use of public data being fragmented between multiple workstations. Answers show very large differences, with one respondent concentrating three-quarters of the jobs found. In spite of the lack of representativeness, it can be stated that on a target of 100 jobs (Luxembourg-wide) estimated by ex-ante calculations, just under half is reached by a (small) sample of 13 companies. Without being able to prove it, these figures suggest that the actual number of jobs present has a higher potential than the first estimates.

Concerning the conditions for achieving an optimal impact, the data formats favoured by companies (XML in general, JSON also) are not surprisingly those which allow easy re-use and combination with other data (the data at PDF format are not mentioned in any case). In addition, all respondents express their preference for accessing data through an API where possible.

4.3 QUESTIONNAIRE AIMED TO REACH CIVIL SERVANTS

The respondent panel is limited in number but has a fairly wide range of jurisdictions, as well as STATEC respondents (the government statistics office), but all are however only national.

4.3.1 Impacts

Respondents were asked about their access to public data - whether they are released as Open Data or not – report a variety of means on that purpose. Almost all of them do mention the Luxembourg Open Data platform among these channels, this is an indication that the use of Open Data is now part of the customs of public stakeholders and this is at the same time the confirmation that the public sector has the potential to represent a large portion of the re-users. As part of their duties, they also carry out direct exchanges with other administrations, automatically - for example by FTP - or for occasional needs by telephone or e-mail requests.

Most respondents say they perceive positive impacts on Open Data policies, but these are mostly moderate.

Regarding uses, almost all respondents report that Open Data has led to an increase (from low to medium) in their use of public data. The few examples of detailed re-use are all relating to geographic information, for example geo-referenced addresses.

This re-use's increase is understood as the result of the removal of different barriers. In addition to financial barriers, the removal of procedural barriers is considered the most important. It allows an increase in usage because agents are no longer restrained in their access to data by procedures they knew almost everything, which could discourage them. Civil servants also point an impact in terms of quality of work (there is no more break in their workflow) and especially in time, because the transaction is virtually immediate.

Most respondents believe that their current skills, most often related to their previous duties and studies, are adequate. Only two respondents believe that new skills have been developed by themselves or their colleagues to benefit from open data. One of them explained that he acquired

rudimentary programming skills to manipulate the data and integrate it into the data that he was already used to processing for his statistical calculations. Another point is the opportunity offered by the opening of new types of data, which first requires the acquisition of specific knowledge related to the field, to combine them with the data they are used to dealing with.

Impact is much weaker regarding the creation of new services: the respondents find a facilitation of their tasks, but do not yet note the creation of new public services other than in gestation.

Some of them know re-users of their data. Among the known re-users are banks, insurances, consulting firms and, more specifically, Google and an application dedicated to floods monitoring (Héichwaasser application).

At least once, there was a case of a third-party public actor stimulating re-use by the private sector, since a private sector service provider contracted with an administration was asked to add and aggregate public Open Data to its services.

4.3.2 Conditions mentioned for larger impacts

While Open Data has improved access to public data for the public sector itself, some barriers remain, including the reluctance of various administrations to share their data; to know if the data that one creates shall be opened or not; data models; insufficient metadata.

Despite these pretty privileged access conditions to data owned by other public services or organizations, respondents also encounter barriers to accessing some data sets. The main obstacle they identify is the access to personal data, covered by confidentiality rules. In a symmetrical way, for the same kind of data in their possession, they declare not being able to share them. Perhaps the setting of procedures for the opening of private Open Data would remove some of these barriers. We must add relatively high uncertainties about the status of the data and what qualifies them as open or not.

To maximize time savings, agents attempt to automate the extraction of Open Data and combine it with the data they already have. Even if usual data transformation procedures are not a real obstacle (format changes, statistical aggregation), this optimization is only partial at the moment, because the Open Data models still require manual processing, for example for the management of multi-dimensional databases.

4.4 LOG ANALYSIS

Estimation of the Open Data impacts must go beyond the paradox of transparency, one of the pillars of Open Data, which assumes that re-users may have free and unhindered access to data, but which breaks down at the same time most of the value chain tracking methods designed for prior models and ultimately tend to weaken interactions between producers and consumers of public data.

The basic principle of this study is that log files, as quantitative data, can be used to partially bridge the gap created by the transparency paradox, to assess the impacts of Open Data (at least indirectly) through the collection of data generated by the re-users or even the end users. These data provide information on the intensity and (partially) on the modalities of uses that are made of the platform's data. Thus log analysis is part of the ex-post indicators, which can be compared with the results achieved through ex-ante study. In contrast with ex-ante studies, which provide figures derived from various indicators, this ex-post and bottom-up approach allows precise figures to be obtained - even if they have varying degrees of reliability - but it is more difficult to relate them directly to major indicators such as GDP. If they have a relative lack of significance by themselves, as to the final impacts

or the intermediate uses, it is their comparison and their longer-term evolution, their cross-referencing with other indicators, which will make it possible to give more reliability to these methods.

The developments below clarify the concepts used and collect a set of data that must be compared to data collected by other types of approaches.

To draw the contours of the continuum from access to usage and usage to impacts, this study uses the concepts and tools of Web Analytics. These approaches are used for various purposes, for cyber security, e-commerce, or to study uses to improve the design of a site. Use of usage traces to define the value of a non-market resource has already been explored, for example by research libraries. They are responsible for providing electronic resources that represent an immediately identifiable cost, but do not have an easy indicator to justify the value they bring (even more their return on investment). Access analysis by their public allows them at least to provide quantitative data, and to study how their resources are used and thus improve their presentation or content.

This study adopts this perspective and aims to define indicators to inform the mass, frequency and nature of uses. Some indicators do not necessarily have immediate meaning on their own. Their evolution over time and the comparison with similar figures collected in other countries, and with other types of indicators, on the other hand, represent useful information for the determination of impacts.

Regarding the traffic received by the platform, the study makes it possible to find a ceiling value of page views for one year – around 401 092 - and a floor value of the order of 92 410, a still high ratio at 4.3.

Of the 5,711 visits that the system could relate to a geographical origin, 1,312 can be attached to the Greater Region. Even if only a small sample is available, and its representativeness cannot be ensured, we can nonetheless draw the conclusion that for all the visits which the system has been able to determine, Luxembourg and the Greater Region as a whole represent only a minority of visits.

The pie chart (see below) distributes the terms entered in the search engine of the platform according to the categories they belong to in the typology of the European Data Portal. More than 40% of the search terms are in the Regions & Cities category, which - while taking into account the potential biases associated with a human categorization - corresponds quite well to the content of the platform, centered on data from the administration and public services. A more detailed analysis of search terms in this category shows that some of the popularity of this category is due to the fact that it contains a lot of data related to geographic information. From the available data, about one-third of the total research, which concentrates the most frequently-entered research, French is majority (and almost sole) language used.

Logs of the Géoportail's API were analyzed to compare their interest with those of the catalog. The main advantage of these logs is that the API requires an access key and thus the complete set of re-uses could be studied, as well as the frequency of solicitation of the API by each of these re-uses. Each identified and accessible URL has been categorized using the typology of the European Data Portal. The limited number of re-users explains that the content is rather polarized. Calls by URLs of tourist interest thus represent nearly half of the URLs to which a category has been assigned (but not the majority of the page views), followed by the use of the API by RTL (86), transport (essentially the fact of Mobiliteit, the public transport agency) and webpages locating administrations or public services (41). Re-use therefore mostly intends to increase the information level available for the general public and to facilitate his daily life.

Overview figures

Table 2: Main indicators of use(s)

Measures	Values
Number of pages views	401 092
Number of unique page views	230 374
Ratio page views / unique page views	1,7
Annual sum of unique daily visitors	165 416
Average number of unique daily visitors (per day)	453
Ratio page views /unique page views	2,4
Number of downloads	7 248
Number of bounces	8 403

Temporal coverage: from 1st of December 2016 to 1st of December 2017

Table 3: Comparison with external statistical indicators

Measures	Values
Ratio page views / labour force employed in knowledge intensive activities	3
Ratio annual sum of unique daily visitors / labour force employed in knowledge intensive activities	1,25

Temporal coverage: from 1st of December 2016 to 1st of December 2017

Table 4: Comparison with Geoportail's API

Measures	Values
Page views / annual projection	531 067 / 2 124 268
Number of unique page views	982 502
Number of unique visitors	409 122
Ratio annual projection of number of pages viewed (API) / sum of API page views (catalog)	6 897

Temporal coverage: from 1st of September 2017 to 1st of December 2017

Table 5: Thematic classification of URLs using the Geoportail's API

Categories	**Number of URLs using the API**
Regions & cities	5
Transport	72
Tourism5	148
Government & public sector	41
Education, culture & sport	1
Population & society	86

Temporal coverage: from 1st of September 2017 to 1st of December 2017

Table 6: Number of page views by content type

	Page views	**Unique page views**
Regarding data sets	285 053	129 049
Regarding re-uses	25 629	21 145
Regarding organizations	20 438	17 765
Regarding metrics	11 006	10593
Others	58 966	51 822

Temporal coverage: from 1st of December 2016 to 1st of December 2017

Table 7: Analyzes of geographical provenances and research

Measures	**Values**
Number of visits recorded for the region indicator	34 293
Number of geolocated visits	5 711
Number of terms sought	31 352
Number of page views (opened after consulting search results)	92 410
Ratio number of page views after viewing search results / search numbers	2,9
Ratio number of page views / number of pages views after viewing search results	4,3

Temporal coverage: from 1st of December 2016 to 1st of December 2017

[5]As there is no apparent consensus on the European Data Portal, tourism is arbitrarily categorized in Economy & Finance and Environment.

Table 8: Identified visitors attached to the Greater Region

	Visits	**Actions**
Luxembourg, Luxembourg	1 201	19 658
Grevenmacher, Luxembourg	35	174
Diekirch, Luxembourg	1	9
Lorraine, France	23	105
Liège, Belgium	22	109
Hainaut, Belgium	3	10
Brabant Wallon, Belgium	2	3
Luxembourg, Belgium	2	4
Namur, Belgium	1	4
Rheinland-Pfalz, Germany	21	180
Saarland, Germany	1	2

Temporal coverage: from 1st of December 2016 to 1st of December 2017

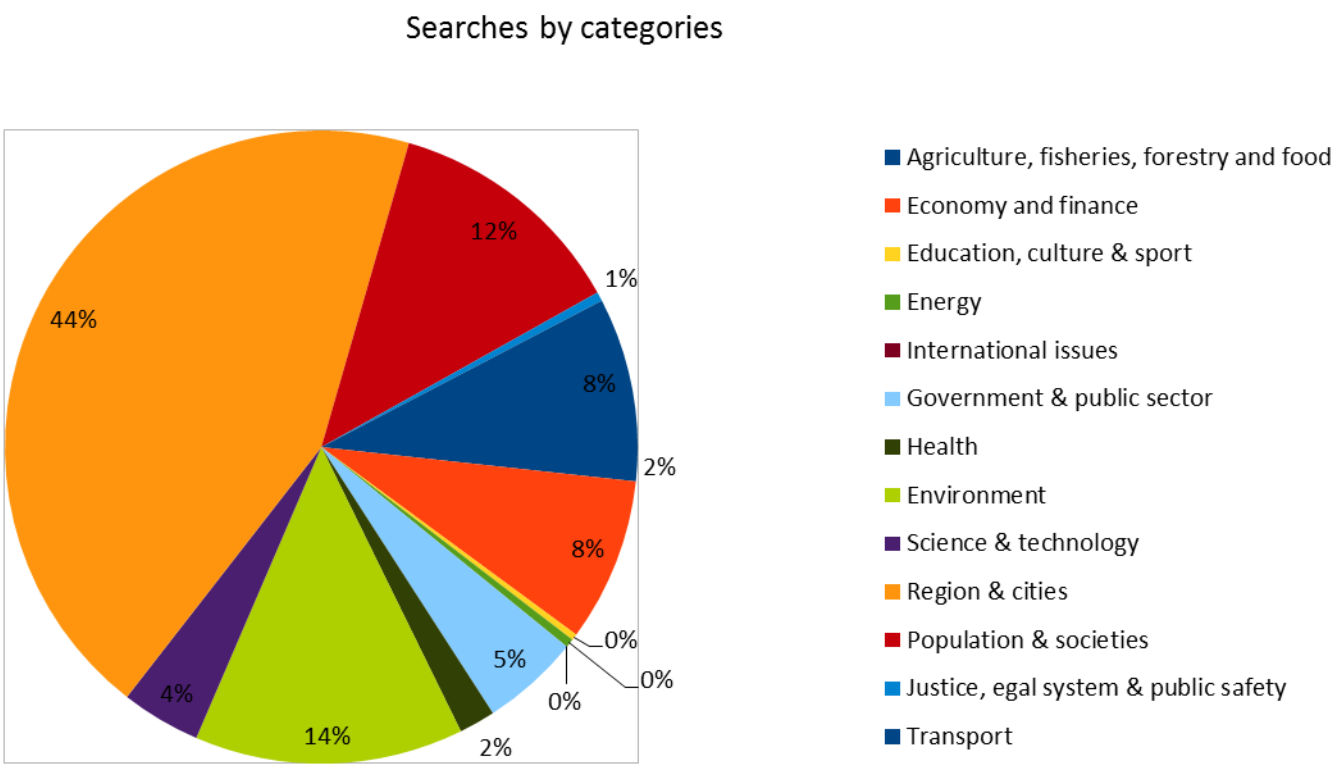

Figure 1: Percentages of search terms according to the categories used by the European Data Portal

There is no data about international issues.

Temporal coverage: from 1st of December 2016 to 1st of December 2017

5 CONCLUSION

Ex-ante approaches make it easier to analyse these metrics in terms of economic impact and value creation with precise estimates. On the other hand, the result is a fragile scientific validity and a limited scope. The interest is, however, to express a potential to form a basis of comparison, or at least an objective, for bottom-up (and ex-post) approaches that are better based on the reality of uses and benefits, but face also issues such as the generalization of the results and particularly in the case of Open Data, which characteristics prevent the use of some econometrics tools (such as the elasticity of demand at cost) and which lead to distorted links between data producers, re-users and end-users. Ideally, the different methods are supposed to converge and the sum of the results of the ex-post analysis should confirm (or invalidate) the figures of the ex-ante estimates. This result, even impossible to achieve in practice, has nonetheless led to the constitution of this methodology.

Acknowledgment

The authors would like to thank all the persons and organisations, from private and public sectors who participated in the various questionnaires or provided data sets.

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