European Commission

# Creating Value through Open Data

EUROPEAN DATA PORTAL

**Creating Value through Open Data:**
Study on the Impact of Re-use of Public Data Resources

*Digital Agenda for Europe*

This study has been prepared by Capgemini Consulting as part of the European Data Portal. The European Data Portal is developed by the European Commission with the support of a consortium led by Capgemini Consulting, including INTRASOFT International, Fraunhofer Fokus, con.terra, Sogeti, the Open Data Institute, Time.Lex and the University of Southampton.

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# Creating Value through Open Data

**November 2015**

A study on the Impact of Re-use of Public Data Resources

# Abstract


## The European Data Portal

Within the context of the launch of the European Data Portal, further evidence of the quantitative impact of re-use of Open Data is measured. The aim of this study is to collect, assess and aggregate economic evidence to forecast the benefits of the re-use of Open Data for the EU28+. Four key indicators are measured: direct market size, number of jobs created, cost savings, and efficiency gains. Between 2016 and 2020, the market size of Open Data is expected to increase by 36.9%, to a value of 75.7 bn EUR in 2020. The forecasted number of direct Open Data jobs in 2016 is 75,000 jobs. From 2016 to 2020, almost 25,000 extra direct Open Data jobs are created. The forecasted public sector cost savings for the EU28+ in 2020 are 1.7 bn EUR. Efficiency gains are measured in a qualitative approach. A combination of insights around efficiency gains of Open Data, and real-life examples is provided. To measure the success of Open Data policies, a series of recommendations is put forward to help governments keep track of the direct and indirect benefits of their policies. This is key in further accelerating the publishing of Open Data and encouraging its re-use.

## Le Portail européen de données

Dans le cadre du lancement du Portail européen de données, l'impact quantitatif de la réutilisation des données ouvertes a été mesuré. L'objectif de cette étude est de recueillir, analyser et agréger les preuves économiques des avantages de la réutilisation des données publiques au sein de l'UE28+. Quatre indicateurs clés sont mesurés: le volume du marché, le nombre d'emplois créés, les économies de coûts ainsi que les gains d'efficacité. Entre 2016 et 2020, la taille du marché des données ouvertes devrait augmenter de 36,9 %, pour atteindre une valeur de 75,7 milliards d'euros en 2020. Selon les prévisions, en 2016, le nombre d'emplois lié directement à la réutilisation des données ouvertes est de 75,000 postes. De 2016 à 2020, ce sont près de 25,000 nouveaux emplois qui seront créés dans ce secteur. D'ici à 2020, grâce à la réutilisation des données ouvertes, le secteur public serait en voie de réaliser 1,7 milliards d'euros d'économie sur l'ensemble de l'UE des 28+. Une approche plus quantitative est suivie afin de mesurer les gains d'efficacité. Ces gains sont abordés sous la forme d'une étude de cas. Une série de recommandations est formulée afin d'encourager les Etats à mesurer plus en détail le succès de leurs politiques d'ouverture de données et plus particulièrement, les bénéfices directs et indirects. Ces aspects sont essentiels afin d'accélérer la publication de jeux de données supplémentaires et d'en encourager la réutilisation.

# Executive Summary

*"If I had to express my views about the digital future – that of Europe or indeed, of the whole world - I could do it with one word: data."*

*Andrus Ansip,*
*Vice-President Digital Single Market* [I]

I https://ec.europa.eu/commission/2014-2019/ansip/announcements/speech-vice-president-ansip-bruegel-annual-meeting-productivity-innovation-and-digitalisation-which_en


20,24
3,45 %
27,98
12,45
36,46
20,24
52,45
46,47
36,46
81,85
46,47
20,24
93,87
5,87 %

# Executive Summary

## Executive Summary

Governments have a large number of basic data which can be of economic and social value to society as a whole. Along those lines, more and more European countries are developing policies to release this data as Open (Government) Data. Open Data refers to information that can be freely used, modified, and shared by anyone for any purpose. It must be available under an open licence and provided in a convenient and modifiable form that is machine readable.

Within the European Union, key framework conditions for successful Open Data policy making have been set up. In doing so, the European Commission aimed at creating a "data value chain friendly" policy environment. The objective is to put in place the "systemic" prerequisites for effective use and re-use of data through legal and soft law measures.

In 2003, the European Union (EU) adopted legislation to foster the re-use of Open Government Data in Member States via the Public Sector Information (PSI) Directive 2003/98/EC.[II] The main objective was to ensure equal treatment of all potential re-users where the public sector body had released information for re-use. The PSI Directive was subsequently amended in 2013 by Directive 2013/37/EU.[III] With this amendment, the general principle was introduced that all information accessible under Member State legislation is in principle re-usable. Also, administrative charges should in principle no longer exceed the marginal costs of making it available for re-use, excluding charging of the re-user for the production of the information. Re-use of information released for re-use by cultural institutions should also be subject to an obligation of equal treatment of all potential re-users while such institutions could continue to charge re-users in a way allowing them to recover the costs of production of the information.

*"Europe setting up a data value chain friendly environment"*

## Synthèse

Les gouvernements disposent d'un grand nombre de données de base qui peuvent être d'une valeur économique et sociale. Dans ce sens, un nombre croissant d'États européens ont été amenés à développer des politiques visant à publier les données publiques plus systématiquement. Les données ouvertes, ou Open Data en anglais, renvoient à des informations qui peuvent être librement utilisées, modifiées et partagées par toute personne à quelque fin que ce soit. Elles se doivent d'être disponibles sous licence ouverte, dans un format facile d'utilisation et modifiable. Enfin ces données doivent être fournies sous une forme lisible par machine.

Au sein de l'Union européenne, des conditions-cadres essentielles à la réussite de l'élaboration de politiques de données ouvertes ont été mises en place. Pour ce faire, la Commission européenne vise à créer un environnement favorable à l'ensemble de la chaîne de valeur des données. L'objectif est de mettre en place les conditions « systémiques » indispensables pour soutenir la publication et la réutilisation des données publiques. Ces instruments peuvent être autant législatifs que non contraignants.

En 2003, l'Union européenne (UE) a adopté de nouvelles dispositions législatives favorisant la réutilisation de données publiques ouvertes dans les États membres. Il s'agit de la directive sur la réutilisation des informations du secteur public 2003/98/CE.[II] L'objectif principal était d'assurer l'égalité de traitement de tous les réutilisateurs potentiels, dans le cas où, l'organisme de service public concerné publierait des données à des fins de réutilisation. La directive a été modifiée en 2013 par la directive 2013/37/UE.[III] Par cet amendement, le principe général mis en place est que toutes les informations accessibles, en vertu de la législation des États membres, soient en principe réutilisables. En outre, les charges

II http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:345:0090:0096:en:PDF
III http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32013L0037

*"European countries moving forward with Open Data at different speeds"*

The expected impact of the Open Data policies and the development of data portals is to drive economic benefits and further transparency. These benefits have been largely outlined by a number of studies. However, few studies offer aggregate figures covering several different macroeconomic indicators.

Within the context of the launch of the European Data Portal, the European Commission wished to obtain further evidence of the quantitative impact of re-use of Public Data Resources. Thus, the aim of this study is to collect, assess and aggregate all economic evidence to forecast the benefits of the re-use of Open Data for all 28 European Member States and the European Free Trade Association (EFTA) countries (Norway, Iceland, Liechtenstein, Switzerland), further referred to as EU 28+, for the period 2016-2020.

Several benefits of the use of Open Data are identified, and consist of direct and indirect benefits. Direct benefits are monetised benefits that are realised in market transactions in the form of revenues and Gross Value Added (GVA), the number of jobs involved in producing a service or product, and cost savings. Indirect economic benefits are i.e. new goods and services, time savings for users of applications using Open Data, knowledge economy growth, increased efficiency in public services and growth of related markets.

To provide an accurate estimate of the benefits of Open Data, one first needs to look at the Open Data Maturity per country and how this maturity has evolved. There are substantial differences between the EU28+ countries when measuring the progress made so far in terms of Open Data. The first country to have an Open Data portal was Spain in 2009. They are also one of the frontrunners in terms of their Open Data policy. The most recent countries to have launched a portal are Croatia, the Czech Republic, Hungary, and Lithuania in 2015. To take these discrepancies into ac-

administratives devraient, en principe, ne pas dépasser les coûts marginaux de leur mise à disposition en vue de leur réutilisation, et exclure donc, tout frais supplémentaire pour l'usager. La réutilisation des données publiées par les institutions culturelles doit également être soumise à une obligation d'égalité de traitement de tous les réutilisateurs potentiels. De telles institutions pourraient continuer à percevoir des frais qui leur permettraient de couvrir les coûts de production de l'information.
L'impact attendu des politiques de données ouvertes et la mise en place de portails de données est bien entendu économique mais aussi d'accroître la transparence. Ces avantages ont été largement évoqués par un certain nombre d'études. Toutefois, peu d'études proposent des bénéfices chiffrés couvrant plusieurs indicateurs macroéconomiques.

Dans le cadre du lancement du Portail européen de données, l'impact quantitatif de la réutilisation des données ouvertes a été mesuré pour la période 2016-2020. L'objectif de l'étude est de recueillir, analyser et agréger les preuves économiques des avantages de la réutilisation des données publiques au sein de l'UE28+. L'UE28+ comprend les 28 Etats membres de L'UE et les pays de l'Association européenne de libre-échange (AELE) (Norvège, Islande, Liechtenstein, Suisse), ci-après dénommé l'UE28+.

Plusieurs avantages liés à l'utilisation des données ouvertes sont identifiés et consistent à la fois en des avantages directs et indirects. Les avantages directs sont traduits en valeur monétaire et comprennent les transactions effectuées sous forme de recettes et de la valeur ajoutée brute, le nombre d'emplois nécessaires à la réalisation d'un service ou d'un produit, ainsi que les économies de coûts réalisées. Les avantages économiques indirects sont les effets induits du fait de l'utilisation de nouveaux biens et services, les gains de temps pour les usagers d'applications utilisant les données ouvertes, la croissance de

count, a model was developed to classify the maturity of a country with regards to Open Data. Based on the scores on several indicators, countries were compared in terms of their maturity. This resulted in a matrix with different scores per country. A country can be classified as being either a Trend Setter, Follower, Advanced Beginner or Beginner.

The model showed that in 2005, 63% of the Member States could be classified as a Beginner whilst not a single country could be classified as a Trend Setter. These numbers changed substantially over the past 10 years. In 2015, 31% of the countries can be classified as a Trend Setter whereas only 19% is still a Beginner. By 2020 all countries will have a fully operating portal. Additionally, countries will also introduce improvements to increase their Open Data Maturity. Thus by 2020, almost all EU 28+ Member States will have become Trend Setters.

Using the Open Data Maturity model of the EU28+ countries, the market size of Open Data has been calculated. A distinction can be made between the direct market size and the indirect market size. Together they form the total market size for Open Data. For 2016, the direct market size of Open Data is expected to be 55.3 bn EUR for the EU 28+. Between 2016 and 2020, the market size is expected to increase by 36.9%, to a value of 75.7 bn EUR in 2020. The total market value of Open Data is estimated between 193 bn EUR and 209 bn EUR for 2016 with an estimated projection of 265-286 bn EUR for 2020, including inflation corrections. For the period 2016-2020, the cumulative direct market size is estimated at 325 bn EUR. The cumulative total market size for Open Data is forecasted to be between 1,138 and 1,229 bn EUR.

l'économie de la connaissance, le renforcement de l'efficacité des services publics et la croissance des marchés connexes.
Afin de fournir une estimation précise des bénéfices liés à l'ouverture des données, il convient d'abord de se pencher sur la maturité des politiques de « l'Open Data » en Europe. Il existe des différences substantielles entre les 28+ pays de l'UE lorsqu'il s'agit de mesurer les progrès accomplis à ce jour en matière d'ouverture de données. Dès 2009, L'Espagne est le premier pays à lancer un portail de données publiques ouvertes. Les derniers pays à avoir ouvert un portail en 2015 sont la Croatie, la République Tchèque, la Hongrie et la Lituanie. Afin de tenir compte de ces différences, un modèle a été conçu pour classer les pays en fonction de leur maturité « Open Data». Les indicateurs sélectionnés ont donc permis de regrouper les pays en fonction de leur maturité : débutant, débutant avancé, suiveur et précurseur.

Le modèle de maturité « Open Data », a montré qu'en 2005, 63 % des États membres pouvaient être considérés comme des débutants, aucun pays ne faisait office de précurseur. Ces chiffres ont considérablement évolués au cours des 10 dernières années. En 2015, 31 % des pays sont maintenant dits précurseurs contre seulement 19% de débutants. D'ici à 2020, tous les pays bénéficieront d'un portail de données pleinement opérationnel. Par ailleurs, les pays européens mettront également en place des améliorations visant à accroître leur maturité « Open Data ». Ainsi, à l'horizon 2020, la quasi-totalité des 28+ États auront atteint le stade de précurseur.

En se basant sur le modèle de maturité « Open Data », le volume du marché des données ouvertes a été calculé. Il est important de différencier la taille du marché direct de celle du marché indirect. Ensemble, ils constituent la taille totale du marché. Pour l'année 2016, la taille du marché direct des données ouvertes devrait être de 55,3 milliards d'euros pour l'UE28+. Entre 2016 et 2020, la taille du marché direct devrait augmenter de 36,9 %, pour atteindre une valeur

*"Direct market size of Open Data is 55,3 bn EUR for 2016 and expected to grow by 36,9% by 2020 in the EU 28+"*

*"Between 2016 and 2020 25,000 jobs directly related to Open Data will be created "*

Open Data cross-cuts through different sectors of the economy. So next to calculating the overall Open Data market size in 2020, it is interesting to know how large the influence of Open Data will be in specific market sectors. Public administration is by far the sector that will gain the most from opening up data, with a value of 22 bn EUR in 2020. This confirms that the public sector is the first re-user of its own data. For agriculture, and the arts and entertainment sector, the benefits expected are smaller with 379 million EUR each. Open Data still has a lot of potential in these sectors but will take more time to reach the full potential.

de 75,7 milliards d'euros en 2020. La valeur totale de marché des données ouvertes, quant à elle, est estimée entre 193 milliards d'euros et 209 milliards d'euros pour 2016. D'ici à 2020, le marché total des données ouvertes s'établirait entre 265-286 milliards d'euros, après correction de l'inflation. Pour la période 2016-2020, le marché direct cumulé des données publiques ouvertes est de 325 milliards d'euros. Pour la même période, the marché cumulé total, direct et indirect, serait donc compris entre 1,138 et 1,229 milliards d'euros.

Les données ouvertes recoupent différents secteurs de l'économie. Il est donc

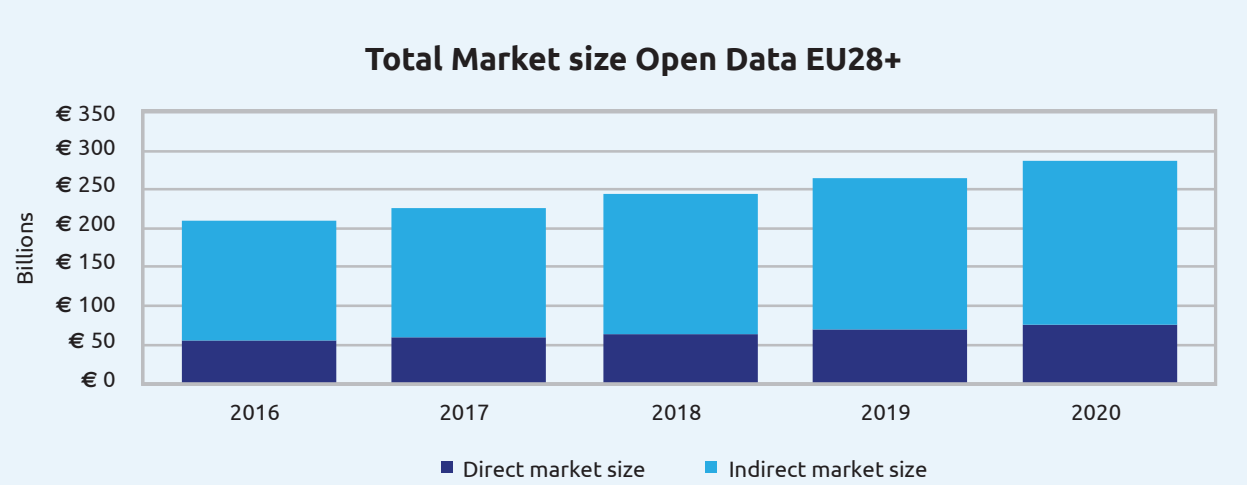



*Figure 1 – Total market size (high bound), split in direct and indirect size for EU28+in billions, 2016-2020*
*Figure 1 - Marché total (fourchette haute), direct et indirect pour l'UE28+ en milliards, 2016-2020*

The metric for the number of jobs aims at determining how many jobs will be created in the EU 28+ private sector that will be directly linked to the re-use of Open Data. This thus excludes staff working in public statistical offices and other government administrations. The forecasted total number of direct Open Data jobs in 2016 has an upper bound of 75,000 jobs. By 2020, the upper bound provides a forecast of just under 100,000 direct jobs directly related to Open Data jobs. This equals a growth

tout à fait pertinent de considérer la valeur des données ouvertes par secteur. L'administration publique est de loin le secteur qui profitera le plus de l'ouverture des données, avec un gain attendu de 22 milliards d'euros en 2020. Cela confirme que le secteur public est bien le premier ré-utilisateur de ses propres données. Dans les secteurs de l'agriculture, de l'industrie du spectacle et les arts, les bénéfices attendus sont moindres, avec une chiffre d'affaire de 379 millions d'euros pour chacun de ces

of 32% over a 5-year period. Per year, the increase in number of jobs is forecasted to grow at an average rate of 7.3%. Thus, in the period 2016-2020, almost 25,000 direct Open Data jobs are created.

secteurs. Ces secteurs étant moins matures en termes d'Open Data, l'exploitation des données ouvertes n'en est qu'à ses débuts. En ce qui concerne le nombre d'emplois créés, l'indicateur vise à mesurer les emplois nouvellement créés dans le secteur privé

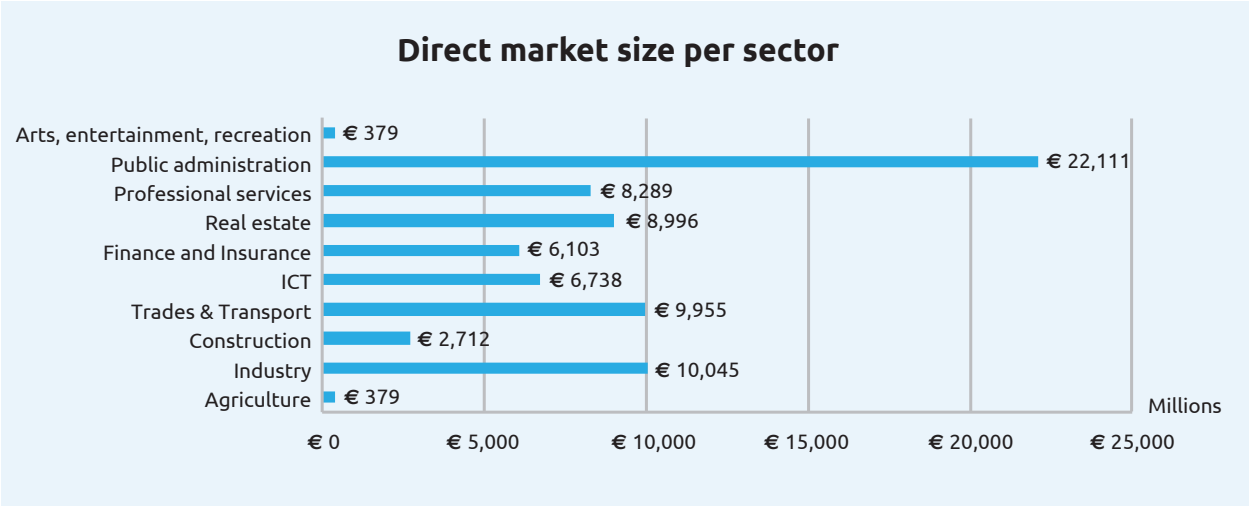



*Figure 2 – Direct market size of Open Data per market sector for EU28+ in millions, 2020*
*Figure 2 - Volume du marché direct des données ouvertes réparties par secteur de l'économie pour l'UE28+ en millions, 2020*

Public administrations seek to further understand the cost savings they can realise thanks to Open Data. Based on the forecasted EU28+ GDP for 2020, whilst taking into account the countries' respective government expenditure averages, the cost savings per country can be calculated. The accumulated cost savings for the EU28+ in 2020 are forecasted to equal 1.7 bn EUR.

The metric efficiency gains has a more qualitative approach compared to the other three metrics. It offers a combination of the insights around the efficiency gains of Open Data and real-life examples. Efficiency is an important factor in all administrations and companies and across all sectors. The aim of efficiency is to improve resource allocation so that waste is minimized and the outcome value is maximised, given the same amount of resources. Three exemplar indicators are assessed in more detail: how Open Data can save lives, how it can be used to save time and how

et qui sont directement liés à la réutilisation des données ouvertes. Cet indicateur exclut donc les personnels travaillant dans les bureaux statistiques et autres administrations publiques. Selon les prévisions, en 2016, le nombre total d'emplois directs liés à la réutilisation des données ouvertes est estimé à 75,000 emplois, en prenant la fourchette haute. D'ici à 2020, la fourchette haute offrirait une prévision d'un peu moins de 100,000 emplois, à nouveau directement liés à la réutilisation des données ouvertes. Cela équivaut à une croissance de 32 % sur une période de 5 ans. Par an, la hausse du nombre d'emplois devrait croître à un taux de 7,3 %. Ainsi, pour la période 2016-2020, près 25,000 emplois vont être créés.

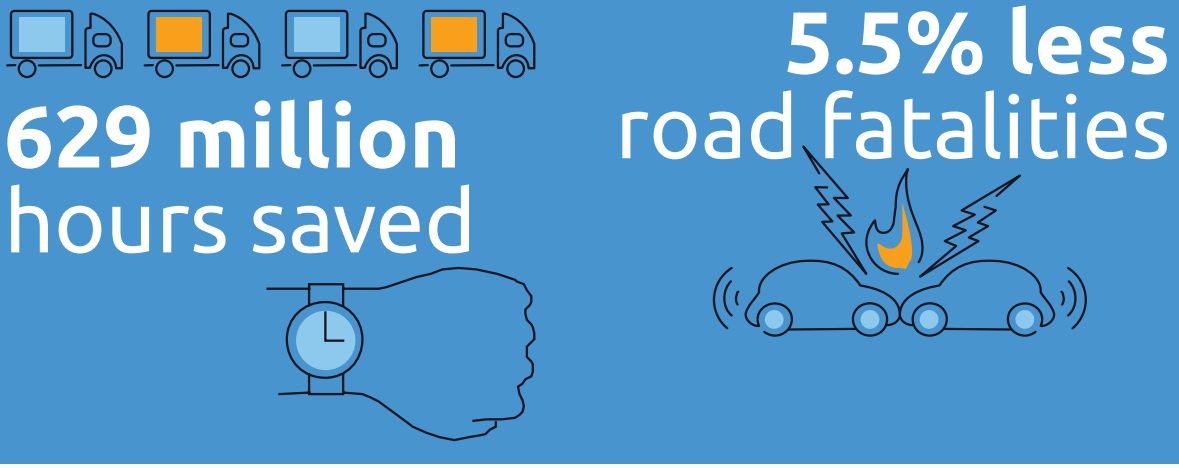
En complément, Les administrations publiques cherchent à mieux comprendre comment rationaliser leurs coûts grâce à l'utilisation des données ouvertes. Les économies potentielles peuvent être calculées en se basant sur le PIB de l'UE28+

Open Data helps achieve environmental benefits. It is shown that Open Data has the potential of saving 1,425 lives a year (i.e. 5,5% of the European road fatalities). Furthermore, applying Open Data in traffic can save 629 million hours of unnecessary waiting time on the road in the EU.
In conducting the macroeconomic analysis of the impact of the re-use of Open Data for Europe, several observations are made. The majority of studies performed previously are ex-ante estimations. These are mostly established on the basis of surveys or indirect research and provide for a wide range of different calculations. No comprehensive and detailed ex-post evaluations of the materialised costs and benefits of Open Data are available.

Now that governments have defined Open Data policies, the success of these initiatives should be measured. To do so, a series of recommendations are put forward to help governments keep track of the direct and indirect benefits of their policies. This is key in further accelerating the publishing of Open Data and encouraging its re-use.

pour 2020, tout en prenant en compte le pourcentage respectif de PIB que représentent les dépenses publiques au niveau national. Les économies, en matière de coûts, réalisées par l'UE28+ en 2020 devraient être de 1,7 milliards d'euros.
Par rapport aux trois indicateurs précédents, une approche plus qualitative est suivie afin de mesurer les gains d'efficacité. Ces gains sont abordés sous la forme d'une étude de cas et offrent des exemples concrets d'application des données ouvertes. L'efficacité est un facteur important pour toutes les administrations et entreprises, tous secteurs confondus. L'objectif est d'améliorer l'efficacité de l'attribution des ressources, de sorte que les pertes soient réduites au minimum et de maximiser la valeur, tout en utilisant la même quantité de ressources. Trois études de cas sont examinées plus en détail: comment les données ouvertes peuvent-elles sauver des vies, comment est-il possible d'utiliser les données ouvertes pour gagner du temps et enfin comment les données ouvertes contribuent au développement durable et à la préservation de l'environnement. Il est démontré que l'ouverture des données représente le potentiel de sauver 1,425 vies par an (soit 5,5 % des décès dus aux accidents de la route en Europe). En outre, l'application des données ouvertes dans le contexte de la circulation routière peut contribuer à faire économiser 629 millions d'heures de temps d'attente inutile sur les routes de l'UE.

En menant cette étude sur l'analyse macroéconomique des effets de la réutilisation des don-



Several recommendations are made along those lines:

- The costs and benefits of releasing data should be further detailed.
- A marginal or free cost model for Open Data is needed.
- Government Portals should maintain site analytics in order to obtain important information on who uses the websites, which data sets are being downloaded and how many downloads take place.
- On Open Data portals, feedback mechanisms should be created.
- Governments should conduct surveys into the re-use of Open Data in the private sector.
- The work force should be empowered to make the most of Open Data.

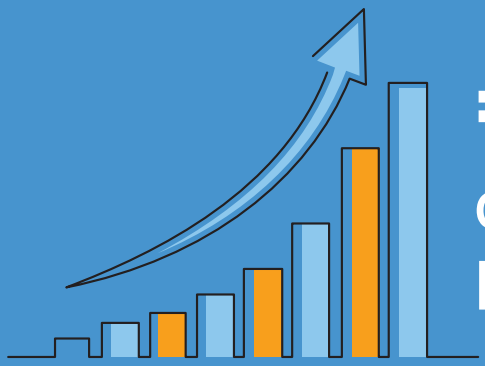
nées ouvertes pour l'Europe, plusieurs constatations méritent d'être soulignées. La majorité des études réalisées précédemment offrent des estimations ex ante. Ces dernières sont pour la plupart établies sur la base d'enquêtes ou de recherche indirecte et offrent un large éventail de méthodes et calculs. Aucune évaluation ex-post complète et détaillée des coûts et bénéfices de la publication de données ouvertes par les administrations publiques n'a été réalisée à ce jour.

Alors que les différents gouvernements ont mis en place des politiques soutenant l'ouverture des données publiques, le succès de ces initiatives doit être évalué plus en détail. Pour ce faire, une série de recommandations est formulée, visant à aider les gouvernements à suivre les avantages directs et indirects de leurs politiques « Open Data ». Cette étape est essentielle pour accélérer encore la publication de données ouvertes et à encourager leur réutilisation.

Plusieurs recommandations sont formulées dans ce sens:

- Les coûts et avantages de la publication de données devraient être plus détaillés.
- Un modèle de coût marginal ou entièrement gratuit devrait être mis en place.
- Les Portails de données ouvertes devraient comporter systématiquement une analyse de leur fréquentation, aussi appelée analyse audience internet. Cela permettrait d'obtenir des informations importantes sur le comportement des visiteurs : quelles données sont les plus fréquemment téléchargées, combien de téléchargement ont lieu, etc.
- Sur les Portails de données ouvertes, les mécanismes de retour d'information doivent également être mis en place.
- Les gouvernements devraient mener des enquêtes sur la réutilisation des données ouvertes par le secteur privé.
- Les fonctionnaires et la main main-d'œuvre en général devraient être habilités à tirer le meilleur parti des données ouvertes.

*"Governments can accelerate their Open Data journey by measuring the success of their Open Data initiatives"*



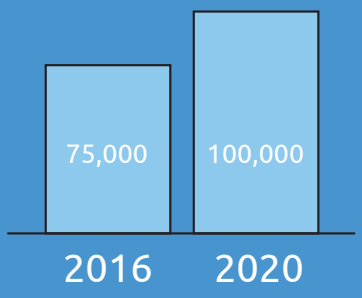
# € 325 billion

direct market size
EU28+ for 2016-2020

# 25,000

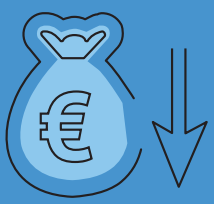
jobs created

## Open Data jobs




# € 1.7 bn

government
cost savings

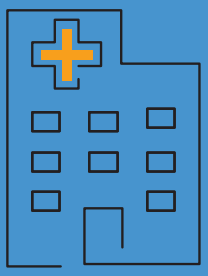


more Open Data can help make

# better decisions

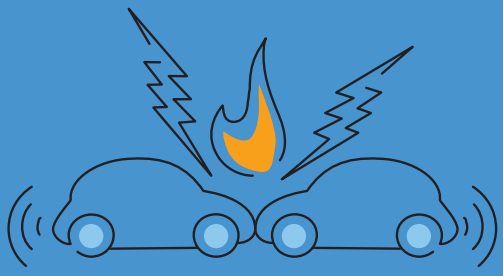
## 7,000 lives

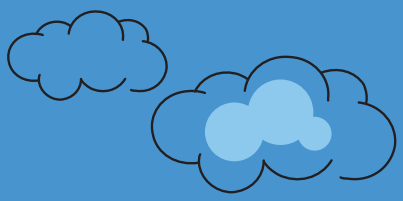
saved due to quicker response



## 5.5% less

road fatalities





Congestion

# costs are 1% of GDP

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# 1 Introduction

*"The digital economy revolves around data. It is the driving force behind those three main elements of productivity, innovation and digitalisation. Let's not lose time being afraid - let's build an open and vibrant data economy."*

*Andrus Ansip, Vice-President Digital Single Market* [1]

1 See https://ec.europa.eu/commission/2014-2019/ansip/announcements/speech-vice-president-ansip-bruegel-annual-meeting-productivity-innovation-and-digitalisation-which_en

1

# Introduction

## 1.1 The European Data Portal

Compared to other regions across the globe, the European Union (EU) Member States are generally characterized by an above-average participation of the public sector in the national economies, with common estimates of the public sector's stake in national GDPs ranging from 25% to 50% of their respective economies, depending on the country and on the metrics used.[2] As a result, European administrations generally invest a significant budget in the creation of Public Sector Information (PSI), or Open Data. This information has a potential economic value that significantly exceeds its strict public sector utility.

*"The desire to realise the potential economic value of PSI is not new"*

The desire to realise the potential economic value of PSI is not new, neither at the national level, nor at the EU level. In the past, various Member States had already implemented legislation favouring open access / freedom of information rights, and permitted re-use of PSI to a certain extent. However, the nature and scope of these laws differed significantly: the scope of the information that could be requested varied from country to country, with different exemptions in each country. Some countries described re-use limitations in their national laws, whereas others did not describe any exact rules. Compensation schemes could also differ, ranging from free use to paid licensing. Some data sets could also be made subject to competitive restrictions where data would only be made available to a limited number of government partners (up to and including the granting of monopolies). The fragmented policy landscape was harmful to the development of the European internal market, as aspiring re-users would need to assess on a country per country, case by case basis what information was available. Recognizing the significant economic potential that could be unlocked in the EU through a more proactive policy approach, subsequent actions have gradually expanded the scope of the EU's intervention, in order to create a well-functioning Open Data Economy, as a part of the EU's general ambition of creating a Digital Single Market.

From a legal perspective, the adoption of the PSI Directive (in 2003,[3] amended in 2013[4]) has to some extent harmonized national rules on PSI reuse, thus creating a more even landscape. Thus, significant work has been done already in encouraging the development of a healthy Open Data ecosystem in the EU.[5]

One of the key requirements for a healthy Open Data ecosystem is still missing: the deployment of a pan-European data portal infrastructure, aggregating metadata records of public data resources from all over Europe, and driving alignment with respect to data formats, metadata information, as well as the availability of metadata information in more than just the original language.

Along these lines, the European Commission, in the framework of its Connecting Europe Facility (CEF) programme, launched the European Data Portal[6] project in December 2014.

2 See http://ec.europa.eu/enterprise/policies/innovation/files/epsis-2013_en.pdf, notably p.11-13
3 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:345:0090:0096:en:PDF
4 http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32013L0037
5 See the national overviews on https://ec.europa.eu/digital-agenda/en/implementation-public-sector-information-directive-member-states
6 Swww.europeandataportal.eu

The project consists of three parts:

- Deploying a Pan-European Data portal;
- Fostering the uptake on the supply side of public data resources;
- Fostering the uptake on re-use of public data resources.

One of the objectives of the latter part of the project is to perform a macroeconomic analysis of the impact of the re-use of Open Data.

### 1.2 Objective of this study

More and more countries are developing policies in the field of Open Data. The expected impact of these policies, in line with broader innovation policies and strategies, is to drive monetary benefits and further transparency. These can be realised thanks to the development of innovative services and / or in realising economies of scale. Moreover, data has a marginal cost of zero, thus the re-use is likely to generate benefits.

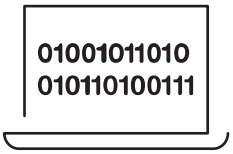
The benefits of Open Data have been largely outlined by a number of studies. However, few studies offer aggregate figures covering several different macroeconomic indicators. Within the context of the launch of the European Data Portal, the European Commission wished to obtain further evidence of the quantitative impact of re-use of Public Data Resources.

The aim of this study is to collect, assess and aggregate all economic evidence to forecast the benefits of the re-use of Open Data for all 28 European Member States and the European Free Trade Association (EFTA) countries (Norway, Iceland, Liechtenstein, Switzerland), further referred to as EU 28+, for the period 2016-2020. The production of macroeconomic indicators and their calculations will be further presented within the report.
The economic impact of Open Data will be assessed using the market size of Open Data in euro and percentage of Gross Domestic Product (GDP), the number of jobs created through the availability of Open Data, the cost savings that can be reached in the public sector and efficiency gains for individual citizens (everyone).

### 1.3 Definitions

Understanding the economic value of Open Data requires an initial understanding of the different characteristics and semantics. Different terms and notions are used to refer to public data resources. The most commonly used are Open Data, Public Sector Information and Open Government Data.

***Open Data*** refers to the information that can be freely used, modified, and shared




by anyone for any purpose. It must be available under an open licence and provided in a convenient and modifiable form that is machine readable. An open licence might say that people who use the data must credit whoever is publishing it (this is called attribution). It can also say that people who mix the data with other data have to release the results as Open Data as well (this is called share-alike). These principles for Open Data are described in more detail in the Open Definition.[7]

***Public Sector Information*** (PSI) is information collected by the public sector. The definition according to the OECD is that PSI is generated, created, collected, processed, preserved, maintained, disseminated, or funded by or for the Government or public institution.[8] It is also information that is dynamic and continually generated and readily usable in commercial applications. The European Directive on the re-use of

7 http://opendefinition.org/
8 OECD (2006), p. 8

PSI provides a common legal framework for a European market for government-held data (e.g. PSI).[9] It is built around the key pillars of the internal market: free flow of data, transparency and fair competition.

***Open Data is a sub-set of the commonly used term Big Data***, which is a popular term to describe any collection of large information sets. The definition of Big Data as provided by Gartner is "Big Data is high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making".[10]

The definitions of Open Data, Public Sector Information and Big Data show a large overlap. This overlap is also shown in Figure 3. The part where Public Sector Information is also open is commonly defined as Open Government Data.

***Open Government Data*** is a subset of Public Sector Information as well as Open Data.[11] Open Government Data can also be a subset of Big Data.

An example where PSI, Big Data and Open Data overlap, is in large public government data sets, for example weather or health data. When only Open Data and Big Data overlap, one could think of large data sets from scientific research or social media. Where Open Data does not overlap with PSI or Big Data, this usually entails business reporting or business data (e.g. customer complaints).

In the context of this study, the intention is to measure the impact of the re-use of public data resources in the public and private realm, including geospatial data. Hereafter public data resources which entail both Open Data and Public Sector Information will be referred to as Open Data (visualised as the dark orange field in Figure 3). In general, the specific scope used within the EU Open Data Portal project is data published by public administrations or on their behalf. The focus is not on community data.

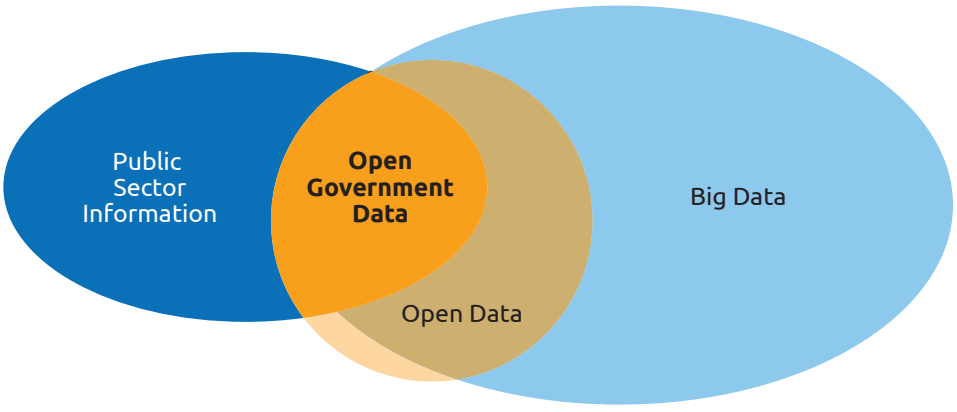
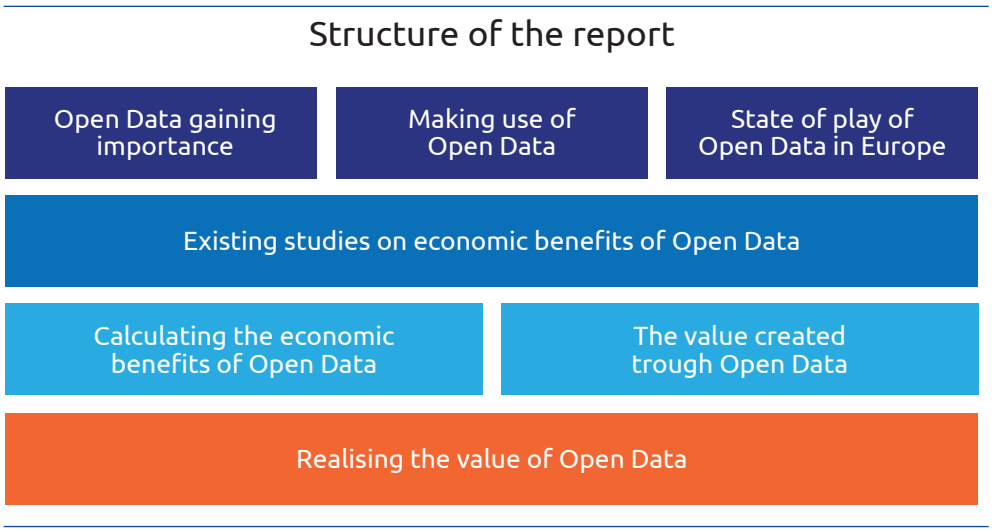



*Figure 3 – Boundaries of Open Data and Public Sector Information*

9 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:345:0090:0096:EN:PDF
10 http://www.gartner.com/it-glossary/big-data
11 http://opendatahandbook.org/glossary/is/

### 1.4 Overall structure of the study

This study provides an assessment of the potential macroeconomic impact of the re-use of public data resources using a model-based assessment. It consists of four main parts. The first part contains a description of the global context on the emergence of Open Data (Chapter 2) and the use that is being made of Open Data (Chapter 3). This part also looks at the EU state of play with regards to Open Data (Chapter 4). The second part of this study offers an overview of the different studies that are done so far in the field of quantifying the benefits of Open Data (Chapter 5). The third part sets out the approach taken (Chapter 6). Then, the results of this study are presented in the form of macroeconomic calculations (Chapter 7). Finally, the last part focuses on how the benefits of Open Data can be realized (Chapter 8).



2

# Open Data gaining importance

This chapter sets out the general context of Open Data with regards to its emergence and relevance. The emergence of Open Data will be described from a global perspective. The first part describes how Open Data came to play a growing role on the governmental agenda and the second part is focused on the creation of a European framework around Public Sector Information.

## 2.1 Government regulation moving towards Open Data

Open Data has gained a very prominent role in today's society. People increasingly rely – often even while they are unaware of it – on Open Data in their everyday lives. Today's technology allows for a new way to provide basic data. Applications on smart phones for weather forecasts, navigation, restaurant finders and the like are made based on Open Data. Governments have a huge number of basic data which can be of economic and social value to society as a whole.[12] Open Data bridges the gap between government and citizens in terms of information. As Pollock rightly states 'the supply of basic information 'structure' has become essential to the information economy of the 21st century'. [13]

The increase of information sharing via the internet contributed to a political focus on this development leading towards the introduction of the European PSI Directive in 2003. In the second half of the last decade, civil society – relying on the Freedom of Information right – had for several years been putting pressure on governments to systematically make government data available in machine-readable formats. A machine-readable format is data (or metadata) which is in a format that can be accessed and processed by a computer. Freedom of Information laws allow access by the general public to certain types of data held by national governments.

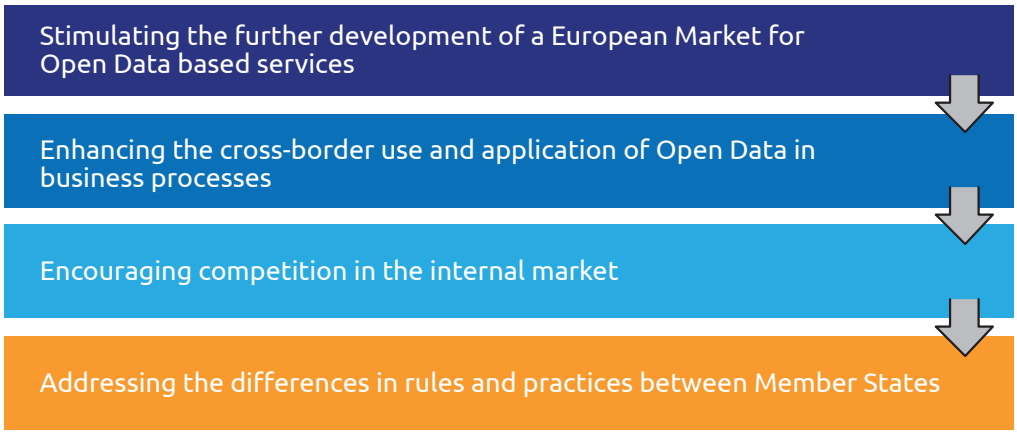
Open Data can be seen as an important part in strengthening citizen right, as it will make it much easier to obtain access to the information you want when it is already available online for free. As a result of the release of more data, grassroots initiatives such as TheyWorkForYou in the UK[14] – which tracks the activities and initiatives of members of UK's Parliaments and assemblies – and the equivalent at US level GovTrackUs[15] – which tracks the bills and activities of US Congress members – emerged. These initiatives contributed to bringing further transparency to the democratic process.

## 2.2 Introduction of the European PSI Directive

Since 1998, the European Commission has formulated an Open Data Policy via a Green Paper on Open Data.[16] Based on an assessment of the state of play of Open Data in the EU Member States and the situation in the United States (US), the fundamental role of Open Data was acknowledged for the proper functioning of the European internal market. The initial objective set out in this Green Paper was to make information which is already available more clear and easily accessible via electronic media. This set the grounds for further debates at European level regarding Open Data.

12 Uhlir, P. (2009), p. 3
13 Pollock, R. (2009), p. 2
14 http://www.theyworkforyou.com/
15 https://www.govtrack.us/
16 European Commission (1998)

In 2003, the EU issued legislation to govern the publication of Open Government Data in Member States via the so-called Public Sector Information (PSI) Directive 2003/98/EC.[17] The main objective was to enable better access to Open Data by:




The European PSI Directive was established on a minimum harmonisation basis allowing Member States leeway in the interpretation and implementation of the framework. The European Directive established framework[18] rules regarding availability, accessibility and transparency of Open Data in Europe. In addition, it was recommended to have a standard electronic licence for the re-use of Open Data and to have a tool to find the relevant data sets via a list of portal websites. As for the payment regime, the European Directive stated that it does not prevent differentiated charging policies.[19] Recital 15 indicated that "...the Member States should encourage public sector bodies to make documents available at charges that do not exceed the marginal costs for reproducing and disseminating the documents". Nevertheless, in the European Directive itself, Member States are allowed to apply charging mechanisms which should not exceed the production and distribution plus a reasonable return on investments. As a result, different regimes have been established from full cost recovery, via partial cost recovery, to a marginal cost model.[20]

The upswing of Open Data has particularly gained momentum at the beginning of the 21st century as politicians in the US and UK, mainly, became aware of the need to improve access to basic government data. Specific initiatives followed suit, such as the UK Power of Information report [21] and the Open Government Directive from American president Obama, established on his first day in office in 2009 stating that there is a need to "create an unprecedented level of openness in Government".[22] Following this, two important milestones were launched: a data portal called data.gov was established in the US in May 2009 and its equivalent in the United Kingdom (UK), data.gov.uk, in January 2010.

These initiatives have set a process in motion towards more political awareness not only among national public authorities, but also at the World Bank and the Organisation for Economic Co-operation and Devel-

17 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:345:0090:0096:en:PDF
18 Art. 1 of Directive 2003/98/EC
19 Recital 19 of Directive 2003/93/EC
20 Vries et al. (2011), p. 23
21 Mayo and Steinberg (2007)
22 https://www.whitehouse.gov/open

opment (OECD). Governments around the world are making political statements and commitments towards an open government and Open Data. In 2011, an international platform called Open Government Partnership was created to improve the quality of public services via Open Data to become more transparent, accountable and responsive to citizens.[23] Ever since, one can discern an increase in the number of national and sub-national Open Data portals, digital and eGovernment strategies and open government declarations around the world.

The UK and Spain set the example for many European countries towards opening up government data via data portals. Others followed, like Norway, France, Italy and Estonia. The approaches taken to publish Open Data to citizens differ. Two main streams can be observed: firstly, the approach whereby the access to and re-use of Open Data is unrestricted and on a free or marginal cost basis which is mainly used in US, Canada and Australia, the so-called open access model. The second approach allows public sector bodies to charge costs for the access and re-use of Open Data which was applied by many European countries. The charging for data is still a lively topic, but this will be discussed in more detail in Chapter 4.2.

*"The need to improve access to basic government data"*

This chapter focused on the growing influence of Open Data on a global level. The historical perspective of Open Data legislation was discussed as well as the introduction of the European PSI Directive. The next chapter will further focus on how Open Data can be re-used, and what impact this re-use generates.

23 http://www.opengovpartnership.org/about/mission-and-goals

3

# Making use of Open Data

This chapter explores in which ways Open Data is re-used. The Data Value Chain can serve as a basis to understand different types of re-use. Data domains that are recognized as having the highest commercial value are equally discussed before exploring the direct and indirect benefits of Open Data. Finally Data driven innovation is discussed.

The policy changes around Open Data and the fact that more data sets become available created a gradual upsurge of the application and re-use of Open Data. More companies, and to a limited extent SMEs, started using Open Data as (one of their) raw materials.[24] The possibilities of re-using Open Data have such a potential that Big and Open Data are considered together with ICT as this era's 'general purpose technologies'.[25] This type of technology is an invention that forms a prerequisite for other inventions and imposes a substantial and long term impact on wealth and quality of life. They have potential uses in the economy, room for cost cutting technological improvement and are complementary to other innovations. One of the many questions evolving around Open Data is: what kind of Open Data is available, where can it bring value and what kind of products and services can be produced?

## 3.1 Data Value Chain

Open Data is, in the context of this study, information that can be freely used, modified, and shared by anyone for any pur-

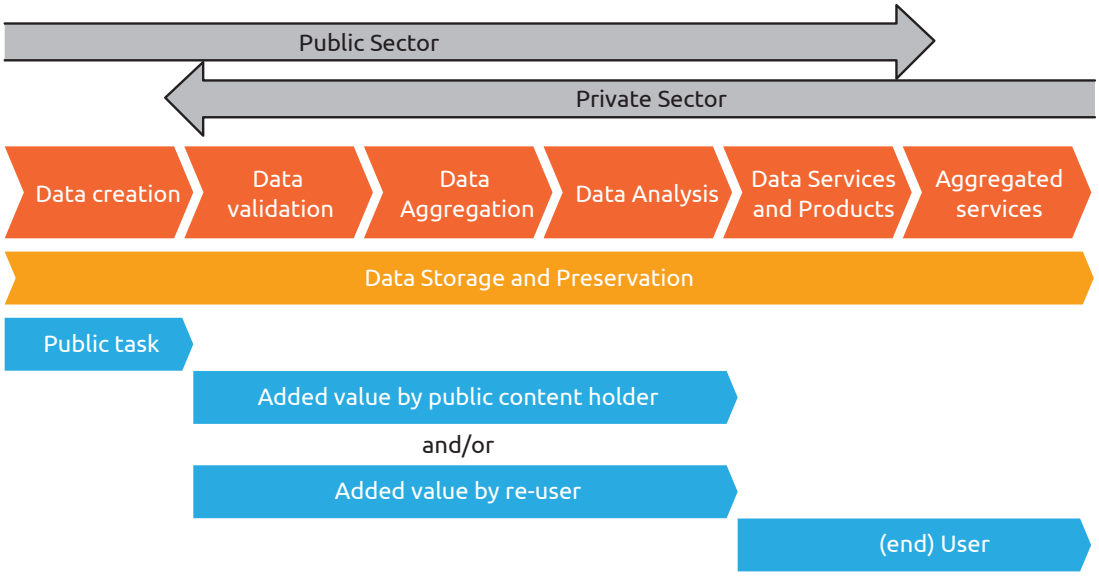



*Figure 4 - Open Data Value Chain*[26]

24 http://cordis.europa.eu/fp7/ict/content-knowledge/docs/open-data-re-use-incubator4-3-a.pdf
25 DemosEurope & WISE (2014), p. 8.
26 Capgemini Consulting, based on: MEPSIR (2006), p. 46 and http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=3488

pose. It must be available under an open licence and provided in a convenient and modifiable form that is machine readable. To create value from Open Data; the first step is for data to be created. The next steps, in which Open Data is processed, are described in the Open Data value chain as shown Figure 4.

Within the Data Value Chain, data needs to be validated after it is collected or created. After these first steps, the data is aggregated. When the data is released via a portal or bought by a private company, it can be analysed. Analyzing the data will make it possible to combine different information or make visualizations. This will lead to the creation of data services and products. These services can be aggregated one step further. During this entire process, data needs to be stored and preserved. This can be done by different individuals or departments, but also by centralizing the data in a separate department.

Often, Open Data is thought of as unprocessed raw public data that is easy to transfer and re-use by the private sector. However, this is an oversimplification according to Pénin. Open Data exists in many forms and degrees.[27] Three forms of Open Data can be distinguished and are related to the Data Value chain:

- Raw data corresponds to quantities or other quantitative or qualitative attributes derived from observation, experiment, measurement or computation. The data are not structured, contextualised nor commented.
- Information corresponds to a set of contextualised and structured data, the producer's intention being to make them meaningful.
- Knowledge corresponds to cognitive appropriation of the information by an individual who organises, synthesises and/or summarises it to make it more readily understandable.

Within the Data Value Chain, several archetypes are distinguished by the World Bank,[28] both in the public and the private sector. Data creation is done by the *Suppliers*. The organisations that collect and aggregate the Open Data are called the *Aggregators*. Individuals or companies that analyse the data and create services and products can be divided into *Developers* and *Enrichers*.

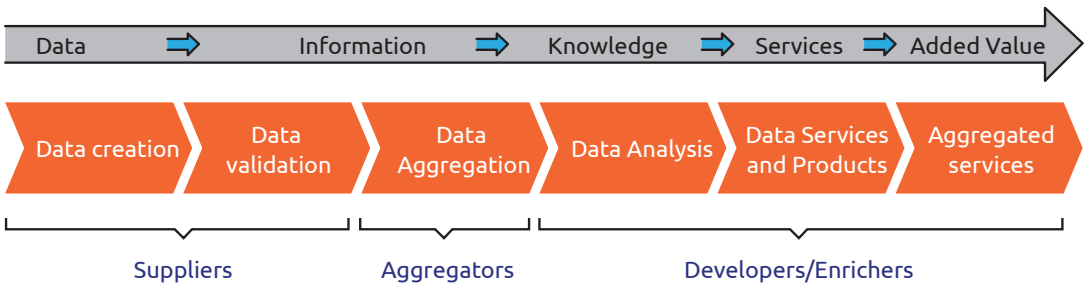



*Figure 5 - Data Value Chain Archetypes*

27 Pénin, J. (2011), p. 2
28 http://www.worldbank.org/content/dam/Worldbank/document/Open-Data-for-Economic-Growth.pdf

Developers are organisations and individual developers who design, build and sell web or smart phone applications to deliver government Open Data to customers (normally in the private sector) in attractive and informative ways, sometimes in competition with "official" applications.

Enrichers are organisations which use Open Data to gain new or better insights that they can deliver in services or products to their customers – often completely new services which could not exist without Open Data.

The last archetype are the *Enablers*, which provide platform and technologies that other businesses and individuals use. They are a vital part of the Open Data Value Chain – while being revenue generating themselves, they also provide cost-effective and easy-to-access services for both data suppliers and data consumers.

The Data Value Chain shows the potential value that can be reached by making Open Data available for re-use. Ideally, public bodies make their Open Data available for free, so no payment is received. However, both the public and / or the private sector create data services and goods, as well as aggregated services for (end) users. The products and services that can be made out of Open Data are manifold. For these services and products, a payment is received. In this way, value is created by making use of Open Data. The aim of this study is to collect evidence to forecast the size of this value.

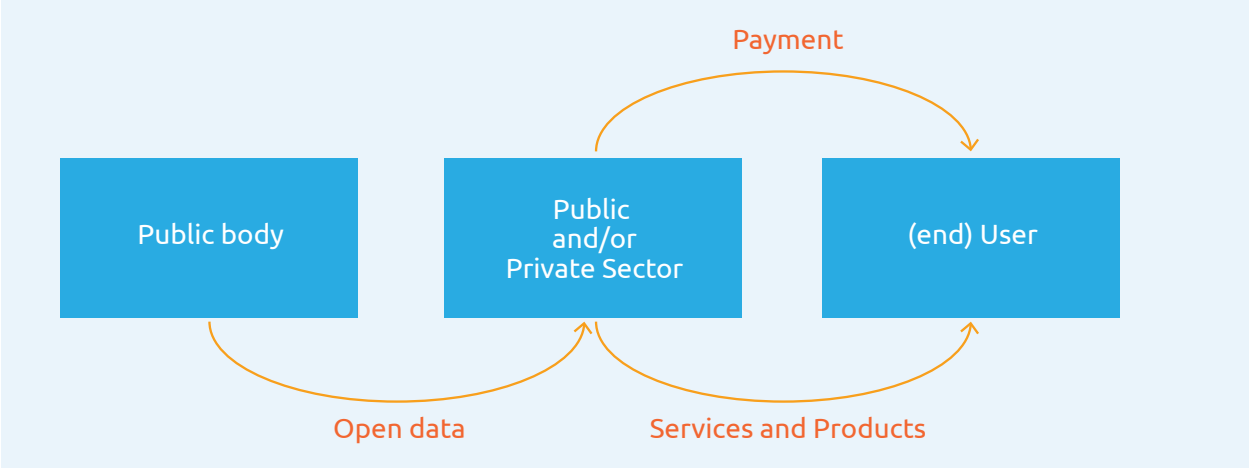



*Figure 6 – Payments within the Data Value Chain* [29]

29 Capgemini Consulting, based on: MEPSIR (2006), p. 46

Open Data can be used for numerous different purposes. The products and services can originate from the public and the private sector, as well as from the non-profit sector. Examples of public sector Open Data initiatives are 'Lexbase', and 'Where do I live'.

**Lexbase** [30]
Lexbase is a web service that provides public information from Swedish courts and other authorities. On the website judgments in criminal and civil cases concerning individuals and companies can be found. The database is updated with new judgments and decisions every day. The website is used to provide citizens with information about the criminality in different areas, e.g. their neighbourhood.

**Where do I live** [31]
Where do I live is a Lithuanian tool that provides Lithuanian citizens with information about their neighbourhood in terms of pollution, noise, crime levels, housing prices, schools, kindergarten, average estate and utility costs.

Beside the public sector initiatives, also a lot of examples of a private good or service based on Open Data exist. Two examples are the 'Diabetes Risk Checker' and the 'Res I STHLM'.

**Diabetes Risk Checker** [32]
The Diabetes Risk Checker which is developed by UK doctors and academics. It indicates a citizen's risk of developing type-2 diabetes in the next ten years by asking a series of simple questions. Being able to predict if citizens are at risk of diabetes should lead to a change in behaviour.

**Res I STHLM** [33]
Aimed at simplifying citizen's travelling in Stockholm (Sweden), the application Res I STHLM was developed. Available for IOS and Android, this application collects public transport information to provide users with planning their journey in Stockholm. The app uses timetables and disturbance information from Stockholm Public Transport. By specifying from and to where you want to travel within the Stockholm region, you get proposals for journeys including the subway, commuter trains, local trains, buses and boats among others.

30 https://www.lexbase.se/
31 www.kurgyvenu.lt
32 http://diabetesriskchecker.com/
33 http://sthlmtraveling.se/

The non-profit sector also uses Open Data to create services to, for example, better monitor political activity.[34] Multiple examples exist of such initiatives, like the 'Major Projects Authority' and 'NosDéputés.fr'.

**Major Projects Authority** [35]

Before 2010, two thirds of the major projects in the UK ran over time and over budget. Some major projects had no clear senior responsible owner, unclear accountability to ministers and Parliament, and poor information on the delivery of that project. Now a project delivery function is introduced with central leadership and oversight provided by the Major Projects Authority. It is driving forward a culture of better management information with clear lines of accountability. It's the approach that is being put to work across the government's £488 billion (€691 billion) major projects portfolio. Last year better project management saved the taxpayer £3.3 billion (€4.7 billion).

**NosDéputés.fr** [36]

NosDéputés.fr is a site that seeks to enhance the parliamentary activities of Members of the French National Assembly. By synthesizing the various legislative and supervisory activities of the elected government of the nation, the site tries to give citizens new tools to understand and analyze the work of their representatives.

## 3.2 High value data domains

As demonstrated briefly in the previous section, there are many possibilities for the re-use of Open Data. Nevertheless, not all data sets have been considered as having the same potential for re-use. Data sets can be categorized into different data domains, from two different perspectives: a government perspective or a user perspective. For example, the European Commission named five priority domains for release.[37] Yet, the G8 created a charter including fourteen domains.[38] Another study, the Lateral Economics & Omidyar Network used the G20 Agenda Items for the Brisbane meeting in 2014 to identify domains,[39] whereas the MEPSIR study has defined six main domains.[40] There is thus no ultimate way of classifying Open Data, as data is produced and collected throughout all functions of government.

Not every data domain has access to information of the same economic potential. The OECD (2006) report used a sliding scale to indicate the commercialisation potential for categorising Open Data, as is shown in Figure 7.

The domains on top of Figure 7 are recognized as having the highest commercial value. Numerous services and products based on data sets from these domains are already commercially available. On the lower domains, Open Data is already available. However, not always commercial services and products exist for these domains.

34 Granickas, K (2013), p. 19
35 https://www.gov.uk/government/speeches/future-of-public-services-reform-matthew-hancock-speech
36 http://www.nosdeputes.fr/
37 https://ec.europa.eu/digital-agenda/en/news/commission-notice-guidelines-recommended-standard-licences-datasets-and-charging-re-use
38 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/207772/Open_Data_Charter.pdf
39 Lateral Economics & Omidyar Network (2014)
40 MEPSIR, 2006

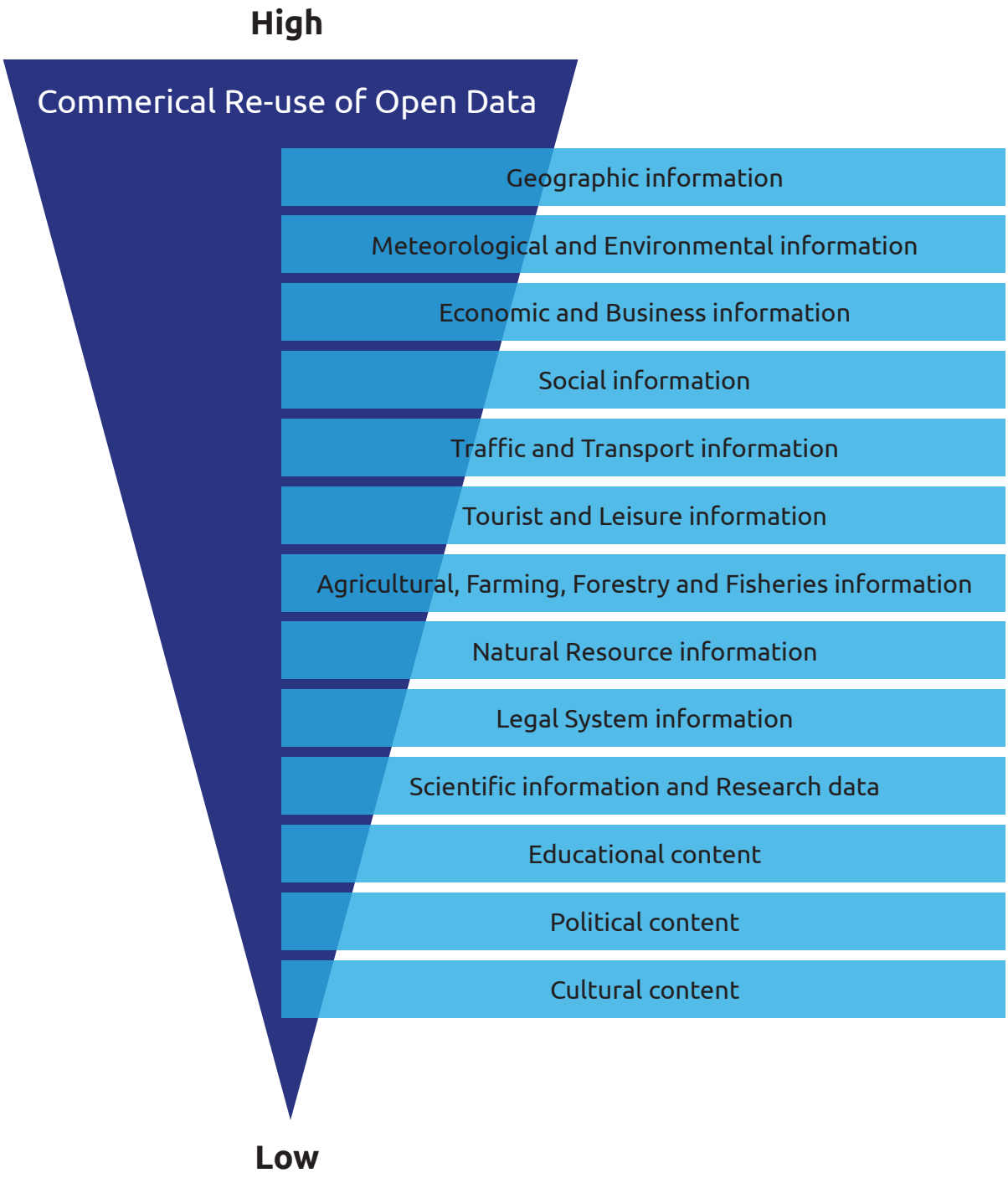



*Figure 7 – PSI and public content domains* [41]

41 OECD (2006)

**BlindSquare** [42]
In Finland an application was developed using a data-driven approach. It is aimed at people that are blind or visually impaired. It describes the environment, announces points of interest and street intersections as you travel. All functions can be accessed through an audio menu to allow navigation and it is possible to add your favourite destinations as well.

Geographic information is recognized as the domain with the highest commercial value and can be used in all the other thirteen different data categories using maps to create visualisations. The cultural domain is a very specific category where it is easy to understand the content. Yet, so far the cultural content seems to be the most difficult to commercialize, despite recent efforts to promote cultural aspects. It is possible to list all cultural activities in a region to bring information from multiple sources together, but it will not necessarily generate revenue.

**Open Data Paris** [43]
In Paris, having a coffee (or 'café') is part of the citizens' culture. The café culture in France goes back centuries, cafes have always been a gathering place for intellectuals to meet and debate philosophical issues. A dataset is created that lists all cafés in which a cup of coffee costs only €1,-.

**Curtain Up!** [44]
Curtain up! is a Polish app for aggregating and filtering Warsaw cultural events? Curtain Up! Will become a democratic platform were both mainstream and alternative events could be added and easily searched through by users. The main source for data is the city of Warsaw Open Data platform. The next things coming are partnerships with cultural institutions, and a carefully crafted promotion plan.

It should be noted that there are no clear demarcation lines between domains in general. Deloitte made a study of data.gov.uk on the sectors most conducive to Open Data. The sectors identified are shown in Figure 8. In this research, for instance culture, named arts has been combined with sports and recreation. Geospatial data can be used in fifteen different sectors according to the study, whereas government spending is only used in three sectors. Certain Open Data domains are thus re-used more often to generate new products and services and are likely to generate a higher impact, although all data domains are interesting for specific companies. It should be noted that there are no clear demarcation lines between domains in general. Deloitte made a study of data.gov.uk on the sectors most conducive to Open Data.[45] The sectors identified are shown in Figure 8. In this research, for instance culture, named arts has been combined with sports and recreation. Geospatial data can be used in fifteen different sectors according to the study, whereas government spending is only used in three sectors. Certain Open Data domains are thus re-used more often to generate new products and services and are likely to generate a higher impact, although all data domains are interesting for specific companies.

42 http://blindsquare.com/
43 http://parisdata.opendatasoft.com/page/home/
44 https://konkurs.danepowarszawsku.pl/pl/projekt/kurtyna-w-gore
45 Deloitte (2013)

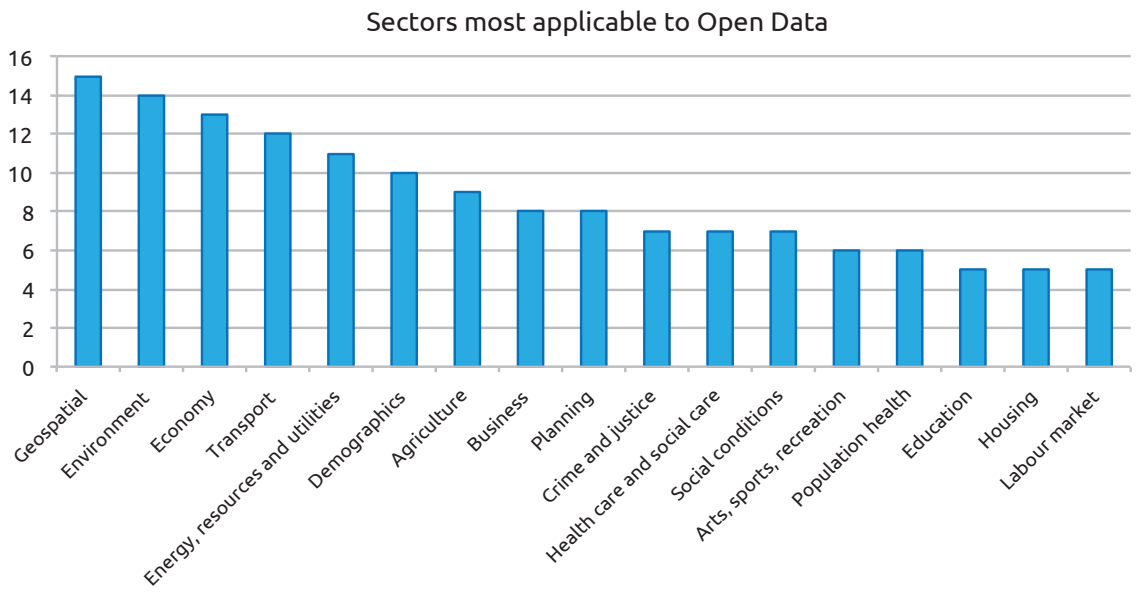



*Figure 8 – Numbers of sectors to which the data is applicable as identified by Deloitte* [46]

As already stated in the Vickery Report of 2011, individual domains are neither exhaustive nor exclusive.[47] Information on environment can also be a part of science and technology data. The focus in recent studies that looked at it from a commercialisation perspective has mainly been on economic value of information on geospatial, energy, health, transport and environment. However, given the different ways of categorisation it is not always easy to assign the impact of re-use exclusively to one single domain.

## 3.3 Understanding the impact of Open Data

To understand the impact of Open Data, one can look at the direct and indirect benefits realised by making government data available for free. Also, one can look at the innovation that is being triggered by Open Data.

### 3.3.1 Direct and indirect benefits

The effects of the use of Open Government Data can be translated into direct benefits and indirect benefits. This direct and indirect impact of provision and re-use of Open Data can take many forms and take place at different stages of the Open Data Value Chain: [48]

- Direct benefits are monetised benefits that are realised in market transactions in the form of revenues and Gross Value Added (GVA), number of jobs involved in producing a service or product and cost savings. These benefits are mainly realized by direct re-users, the so-called data enrichers.[49]

- The indirect benefits of the generation and re-use of Open Data can be divided into economic, political and social indirect benefits.[50] Economic indirect benefits can translate into new job potential, new goods and services, knowledge

46 Deloitte (2013)
47 Vickery, G. (2011), p. 10
48 Granickas, K (2013), p. 4
49 See also section 3.1 - Data Value Chain
50 Granickas, K (2013), p. 15

economy growth, increased efficiency in public services and growth of related markets. At the political level, one can speak of increased transparency and accountability, civic participation, political awareness and access to information. From a social point of view, benefits can take the form of increased social inclusion and empowerment, civic participation, access to information and support to personal decision-making capabilities (for example, if someone's life is saved by using open health data).[51] Indirect benefits are experienced mostly by customers / users of products and services offered by the direct users.

Open Data has and will continue to have a strong influence on the economy in many ways. However, it seems difficult to identify the impact of such technological transformation the moment it occurs. Often it is only after several years that the real impact can be discerned.[52] Nevertheless, certain steps have already been taken to gain the potential of Open Data also at European level.[53] The next section will provide insight in the innovation that is triggered by Open Data.

*"Open Data has and will continue to have a strong influence on the economy in many ways."*

### 3.3.2 Data driven innovation

Data is an asset, but the real economic value comes from the insights which are extracted from it.[54] The mere availability of Open Data alone does not trigger the creation of new and innovative products and services.[55] Innovation is defined by Jetzek et al. (2013) as the implementation of a new or significant improved product (good or services) or process, a new marketing method or a new organisational method in business practices' workplace organisation or external relations. Most of the time there is a need, an idea for a product or service, and the 're-users' need certain data. The data can be Open Data or other data.

Open Data needs to be available, so that in turn it can be re-used, otherwise it would be a lost opportunity. Re-users demand access to full data sets to be used for any purpose.[57] Moreover, the availability of Open Data for free – or at a marginal cost price at most – is further likely to foster innovation among the re-users and facilitate the use for developing new products and services.[58]

Thus, it could be argued that public authorities need to make as much data sets available in case the private sector would like to use certain data. This is also in line with the so-called negative data freedom paradigm that determines what data should by default be published and it is only necessary to determine what data shall not be publicly open and which ways of using should be prohibited.[59] The ability to create innovative products and services cannot be maximized if certain data is unavailable. It should also be noted that Open Data is often used in combination with other data sets (Big Data, private data, etc., for example in (financial) risk modelling tools) which leads to an increase in value of each data source.[60] In addition, ideas to innovate products and services can lead to more competition and trigger further innovation and use of Open Data.[61]

51 Granickas, K. (2013), p. 13
52 DemosEurope & WISE (2014), p. 9
53 http://www.worldbank.org/content/dam/Worldbank/document/Open-Data-for-Economic-Growth.pdf
54 DemosEurope& WISE (2014), p. 59
55 Worldbank (2014)
56 Jetzek et al. (2013a), p. 7
57 Janssen, K. (2012)
58 Koski, H. (2011), p. 6
59 DemosEurope & WISE (2014), p. 14 and p. 63
60 DemosEurope & WISE (2014), p. 47

In the end, data driven innovation positively affects value and can have economy-wide effects through the generation of new knowledge, new processes, services, products and businesses. Innovation brings about the use of new combinations of resources, which in this case is focused on technological connectivity and Open Data, new methods, new products and services which lead to the transformation of markets and industries and increase value.[62]

Next to making data sets available, it is also necessary to ensure that people have the motivation and ability to make use of Open Data, in turn leading to the design of new products and services.[63] The right governance mechanisms need to be in place, as well as the correct insight in the user's perspective.[64] Therefore, interaction via feedback mechanisms, and other interaction with users, is important. The data portals of Spain and the UK have already implemented such mechanisms.

The policy changes around Open Data and the fact that more data sets become available, opened opportunities to make use of Open Data. More companies have started using Open Data by entering the Data Value Chain. The possibilities of re-using Open Data have commercial potential. This chapter discussed the ways of how to make use of Open Data. The next chapter will further focus on the current state of play in Europe regarding Open Data.

61 Koski, H. (2011), p. 6
62 Jetzek et al. (2013a), p. 8
63 Jetzek et al. (2014)
64 United Nations (2014

4

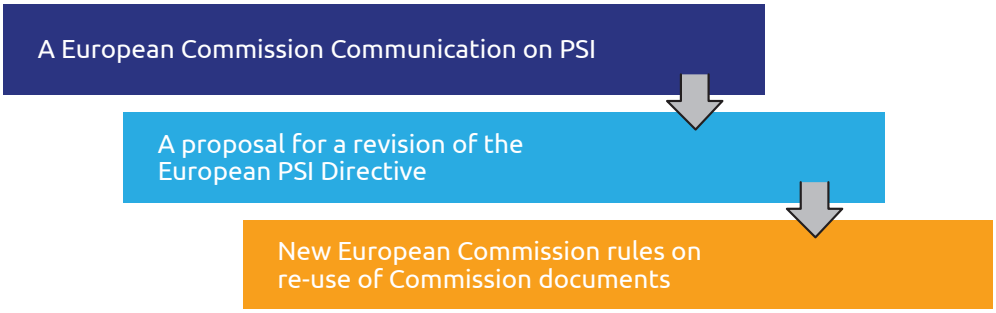
# State of play of Open Data in Europe

This chapter will give an overview of the Open Data policy and initiatives in the current 28 European Member States and the EFTA countries Norway, Iceland, Liechtenstein and Switzerland, the EU28+.

## 4.1 EU Open Data Strategy

In the years after the introduction of the European PSI Directive in 2003, Open Data stayed on the political agenda of the EU. In 2009[65] and 2011,[66] reviews took place of the implementation and application of the PSI Directive at Member States' level. On both occasions, the general conclusion was that some progress has been made. However, difference in Member States' actions and initiatives caused fragmentation, regulatory uncertainty and created distortive competition in the internal market.

In 2010, the European Commission issued the Digital Agenda for Europe.[67] One of the action points on the Digital Agenda is to 'Open up public data resources for re-use'. Shortly after, in December 2011, this was made more specific in the form of a three pack "Open Data Strategy"[68 69 70] which consisted of:




65 European Commission (2009)
66 Homer (2013), p. 21
67 European Commission (2010)
68 European Commission (2011a)
69 European Commission (2011b)
70 European Commission (2011c)

The European Commission's Communication on PSI reviews existing initiatives in the area of Open Data, identifies barriers and proposes concrete steps to unlock the potential of Europe's public sector resources, including both legislative and non-legislative instruments. In addition, non legislative actions were taken in the light of the Open Data Strategy. These included various projects, for example, publicdata.eu,[71] HOMER,[72] Open Data Support,[73] and LAPSI.[74]

The proposal for a revision of the European PSI Directive mainly aimed at further opening up the market for services based on Open Data, by including new bodies in the scope of application of the European PSI Directive such as libraries, museums and archives; capping the fees that can be charged by public authorities at the marginal costs of reproduction and dissemination by default; creating a right of re-use; introducing independent oversight over re-use rules in the Member States; making machine-readable formats for information held by public authorities the norm.[75]

### 4.2 Revised PSI Directive and side initiatives

The European PSI Directive was amended in 2013 by Directive 2013/37/EU.[76] The main amendments are the generalization from the general rule on charging towards a margin-oriented fee, the inclusion of certain types of cultural institutions as public sector bodies, an increased obligation for transparency regarding calculation of applicable fees, and the recommendation to make information accessible where possible and appropriate online and in machine-readable format.

Member States were obliged to transpose the European Directive by July 18th 2015. Currently, a number of Member States are still working on the implementation of the revised PSI Directive, with the support of the European Commission's PSI re-use Guidelines which provide for more details regarding licensing, categories of data sets and charging in addition to the general framework articles of the revised European PSI Directive. The PSI Guidelines are reflecting the general contemporary economic thinking towards more open

*"Member States were obliged to transpose the European Directive by July 18th 2015."*

**HOMER**

In the context of the Digital Agenda for Europe and the Open Data Strategy, HOMER (Harmonising Open Data in the Mediterranean through Better Access and Re-use of Public Sector Information), a strategic project for eight Mediterranean European countries with the focus on Open Data, was initiated. The three year project started in April 2012 and ended in April 2015. The objective was to facilitate the deployment and address legal, cultural and technological challenges of Open Data in Spain, Italy, France, Malta, Greece, Slovenia, Cyprus and Montenegro. The rationale for this project was to bridge the gap – that became apparent in 2010 – of these eight Mediterranean countries with the rest of Europe in terms of Open Data.

71 http://publicdata.eu/
72 http://homerproject.eu/en/news/225-homer-project-comes-to-its-end
73 https://joinup.ec.europa.eu/community/ods/description
74 http://www.lapsi-project.eu/
75 Homer (2013), p. 22
76 http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32013L0037

and interoperable licensing systems, the priority data sets for release and the lowering of charges in the direction of a marginal cost model.[77] The priority data set categories that are identified for release are Geospatial data, Earth observation and environment, Transport data, Statistics and Companies data. The idea for public sector bodies of EU Member States is to charge no more that the marginal cost of reproducing, providing and dissemination of data sets.

Some EU Member States are still sceptical about providing data at marginal or no costs. The price elasticity of demand for Open Data is high: public sector agencies in various countries have witnessed a strong growth in demand for information they provide after switching from cost-based pricing of Open Data to free or maximum marginal cost priced information.[78] Several studies and case examples have shown that cost-based pricing models do not bring cost savings to public authorities in the long run while free or marginal cost models are more beneficial.

It should be noted that in most cases the cost-recovery model creates barriers to the access and the re-use of Open Data.[79] Especially economically less viable people (e.g. citizens, students, researchers with limited budget, start-ups etc) will not make use of Open Government Data if a fee is requested to obtain the data. When public authorities decide to move towards a free or marginal cost model, more downloads can be discerned and other benefits such as an increase of the numbers of start-ups and greater return on investments can accrue. Governments would then witness indirect benefits out of downloads, such as an increase in tax revenues on sold products and services. As such there is an actual benefit gain for governments to provide data at a marginal cost. This results in a tendency towards the marginal cost model in more countries.

**Pettifer**[80]

In 2011, Pettifer argues that the fundamental reason for the market size difference between the US and European meteorological markets are the different Open Data pricing schemes adopted in the US and in Europe. He states that freely available data in the US resulted in a $1.4 billion (EUR 1.28 billion) market in 2006 in value-added meteorological products of all types in the US, while the corresponding market size in Europe with costly Open Data was $372 million (EUR 339 million). The annual growth of meteorological markets in the US and Europe were respectively 17 and 1.2 percent measured since 2000.

Some researchers even go so far and indicate that 'cheap data yields higher (economic) growth' which applies specifically to a Finnish Study done by Koski.[81] She concluded in her study that business growth is 15% higher in countries where public sector geographic data is freely available or sold at a considerably reduced price. The study argues that there is a link between the pricing of geospatial Open Data and small to medium sized firms' sales growth. The estimations show that positive growth impact materializes already one year after switching to the marginal cost pricing scheme, but a stronger boost to the firm growth takes place with a two year lag. Interestingly, marginal cost pricing has

77 http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.C_.2014.240.01.0001.01.ENG
78 Koski, H. (2011), p. 6
79 Trojette (2013)
80 Pettifer, R. (2011)
81 Koski, H. (2011)

not generated notable growth among the large firms; it has been SMEs benefiting most from cheaper geographical information. It seems credible that switching to marginal cost pricing of Open Data substantially lowers SMEs' barriers to enter new market areas.


Governments receive income from commercial licensing fees, but at the same time lose taxation and employment benefits from the potential higher volumes of commercial activities that could be generated if they abandoned upfront charges for obtaining Open Data in the first place. PIRA[82] found that with a conservative projection of a doubling of market size resulting from eliminating licensing fees would produce additional taxation revenues to more than offset the lost income from Open Data charges. Interestingly, in art. 4.1.2 of the European Commission PSI Re-use Guidelines it is stated that 'charging [of the fees] as such for making Open Data available comes at a cost as well: invoice management, monitoring and policing payments, administration of licensing regimes etc'. This means that meeting the request and asking for a fee is not only an administrative burden for the re-user, but also very costly in terms of time and staff for the data supplier.

As discussed, in a free or marginal cost model, the number of requests for Open Data information will increase according to the price elasticity of demand: the higher the access price to Open Data, the lower the demand. Under the cost recovery model costs are generated to meet this demand. If demand increases, the cost increases. However, if the data is available for free or at marginal costs, any extra demand will not lead to higher costs, since these costs are already covered. This will become evident over a certain period of time, taking into account that increased re-use will generate new products and services and better return via taxes to government budget.

The ePSI scoreboard[83] shows for the state of play regarding pricing models that eighteen Member States have a cost recovery model and nine Member States have a marginal cost model. It should be noted that the German national legislation for the implementation of the new European PSI Directive has no provision about costs. So despite the revised European PSI Directive, still two thirds of the EU Member States take a cost recovery approach for the time being.

*"The higher the access price to Open Data, the lower the demand."*

Next to policy and legislative actions, the Commission also launched several initiatives to raise awareness for Open Data and stimulate the creation of networks.[84] For example, the following initiatives were set up:

- The PSI (Expert) Group[85] is a Member States' expert group for the exchange of good practices and initiatives supporting Open Data re-use which was established already in 2002.
- The European Public Sector Information Platform (ePSI)[86] is a web portal that provides news on European developments, good practices, examples of new products and services, and legal cases concerning Open Data re-use.
- The LAPSI Network[87] analysed legal issues related to Open Data, fostered debate among researchers and stakeholders and produced a set of guidelines for access and re-use policies and practices.

82 PIRA International (2000)
83 http://www.epsiplatform.eu/content/european-psi-scoreboard
84 Homer (2013), p. 23
85 http://ec.europa.eu/digital-agenda/en/news/public-sector-information-group-main-page
86 http://www.epsiplatform.eu/
87 http://www.lapsi-project.eu/

- The Share PSI 2.0 Network,[88] a second thematic network working on the exchange of experience and ideas around implementing Open Data policies in the public sector, consisting of a community of government departments, standards bodies, academic institutions, commercial organisations, trade associations and interest groups. Knowledge is principally shared during workshops on the basis of real use cases, in order to ensure that ideas have been tried and tested in practice.

- The Open Data Support project[89] has been created to support possible suppliers of Open Data in publishing datasets. Support activities comprise preparation with a view to sharing metadata, training as a capacity building exercise for public administrations in the EU in the supply and use of Open Data. Finally technical advisory and consulting services are made available to address a wide range of questions related to the provision and use of Open Data.

- The Innovation Action "European Open Data integration and re-use incubator for SMEs,[90] is an integral part of Horizon 2020, which addresses the topic of Big data and Open Data Innovation and take-up. The objective is to support European companies and SMEs in particular, in developing innovative products via so-called European data integration and re-use incubator. The purpose of the incubator is to encourage and support the growth of Open Data supply chains and assist new users.[91] Under the same objective ICT-15-2014, a second activity consists in developing projects in the field of multilingual data harvesting and analytics.

- Interestingly enough, there is a very thin border between Open Data, innovation and digital entrepreneurship. The Startup Manifesto[92] extensively refers to the "opening up government data." Several other initiatives launched by DG CONNECT and DG GROW with regard to digital entrepreneurship can be useful in connecting to e.g. DG GROW activities in the field of developing a Body of Knowledge for ICT professionalism, or other eSkills projects and communities are of direct relevance for the promotion and take up of the Open Data Portal Infrastructure.

At European Level, Open Data is an important topic. There is a decisive movement from Member States towards more open access models. Nevertheless, certain Member States are still reluctant and request to have evidence of the real impact of such change of approach.

### 4.3 Current situation in the EU 28+

As indicated by the DemosEurope & WISE study, the EU28 can be roughly divided into three regions looking at Open Data policies, portals, initiatives, actions etc:[93]

- North (UK, Ireland, Netherlands, Belgium, France, Austria, Germany, Finland, Sweden, Denmark, Luxembourg)

- South (Portugal, Spain, Italy, Greece, Slovenia, Malta and Cyprus)

- East or New Member States (Poland, Czech Republic, Slovakia, Bulgaria, Hungary, Croatia, Estonia, Latvia, Lithuania, Romania)

88 http://www.w3.org/2013/share-psi/
89 https://joinup.ec.europa.eu/community/ods/description
90 http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/87-ict-15-2014.html
91 https://opendataincubator.eu/
92 http://startupmanifesto.eu/files/manifesto.pdf
93 DemosEurope&WISE (2014), p. 84

There is a big difference between those countries looking at the progress they made so far with launching an Open Data portal. The first country to have an Open Data portal was Spain in 2009. They are also one of the frontrunners in terms of their Open Data policy. In Table 1 an overview is given of the year in which the countries launched a national Open Data portal. The most recent countries to have launched a portal are Croatia, the Czech Republic, Hungary, and Lithuania in 2015. Latvia is now in the planning phase of their national portal and Luxembourg aims to launch its portal in the beginning of 2016. The plans for opening a national portal in Malta, Liechtenstein, and Iceland are unknown for the moment.

Despite the development of national portals, not all countries have a national Open Data policy yet, as is shown in Figure 9. It is expected that the focus on Open Data in the upcoming years will accelerate this.

This insight comes from the landscaping performed by the European Data Portal project.[94] The focus of the landscaping is to understand the level of Open Data Maturity from the perspective of the public sector representatives. Open Data Maturity is measured based on two key indicators: Open Data Readiness and Portal Maturity.

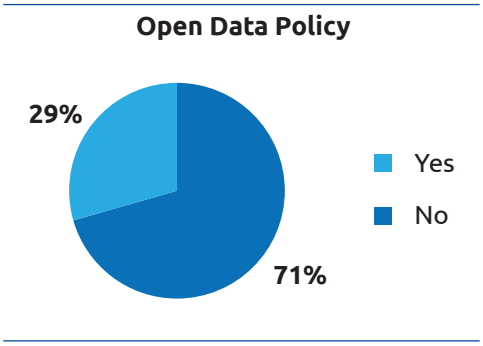



*Figure 9 – Presence of an Open Data Policy*

Open Data Readiness looks at the presence of Open Data policies, the use made of the Open Data available, and at the political, social and economic impact of Open Data. Portal Maturity measures the usability of a portal with regard to the availability of functionalities, the overall re-usability of data, as well as the spread of data.

| 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | ≥2016 |
|---|---|---|---|---|---|---|---|
| Spain | Slovenia | Belgium | | Austria | Bulgaria | Croatia | Iceland |
| | UK | Estonia | | Denmark | Cyprus | Czech Republic | Latvia |
| | | France | | Germany | Finland | Hungary | Liechtenstein |
| | | Italy | | Greece | Ireland | Lithuania | Luxembourg |
| | | Netherlands | | Romania | Poland | | Malta |
| | | Norway | | Slovakia | | | |
| | | Portugal | | Sweden | | | |
| | | | | Switzerland | | | |

*Table 1 – Overview introduction national Open Data portal*

94 www.europeandataportal.eu

Assessing Open Data Maturity shows that the EU28+ countries have completed just 44% of the journey towards achieving full Open Data Maturity. However, there are large discrepancies from one country to the other. A sub-set of countries is still in the process of building their national portals whereas some others are already improving their current portals and launching new initiatives. A third of European countries (32%) are leading the way with solid policies, licensing norms, good portal traffic and many local initiatives and events.

The Open Data Readiness indicator shows a EU28+ average of 44.7%. The results of the Open Data Readiness sub indicators show that the EU28+ countries are most mature when it comes to the presence of Open Data policies. They score on average 57.4% on the presence of Open Data policies. On the use and impact of Open Data, the EU28+ countries score lower, respectively 36 and 29%.

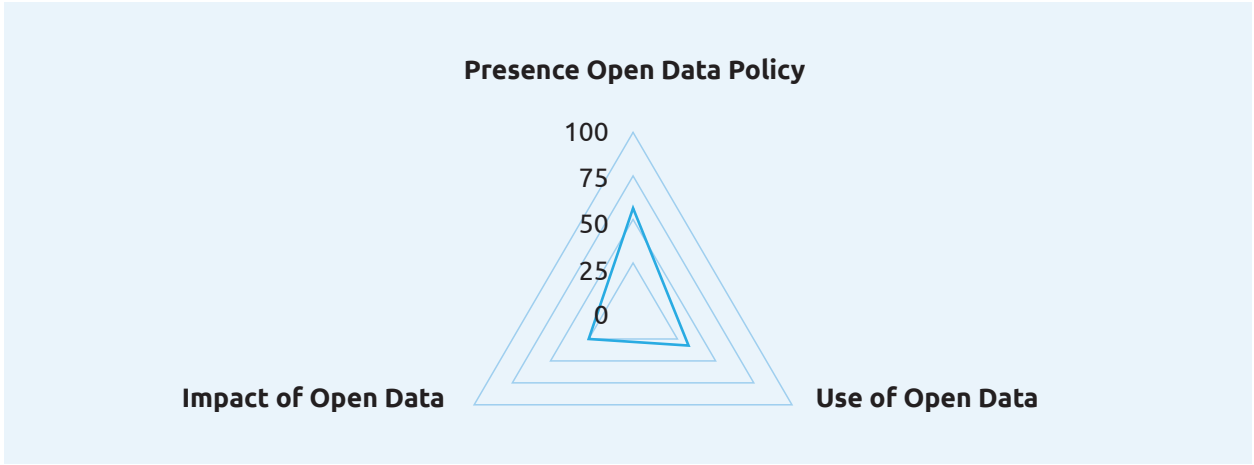



*Figure 10 - Open Data Readiness average EU28+*

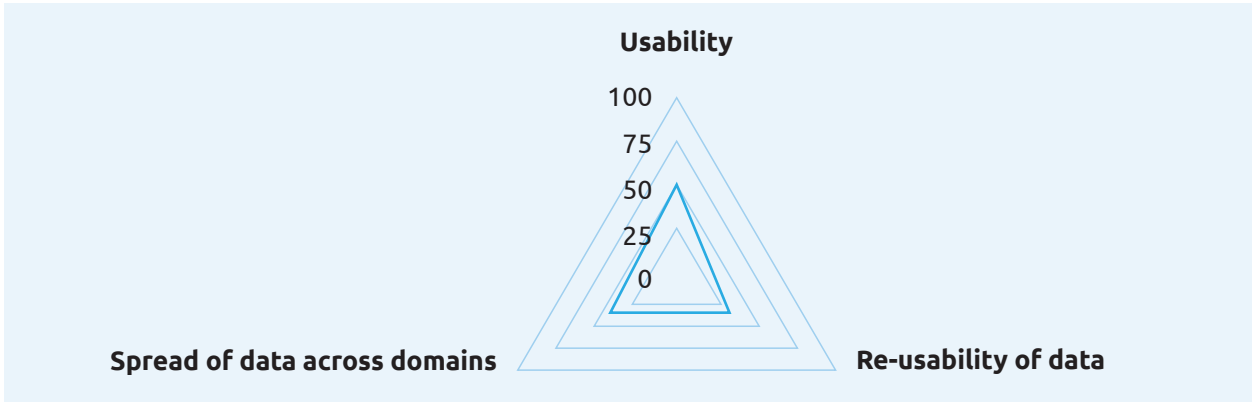



*Figure 11 - Portal Maturity average EU28+*

Almost two-thirds (59%) of the EU28+ countries have developed and implemented a dedicated Open Data policy. With regard to licensing norms, the countries are quite developed, as the EU28+ score 72.9%. However, national coordination in the field of providing guidance to local or domain specific areas is lagging behind with an average of 43.8%.

On the use of Open Data, the EU28+ countries score low, with an average of 36%. The difference within the EU28+ is large. Several EU28+ countries already receive more than 10,000 visitors per month on their national portal. However many countries have no insight into the use of their data.

Thanks to the landscaping exercise, the overall political, social and economic impact of Open Data in the EU28+ can be measured. On all three factors, not even half of the impact is perceived as having been reached. The economy is the most impacted area, scoring an average of 38.3%, the political impact achieved is 30.8% and finally the perceived social impact remains very low, at 8.3%.

The maturity of the Open Data portals is the second key indicator of the Open Data Maturity Assessment. Portal maturity looks at the usability of the portal and the re-usability of the data, as well as the spread of data across domains. Overall, the EU28+ countries score 50% on usability, 33% on re-usability and 42% on the spread of data across domains.

Based on these results, the EU28+ countries are clustered into three different levels of Open Data Maturity, as can be seen in Figure 12 and is explained in more detail on the next page.

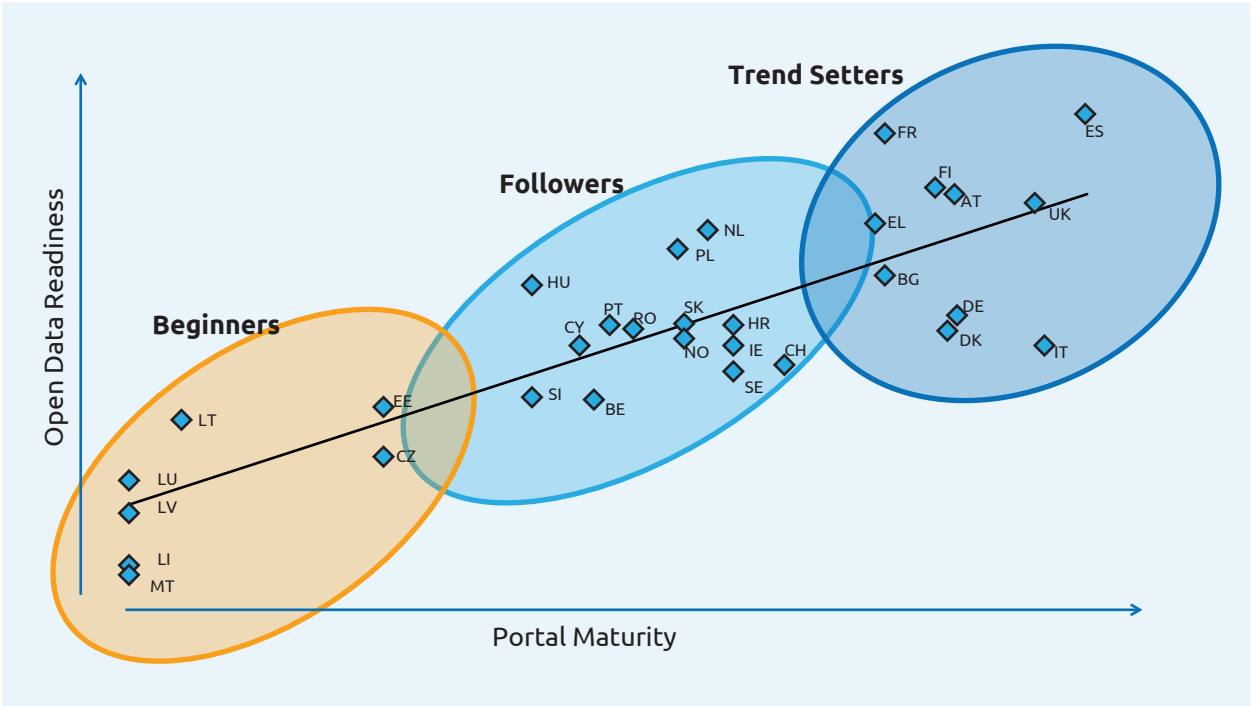



*Figure 12 - EU28+Open Data Maturity Clusters*

**Beginners:** the initial steps have been made but countries still struggle with basics around availability and accessibility. Portal functionalities remain limited and there is a limited coverage in terms of data sets.

**Followers:** the basics are set, including a clear vision and there are advanced features on the portal, however the approach to the release of data is very much in silo and remains limited.

**Leaders:** Trend Setters: these are the most advanced and have solid Open Data portals with elaborate functionalities and coordination mechanisms across domains.

Plotting the scores of the countries into the maturity graph (Figure 12), shows that seven of the EU28+ countries are considered as Beginners. Most of the countries are considered to be Followers. Fourteen countries are classified as Followers. Only ten countries are considered as Trend Setters. Europe benefits from a high level of Open Data Maturity with a large majority of countries where the basics have been set and portals launched. In addition, many of the Beginner countries are in the process of launching further structured initiatives around Open Data. For an overview of the abbreviations, see Appendix I.

Nonetheless, many European countries are Followers, pointing to the fact that they have moved forward with their political agendas and portals. What is critical now is to move further forward and accelerate the publication of data sets as well as providing more guidance to the sub-national level. This is key in ensuring interoperability as well as easing the harvesting of local portals to increase the discoverability of data. Key is also ensuring that data sets are up to date and harvested on a frequent basis. The research conducted shows there is a lot of progress to be achieved in this field in achieving more frequent harvesting of governmental sources.

This chapter discussed the state of play of Open Data in Europe, from 2003 until now. Several European Directives and policies have been discussed, as well as the current situation in the EU 28+. This information will help in performing the macro-economic analysis. Before this analysis is performed, the so far published studies around the impact of Open Data are discussed to find out which lessons can be learned of the previous efforts to quantify the market size of Open Data.

5

# Existing studies on economic benefits of Open Data

This chapter provides an overview of the secondary sources that have been assessed in order to obtain indicative quantitative data on the impact of Open Data. Several publicly available studies have made an attempt at quantifying the economic benefits of the re-use of Open Data. From MEPSIR (Measuring European Public Sector Information Resources) in 2006 to the DemosEurope & WISE research in 2014,[96] approaches have differed with regard to both the constitution of sectors and the calculation methods applied to measuring the economic gains, whether in GDP or currency-value – euro or dollar – expected growth rate.

The literature review can be divided into two main categories:

- Firstly, general studies including multiple countries are discussed that focus on policy context and theory of the re-use of Open Data. These studies provide an overview of the available studies on Open Data or recalculate the Open Data market size based on previous studies, address the different pricing models in existence and/or provide a more qualitative assessment of impacts of Open Data.

- Secondly, there are specific country studies that are done on a national level which focus on the quantitative value of Open Data. In most cases these studies have based their calculations on other, more general, studies.

Following is an overview of a selected number of studies which are considered particularly relevant in the context of this study. For each of these studies a short description is provided. The quantitative data of some of these studies will be used in Chapter 6. Further studies cited throughout the report can equally be found in the list of references.

*"An investment in Open Data is always recovered manifold."*

## 5.1 General studies

The general studies have often made a compilation of available studies. These studies generally explain different policy models and regulations in governing Open Data or outline the impact of Open Government Data from a qualitative perspective. The studies are a good starting point to have a general impression of the landscape of available studies. The studies are presented in chronological order. Their main findings in relation to the economic assessment of the re-use of Open Data are discussed.

Perhaps the very first study in the field of the re-use of Open Data and its possible economic impact is the study launched by the European Commission in the year 2000: "Commercial exploitation of Europe's Public Sector Information: Final Report for the European Commission Directorate General for the Information Society".[97] The so-called PIRA study estimated that the EU15's economic value of Open Data could amount to 68 bn EUR per year based on an investment of 9.5 bn EUR. This would mean a seven-fold Return On Investment (ROI), while the US has a 39 fold ROI (750bn EUR economic value per year based on 19bn EUR investment). It demonstrates that an investment in Open Data is always recovered manifold.

96 DemosEurope&WISE (2014)
97 PIRA International (2000)

Another study that looks at this difference between Europe and the US was 'Borders in Cyberspace: conflicting Public Sector Information Policies and their Economic Impacts', published in 2002.[98] This article explained the difference by the fact the US had an open access model, whereas the EU had a cost recovery model. It provides a thorough general insight in the two main charging models for Open Data. It should be considered as one of the first general introductions apprehending the economic benefits of Open Data.

The OECD, Digital Broadband Content: Public Sector Information and Content Study of 2006 addresses the challenges and related policy issues with respect to both Open Data and public sector content.[99] It states that "knowledge is a source of competitive advantage in the information economy, for this reason it is economically important that there is wide diffusion of public information." The study further provides an overview of Open Data projects that have been implemented in OECD countries and the challenges encountered. It illustrates the economic importance and variety of Open Data and its main commercial applications. It developed a taxonomy, analyses particular domains of Open Data, discusses the benefits of Open Data and identifies main policy issues.

The MESPIR study was actually one of the first in assessing six domains (business, geographical, legal, meteorological, transport information and finally social data) in determining the potential value of Open Data for the economy. The study proceeded with an aggregation of information available at sub domain level, based on estimates provided by data providers and users. On the other hand, calculations were made by determining a proxy bringing together different economic figures such as turnover, staff etc. Whether based on estimates or proxies, both calculations provided very similar results estimating the overall market size of Open Data in the EU25 and Norway in 2005, at €27 billion, roughly 0.25% of the EU25+ GDP (€10,730 billion).[100]

Graham Vickery published a study in 2011 summarising the findings of other studies assessing the re-use of Open Data.[101] The study includes the main developments since 2006 and the baseline established in the MESPIR Report. Vickery confirmed the Open Data re-use market to be of an estimated value of €28 billion in 2008, in-line with the €27 billion estimated within MESPIR. In addition, an aggregate for both direct (enrichers and re-users of open public data) and indirect (users of services provided by data enrichers) economic impacts from Open Data applications was calculated. For the whole economy, it was estimated around €140 billion per annum. Finally, a high estimate based on improved framework conditions for the year 2008[101] could have been up to €200 billion, thus representing 1,7% of the EU GDP.

Peter Uhlir's the Socioeconomic Effects of Public Sector Information on Digital Networks – Towards a Better Understanding of Different Access and Re-use Policies, is a summary of a workshop organised by US National Committee for CODATA and OECD which was held on 4-5 February 2008.[102] The objective of the workshop was to review the state of the art in assessment methods and improve the understanding what is known and needs to be known about the effects of Open Data activities. This summary provides information from different organisations and individuals. The study conducts an assessment

*"Knowledge is a source of competitive advantage in the information economy."*

98 Weiss, P. (2002)
99 OECD (2006)
100 MEPSIR (2006)
101 Vickery, G. (2011)
102 Uhlir, P. (2009)

of economic models, methods and applications before identifying best practices and practical activities to be conducted to enhance the understanding of economic and non economic benefits.

*"The added value of Open Data runs through all streams of the economy."*

Rufus Pollock assesses who should best finance Open Data re-use and analyses the regulatory structure needed to stimulate Open Data re-use.[103] The conclusion was that funding could come from the public authorities' 'updaters' those who update or register the data or re-users who want to make use of the data. One of the recurring questions is whether and how re-users should pay for the data following a cost recovery or free or marginal cost model. Pollock indicates that Open Data should be offered at 'efficient' prices and if possible at marginal costs as the benefits outweigh the costs incurred. Moreover, he states that charges should also be implemented for updates above marginal costs. In addition, a good regulatory structure and governance structure to manage Open Data funding is also important. In the longer term governments will provide basic Open Data free of charge. The marginal costs of providing online access to data are close to zero, but the initial fixed costs may be substantial. However, the initial costs of collecting data were already covered to obtain the data for the primary purpose. Or, alternatively, there were no costs as data was a by-product of some other activity. Costs of preparing data for publication are decreased by the fact that 'raw' data is often acceptable to users who are ready to refine it to meet their needs.

The so-called POPSIS study – 'Pricing of Public Sector Information Study' – conducted in 2011 by Deloitte, analyses 21 case studies.[104] The cases cover a wide range of public sector bodies and different Open Data sectors. The study assesses different models of supply and charging for Open Data and their effects on the downstream market, Open Data re-users, end-users and the Public Sector Body itself. The case studies show a clear trend towards lowering charges and/or facilitating re-use. In the cases where public sector bodies moved to marginal and zero cost charging or cost-recovery that is limited to re-use facilitation costs only, the number of re-users increased by between 1,000% and 10,000%. The study indicates that the potential benefits of lowered charges for re-use of Open Data are high.

Capgemini published a study in 2013 called 'Unlocking Economic Value by Opening Government and Public Data'.[105] This paper analyses trends in Open Government Data interventions among different countries with the aim to identify best practices for stimulating economic impact and creating economic value. The study is best known for the benchmarking of a number of selected countries based on the pace of adoption of Open Data Initiatives and the classification into three categories: Beginners, Followers and Trend Setters. The study found that countries with strong political support achieve higher maturity and better results in their Open Data initiatives. The study also shows that another important factor in determining the success of Open Data programmes is the participation from the user community.

The most recent and most poignant numbers published around the value of Open Data are those in the study 'Open Data: Unlocking innovation and performance with liquid information' published by McKinsey in 2013.[106] The authors recognize that many Open Data initiatives have been motivated by societal goals such as improving the transparency and accountability of institutions, and much

103 Pollock, R. (2009)
104 Vries, M. de et al (2011)
105 Capgemini (2013)
106 McKinsey (2013)

has been written about the importance of these efforts. However, the research focuses on economic value that can be created by Open Data. Globally, across seven sectors (education, transport, consumer products, electricity, oil and gas, consumer finance), Open Data could globally generate $3 trillion per annum and up to $5 trillion a year on the high end of the estimate (2.7 to 4.6 trillion EUR). This added value runs through all streams of the economy from entrepreneurship as well as market segmentation, energy efficiency, etc.

In 2014, the DemosEurope & Warsaw Institute for Economic Studies (WISE)[107] issued a study that focuses on the economic potential of Big & Open Data. It is a quantitative analysis of the EU28 into 21 sectors using a bottom-up macroeconomic model. The quantitative data is focusing on what the additional value is of Big and Open Data. The EU28 is split up in three zones: North, South and East. It is argued that the EU has three main challenges: in recognizing that there are differences across Member States in terms of initial readiness, that there is a need to determine policy choices tailored to local specificities and that Open Data and Big Data are part of broader EU reform agenda. It is considered that data affects the economy in three ways: data to information where data is mined for valuable information, data to product/process when insights from data analysis are used to improve products and processes, data to management which brings data-based information into companies' decision-making processes.

Also in 2014, the World Bank study[108] was published, focusing on how to use Open Data to drive economic growth and business innovation. It examines the evidence for economic potential of Open Data. According to the study, a summary of national studies is presented. Although the estimates differ, the potential of Open Data is very large. To illustrate this point, four companies are discussed which did not exist ten years ago, which are driven by Open Data, and which are each now valued at around $1 billion or more. Furthermore, the study discusses five archetypical types of businesses using Open Data, and discusses the types of data which are proving most likely to lead to widespread business adoption and innovation.

Another study that was published in 2014 is from Lateral Economics and the Omidyar Network that issued a study with the objective of quantifying the potential value of Open Data in G20 and Australia in particular.[109] It reflects on top-down economic calculations of the impact of Open Data. Their calculations show how Open Data can promote the themes of the G20 agenda – trade, finance, fiscal and monetary policy, anti-corruption, employment, energy, and infrastructure – and in so doing achieve more than half of the G20's 2% growth target. Applying their methods to the McKinsey study, they estimate that the implementation of Open Data policies would lead to 13 trillion USD (11.7 trillion EUR) in five years for the G20. For the Australian Open Data market the Open Data worth is estimated at 64 bn AUD (44 bn EUR).

*"The possibilities to re-use Open Data are increasing."*

### 5.2 Country specific studies

At national level, some public authorities have issued or commissioned studies to focus inter alia on the national Open Data strategy or assess the value of Open Data markets from national level perspective. Also, some countries have launched large studies to better understand the economic impact and verify the numbers put forward. This section describes these studies, in chronological order. Studies that look at

107 DemosEurope & WISE (2014)
108 World Bank (2014)
109 LateralEconomics & Omidyar Network (2014)

a specific selection of countries are also included.

SerdaLAB is a French research company focusing on market research and digital information management. On a yearly basis, SerdaLAB assesses the value of sales in the digital information market in France. Twelve different segments of digital information are analysed, for example economic, financial, legal and marketing information. In 2008, the market value of digital information in France is estimated to be at EUR 1.57 bn in 2008 compared to 1.54 billion EUR in 2007.[110] The researchers also observe a trend with regards to Open Data. The possibilities to re-use Open Data are increasing. However, they do focus more on data from Social Media than on Open Government Data.

*"Free access to good basic data for everyone is good business; for the public sector and for society in general."*

'Models of Public Sector Information Provision via Trading Funds' relies on economic models of Newberry, Bentley and Pollock.[111] The study provides estimates for the costs and benefits of marginal cost pricing in relation to bulk, Digital Open Data from big UK public data holders, while relying on prior experiences of agencies adopting marginal cost pricing.

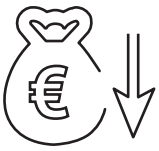
In 2011, the Bureau of Theoretical and Applied Economics, the Strasbourg University, and the CNRS released a study called 'the re-use of Public Sector Information: an economic optimal pricing model'.[112] The report looks at valuation models for the re-use of PSI or Open Data in France. They conclude that Open Data policies can have two aims: (a) disseminate raw data that are difficult to understand and use or (b) make it easier to re-use data by accompanying it with added value. If the first aim is chosen, data should be provided free of charge. Otherwise, choosing a positive pricing model, preferably fine-tuned to the user's willingness to pay, is the optimal solution.

In 2013, a study was issued that took stock of the status of Open Data in eight Mediterranean European countries.[113] These countries were involved in the HOMER project: Harmonising Open Data in the Mediterranean through Better Access and Re-use of Public Sector Information. HOMER was a three year strategic project with the focus on Open Data that started in April 2012 and ended in April 2015.[114] The objective was to facilitate the deployment and address legal, cultural and technological challenges of Open Data. The rationale for this project was to bridge the gap – that became apparent in 2010 – of these Mediterranean countries with the rest of Europe. The study examined the status of Open Data policies in the eight HOMER countries and estimated the socio-economic impact of the HOMER project.[115] In the eight countries the Open Data market is valued at 3.3 billion EUR in 2013. The forecast was that it will increase with 3.6 billion EUR in 2014, which constitutes 9% of the total Open Data Market in the EU (which is considered to be around 42 billion EUR in 2014).

In 2012, the Danish Government, the local governments in Denmark and the Danish regions[116] drafted a common digitalisation strategy for the public sector. The objective of the strategy was to ease everyday life for individuals and businesses in Denmark. Five processes were identified to reach this objective. In order to ensure the re-use of data and to prevent double registration and shadow registers, data will be financed by the government and released to the public and the private sectors. To

110 SerdaLAB (2010)
111 Newberry et al. (2008)
112 Pénin, 2011
113 Spain, Italy, France, Malta, Greece, Slovenia, Cyprus and Montenegro
114 http://homerproject.eu/en/news/225-homer-project-comes-to-its-end
115 HOMER (2013)
116 The Danish Government (2012)

enhance the quality of data, data registers will be expended into a basic register. Also, all data will be linked and a common infrastructure will be established. To coordinate this process, a data committee will be established. The Danish Government states that "free access to good basic data for everyone is good business; for the public sector and for society in general." The net benefits (2020) of this strategy are estimated as €35 million per year for the public sector and €65 million per year for the private sector.



The Shakespeare Review, published in 2013, calls for a National Data Strategy for economic growth in the UK.[117] It states a more directed, more predictable engineering of usable government data is needed to deliver the full benefits of Open Data. In his review, Shakespeare also offers an estimate for the UK, ranging from £6.2bn to £7.2bn (8.8-10.2 bn EUR) per annum. That figure comprises not just direct economic benefits but also the wider social value of Open Data. The direct benefits include the consumer surplus for direct use and consumption of Open Data related products, the revenue from the sales of data and supply chain effects from increased jobs. The wider social value includes for example the specific focus on aspects such as "the time saved as a result of access to real time travel data from Transport for London", which is valued at £15-58m" per annum (21.2-82.1 m EUR).
In 2013, a French report on Open Data was submitted by Judge Mohammed Trojette to the French Prime Minister.[118] The French Prime Minister has repeatedly stated that data produced by public bodies should be made freely available, as long as they are not privacy or national security sensitive. Mr. Trojette performed an assessment of the economic models used for existing Open Data portals. He found 27 portals that do not provide Open Data freely. The report also goes into details regarding the legal frameworks of the different pricing models encountered. Furthermore, the reasons to convert these pricing models into a free model are discussed. Mr. Trojette noted that there has been an overall decrease in revenue generated by public bodies from the re-use of PSI (35 m EUR in 2012, a 33% reduction compared to 2010), and that 90% of all the income came from just ten data sets, which puts into questions the viability of pricing regimes across all French administration.

The Swiss Government performed a study in 2013 to assess the economic impact of Open Government Data (OGD) in Switzerland.[119] They have also investigated the impact of OGD on the Swiss federal budget. The researchers state that estimating the economic impact of OGD in Switzerland is new territory. No comprehensive assessment has been done before. Also, no ready-to-use methodology is available. Therefore the authors look at the results of several other studies to estimate the Swiss OGD value. The different estimates range from 1.2 billion CHF to 6.5 billion CHF (EUR 1.1 bn – 6 bn). The report concludes that Switzerland would benefit from opening up government data. However, the report states that this is a political decision that needs to be taken.

A French report on rebuilding the right to public information in the digital age by Bouchoux was published in 2014.[120] In 1978, French parliament recognized citizen's right to obtain government documentation. In the digital age, this right has taken a new dimension. The ability to re-use government data opens perspectives still largely untapped, for example improved efficiency and quality, or the

117 Shakespeare, S. (2013)
118 Trojette (2013)
119 Bürgi-Schmelz, A. (2013
120 Bouchoux (2014)

development of new services. To increase administrative transparency in the digital age, France must improve the effectiveness of the right to access public administration, increase the completeness of data and support the development of new services.

In a recurring format, the Spanish government issued studies within the Aporta Project Framework and Plan Avanza 2 to transpose the revised European PSI Directive in Spain. The first study analysed Spain's Reuse of Open Data.[121] In the follow-up study of 2012 the analysis is continued based on a questionnaire sent out to 269 companies that have been identified as potential reusers.[122] In 2014, the study was conducted again and published in March 2015 with up-date information about the so-called infomediary sector in Spain.[123] The estimated business volume of the Spanish infomediary sector is considered to be worth of 330-550 million/per year in 2012. The average number of people employed in the Spanish Open Data sector is 3,600 – 4,400 employees.

## 5.3 Lessons learned

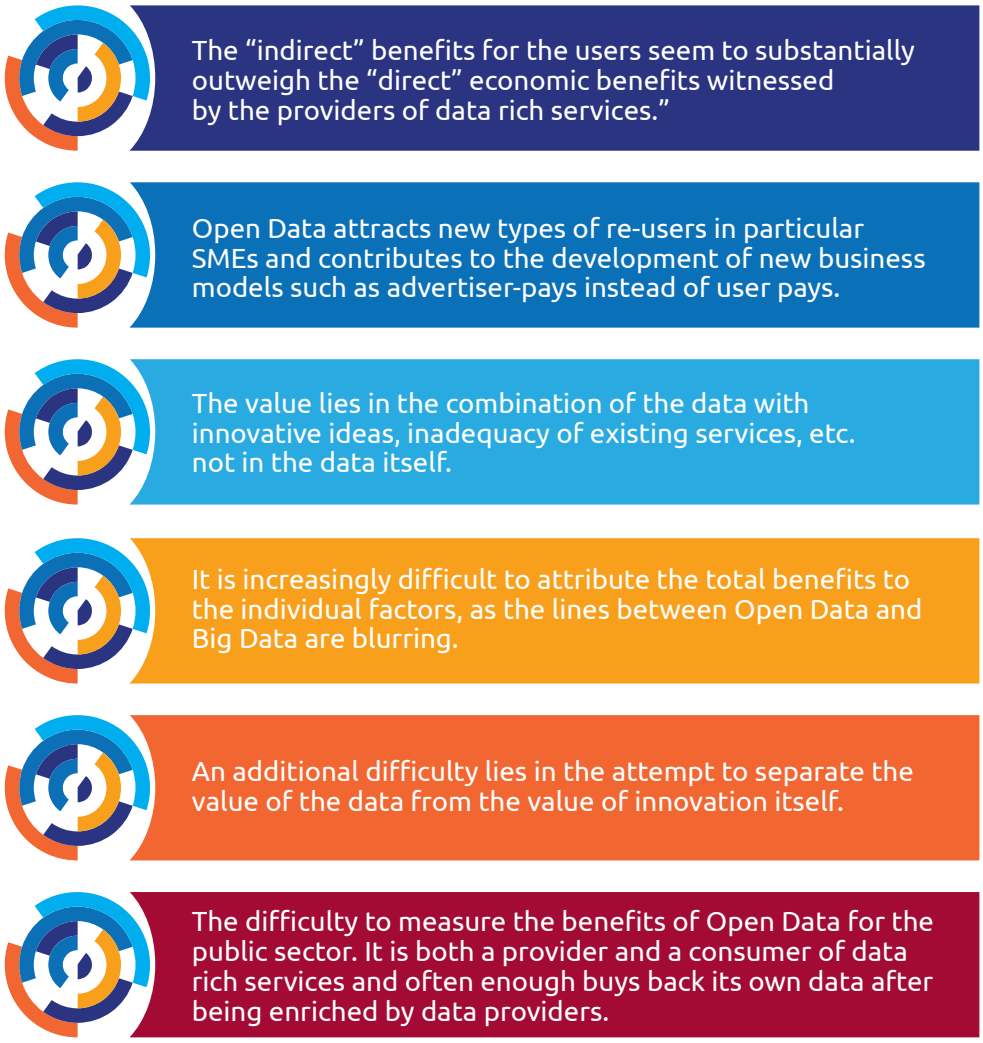
The general and country specific studies that have been conducted in previous years, apply different methodologies and approaches to conduct their research. Reading these studies, one can learn several lessons that must be taken into account when performing the macroeconomic analysis. This chapter summarizes those lessons learned, based on the objectives of this study.

Building on the growing appetite to understand "The Size of the Potential Prize",[124] to quote the latest World Bank Report on Open data for economic growth, the latter report has the benefit of listing the commonalities across the different studies, as can be seen on the next page.[125]

A final key commonality lies in the fact that most, if not all studies, adopt different definitions of Open Data and the sectors being assessed. The scope of what is measured may therefore differ as well, ranging from benefits for data companies, the public sector, or the economy in general. In addition, differences in geographic scope as well as sources used to elaborate GDP forecasts vary. For these reasons not all studies are comparable.

Besides the lessons learned from the commonalities across the different studies, specific lessons can be learned around the objectives of this study: the market size of Open Data, the number of jobs created by Open Data and the cost savings obtained.

121 Datos.gob.es (2011)
122 Datos.gob.es (2012)
123 Datos.gob.es (2014)
124 http://www.worldbank.org/content/dam/Worldbank/document/Open-Data-for-Economic-Growth.pdf
125 Worldbank (2014)




### 5.3.1 Market size

In different studies, several attempts have been undertaken to calculate the market size of Open Data. Two main trends can be observed: studies that aim to quantify the direct market size of Open Data and those that focus on both direct and indirect market size: the total market size of Open Data. Two different approaches are used to calculate either direct or total market size: top-down or bottom-up.

First, the difference between the top-down approach and the bottom-up approach is discussed. The top-down approach is assessing the value of Open Data from an aggregate level, mostly expressed in GDP. In the case of this study, this would mean from a EU28+ level. The bottom-up approach focuses on value of Open Data from country level. It can be the case that only data is available from one EU Member State. This means calculating the data from individual Member States in order to have a more detailed impression of the value of Open Data for all Member States. It also makes it possible to discern differences between Member States. The two approaches are summarized in Figure 13.

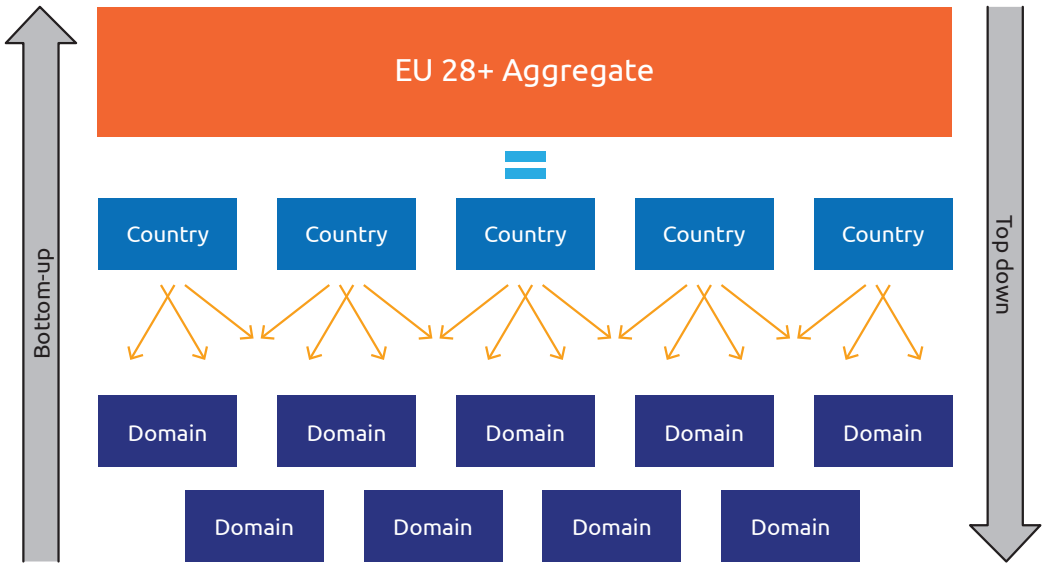



*Figure 13 - Different calculation methods observed during literature review*

There are advantages and disadvantages to both approaches. On the one hand, the top-down approach risks overestimation as the focus is mainly on Open Data without taking into account other data (e.g. private data, etc.). On the other hand, the bottom-up approach risks underestimation as it fails often to take account of the wider impacts. As observed in the literature review, the general approach taken to quantify the economic benefits is a combined top-down and bottom-up.

Second, one could look at the size of specific domains or sectors to estimate the size of direct or total market size for Open Data. The McKinsey study[126] looks at seven sectors: education, transport, consumer products, electricity, oil and gas, and consumer finance. However, in the DemosEurope & WISE study,[127] eleven domains are mentioned. Furthermore, the European Commission and Eurostat have also classified data categories, respectively the DCAT-AP[128] and GDP sectors.[129] The basic use case of the DCAT-AP is to enable aggregation of and search for datasets across data portals in Europe, thus making it easier to find public sector datasets across borders and sectors. Eurostat distinguishes several sectors in their GDP calculations. The size of the sectors is shown as a percentage of a country's GDP. These different methods show quite some overlap, as can be seen in Figure 14. Of the 40 domains distinguished, 33 can be divided into eight groups. Only seven of the 40 domains do not have a clear overlap with any of the other domains.

Finally as regards to the calculation of GDP forecasts, different methods can be applied as several different sources of-

126 McKinsey (2013)
127 DemosEurope & WISE (2014)
128 https://joinup.ec.europa.eu/asset/dcat_application_profile/asset_release/dcat-application-profile-data-portals-europe-200
129 http://ec.europa.eu/eurostat/statistics-explained/images/6/6b/Gross_value_added_at_basic_prices%2C_2003_and_2013_%28%25_share_of_total_gross_value_added%29_YB15.png

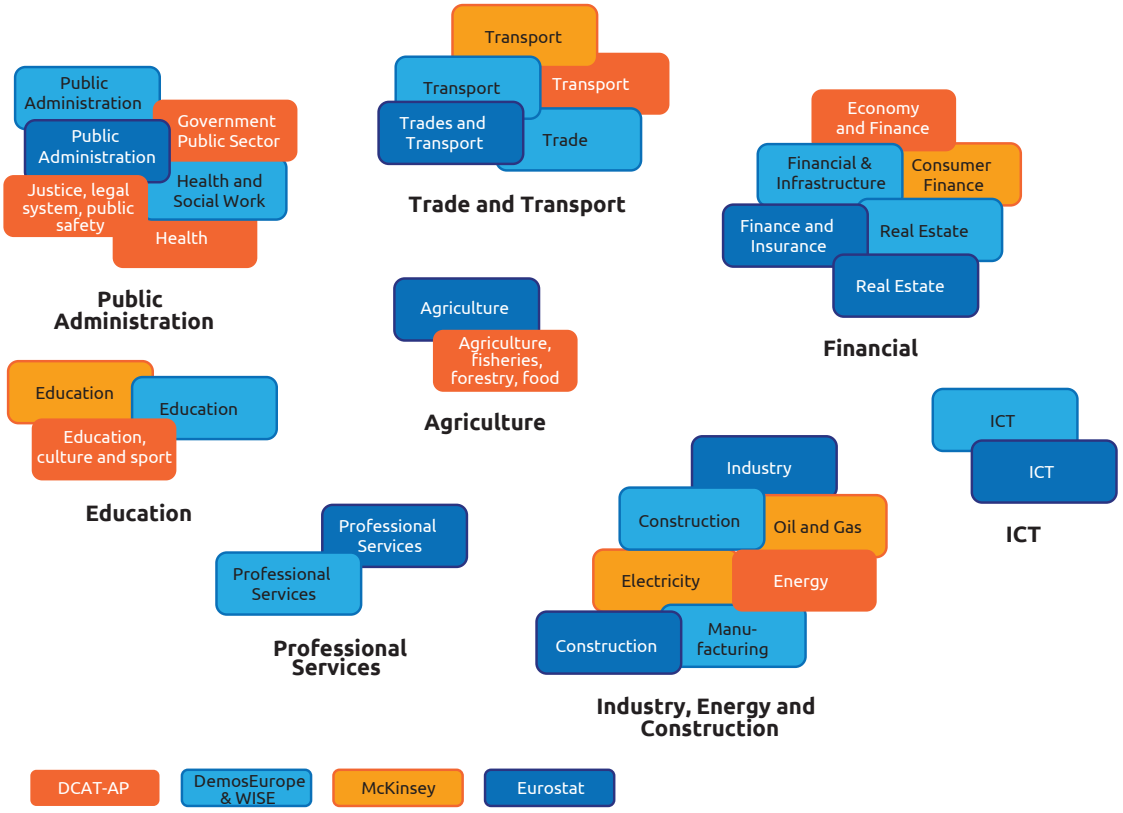



*Figure 14 –Overlap of domains summarized*

fer GDP forecasts. Some studies use the forecasts from the European Central Bank and the European Commission; others look at other international sources such as the Economist Intelligence Unit Global Forecasting Service (EIU). This can result in slightly different numbers thus limiting the comparability of the figures when considering the market value.

Two trends are observed to calculate the market size of Open Data: calculate direct market size or calculate total market size. Our study will calculate both, as from the direct market size the total market size will be derived. To calculate either of these market sizes, the two different approaches observed will be applied. A mix of both the bottom-up and the top down approach is used in this research.

### 5.3.2 Number of jobs

The number of studies available that measure the number of jobs created in the field of Open Data is very limited. Nevertheless, enough evidence exists to support a causal relationship between the release of Open Data and an increase in the number of jobs. Small and medium sized enterprises (SMEs) play an important role in creating more jobs.[130] Different factors can be distinguished that contribute to the creation of more jobs. Data-driven innovation is one example and includes any innovation that is, to a large degree, based on utilizing data to generate val-

*"All firms can use data to enhance their products and services."*

130 http://europa.eu/rapid/press-release_MEMO-12-11_en.htm?locale=en

ue.[131] In general, all firms can use data to enhance their products and services, but SMEs would use data to produce innovative products and services more often. A series of Spanish studies among all firms re-using Open Data has estimated the average number of people employed in the Spanish Open Data sector is 3,600 – 4,400 employees.

### 5.3.3 Cost savings

Several studies and case examples have shown that cost-based pricing models do not bring cost savings to public authorities in the long run. Free or marginal cost models are more beneficial. However, the only study discussed before that looked into the actual cost savings was the study from Denmark. The costs that could be saved per year for the public sector were estimated to be €35 million and for the private sector even €65 million.[132]

Many studies into the value of Open Data have been undertaken. Interestingly enough, these numbers have launched

many discussions within the Open Data community. Typically, discussions covered the method undertaken, the reliability of the data and more importantly how far the figures were intrinsically linked to the re-use of public Open Data. Different approaches, material and geographic scope have limited the comparability of the figures published. Yet, all numbers provide evidence that there is a substantial gain at hand and this gain is evidently very large. This thinking has found its way into the minds of many policy makers, believing they have found the goose that would lay the golden egg. However, few studies offer aggregate figures covering several different macro-economic indicators. Within the context of the launch of the European Data Portal, the European Commission wished to obtain further evidence of the quantitative impact of re-use of Public Data Resources. The next chapter will offer insight into the calculation methods developed for that purpose.

131 Jetzek et al. (2013b)
132 The Danish Government (2012), Jetzek et al. (2013a)

6

# Calculating economic benefits of Open Data

This part describes the methodological approach used to conduct the macroeconomic impact analysis on the re-use of Open Data. The chapter details the methods applied for the calculation of the different metrics.

## 6.1 Definitions of metrics

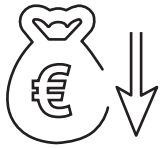
Before deciding on the approach to follow, key metrics have been defined to quantify the impact of the re-use of Open Data. These metrics are the following:

### 1. Market Size and value added as percentage of GDP

The market size is defined through the market volume and the market potential. The market volume exhibits the totality of the realized sales volume of a specific market; the value added. The volume is therefore dependent on the quantity of consumers and their ordinary demand.[133] For the Open Data Market Size turnover and value added related to Open Data is presented. The currency used is euro.

### 2. Number of Jobs Created

The objective is to calculate the number of additional jobs created directly related to Open Data for the private sector. It is necessary to look at how many people are active in this field. The numbers will be provided in persons as it is not always evident whether the jobs are in Full Time Equivalents (FTE's).



### 3. Cost Savings for the public sector

For cost savings, the aim is to look at the cost savings for the public authorities when providing Open Data. These savings include time saved for public administrators by using Open Data which are thus redundant expenditures. Moreover, the savings can also be identified via transaction costs for providing data or by realizing more transparency.

### 4. Efficiency Gains or productivity gains

There are many societal gains from Open Data. Under the heading of efficiency gains, the purpose is to assess the different indirect benefits citizens can have from Open Data. This can be in terms of time saved or lives saved as well as productivity gains. Given that these savings and/or gains are often difficult to quantify, this will be expressed quantitatively if possible as well as qualitatively.

Several economic indicators are used as factors, composites or variables to measure the metrics defined above. It is a challenge to identify economic indicators that are both stable over time and easy to measure when assessing the economic impact arising from the re-use of Open Data. By using only reputable data sources as Eurostat, the European Central Bank, and OECD, it was possible to identify such indicators.

133 https://en.wikipedia.org/wiki/Market_analysis

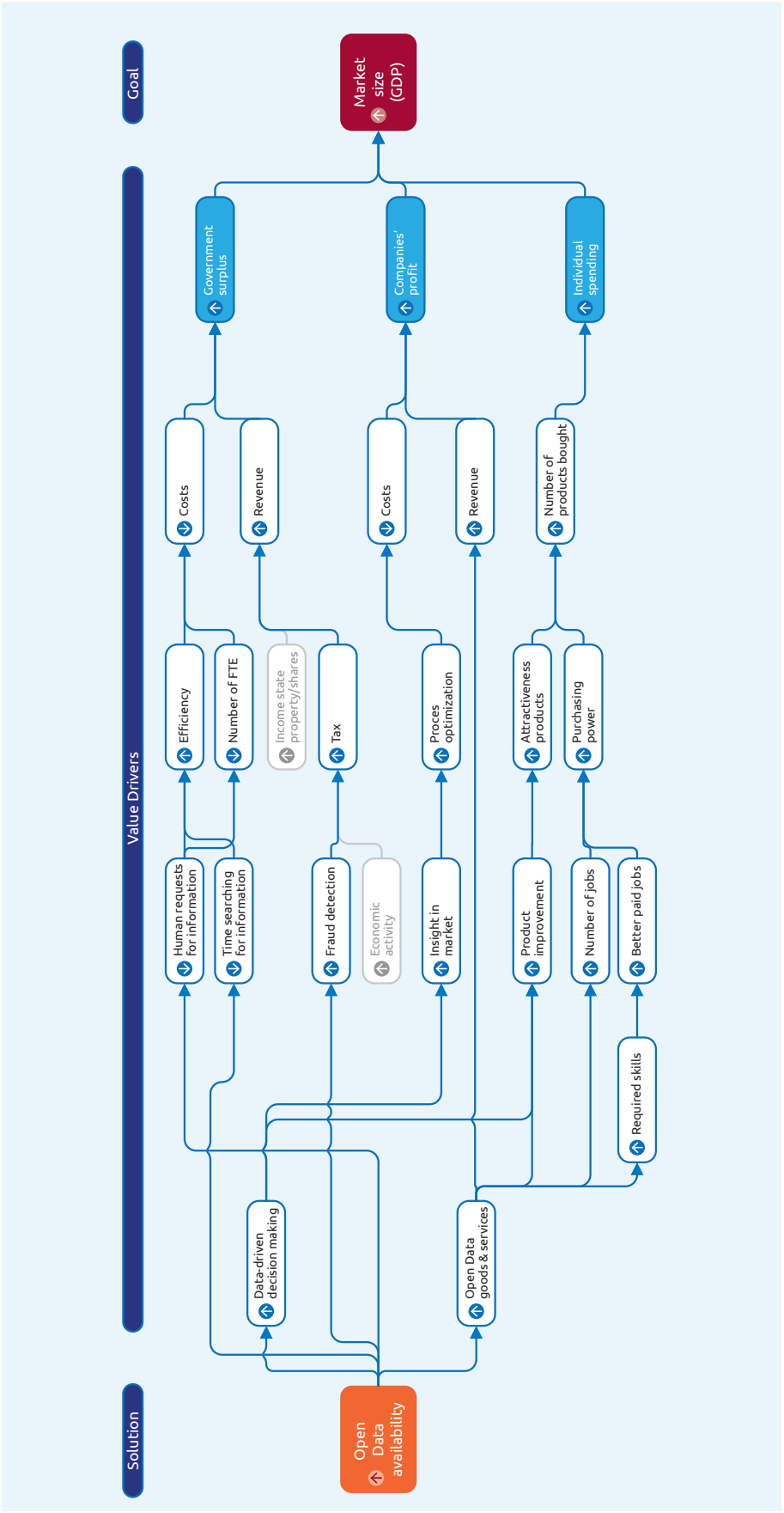



*Figure 15 – Benefits Logic for Open Data*

## 6.2 Influence of indicators on the Open Data market

In order to have a better overview of causal links, the four defined metrics are plotted in a so-called Benefits Logic to indicate which economic indicators influence a certain metric. The Benefits Logic is a method designed by Capgemini to work towards beneficial solutions by starting with the desired result in mind.

The Benefit Logic helps to stay focused on the factors that lead to the required result. The result will be a solution in which value is increased for the organisation or, in the case of Open Data, society. It does not necessarily have to generate value in terms of money. Improving services to customers/citizens could be a desired outcome as well. The Benefits Logic gives an overview of the areas where value can be created. It is used as a first step towards a Business Case that further explores the potential value of a specific solution.

In Figure 15 the Benefits Logic for Open Data is shown. The desired outcome is economic growth in terms of GDP. By looking from the right to the left, different benefit opportunities are presented. For instance, an increase in GDP is reached by an increase government surplus. The government surplus can stimulate the growth of market size and will increase when the government expenditure declines. This could be the result of lower transactional costs. Citizens are not requesting information any longer face-to-face, by telephone or via post which is costly, instead they find everything they need online on the national Open Data portal which is less costly and results in savings.

After completing the Benefits Logic model, it is possible to read from left to right what the benefits of more availability of Open Data are and how they will create economic growth.

## 6.3 Calculation method

The majority of studies performed previously are ex-ante estimations. These are mostly established on the basis of surveys or indirect research and provide for a wide range of different calculations. Koski therefore rightly states that there are no comprehensive and detailed ex-post evaluations of the materialised costs and benefits of Open Data.[134] It is necessary to conduct research ex-post. However, the necessary data to do so is at the moment hardly available. Given these restraints this study will provide ex-ante estimations with the objective to give realistic figures of the direct and total impact of Open Data by 2020.

Different techniques were used to elicit quantifiable results. First of all, data was collected and analyzed. Following the data analysis, calculation formulas were established and initial estimations, proxies and ratios were determined. These formed the basis for further calculation either from an aggregate or individual country level point of view. The aggregate calculations were set off against the individual country calculation findings and vice versa. This allowed for cross-verification and avoided extremes.

### 6.3.1 Data collection

The collection of data was based on two approaches. First of all, a thorough desk research took place of available studies and existing literature. The aim was to understand the policy context, obtain useful quantitative data for the EU28+ and compare findings. Regarding the economic impact studies, the available studies focus on large geographical areas such as the US, Australia or the EU. There are a limited number of quantitative impact studies available for individual countries. In addition, the studies available are mainly from Anglo-

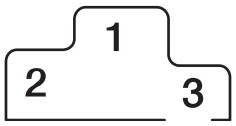
134 Koski, H. (2015), p. 3

Saxon sources. However, several country specific studies were identified and used in this study. An analysis of the available studies is provided in the previous chapter (Chapter 5).

Secondly, so-called primary quantitative data was obtained from Eurostat, OECD, European Central Bank and other reputable sources in order to ensure that the basic facts were stable and established numbers. Thereafter, an analysis of the data from secondary sources took place. The gaps were identified for which no numbers were available. These gaps were 'filled' with data from other sources amongst which primary sources for the EU28+ as a whole or for each individual EU28+ country.

### 6.3.2 Classification

To be able to provide an accurate estimate of the total Open Data market size in 2020, one needs to look at the Open Data Maturity per country and how this maturity has evolved. In order to do so, an Open Data Maturity model (ODM model) was developed by Capgemini Consulting. This model classifies the maturity of a country with regards to Open Data based on four categories using eleven different indicators. The model is largely based on a combination of the research conducted by Capgemini in 2013[135] and the research by Demos-Europe & WISE (2014). The results from the landscaping questionnaire addressed to the EU28+ PSI representatives are also taken into account. [136]




As can be seen in Table 2, there are four main categories which are taken into account to determine the maturity of a EU28+ Member State: status of Open Data, ICT Sector, enterprises and individuals. For each of these categories, indicators usable for quantifications can be sought, mainly with the Eurostat Database. Three indicators are related to the status of Open Data within a country. Two indicators look at the importance of the ICT-sector per country.

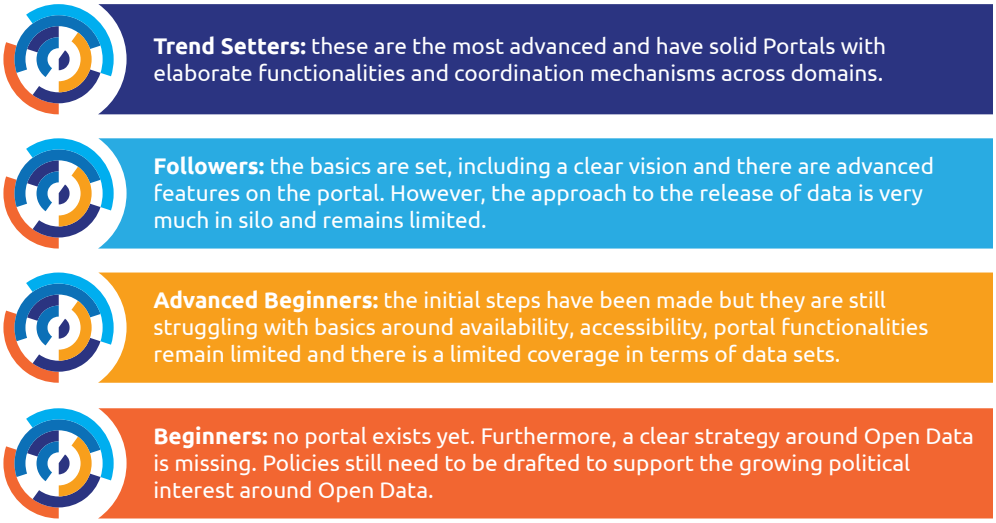
| Category | Indicators |
|---|---|
| Status of Open Data | Open Data Barometer[137] |
| | ePSI Scoreboard[138] |
| | Existence of an Open Data Portal |
| ICT-sector | Percentage of GDP attributable to the ICT-sector |
| | R&D expenditure of businesses in the ICT sector as percentage of total R&D expenditure[140] |
| Enterprises | Percentage of enterprises using internet for interaction with public authorities[140] |
| | Percentage of enterprises who electronically share information on sales for any internal function[140] |
| | Percentage of enterprises' turnover from e-commerce in total turnover[140] |
| Individuals | Percentage of individuals using internet for interaction with public authorities[140] |
| | Percentage of individuals using internet within the last 12 months[140] |
| | Percentage of individuals who have ever used the Internet[140] |

*Table 2 - Factors of the Open Data Maturity Model[139]*

135 The Open Data Economy Unlocking Economic Value by Opening Government and Public Data
136 Open Data Maturity in Europe 2015: Insights into the current European state of play
137 http://barometer.opendataresearch.org/report/analysis/rankings.html
138 https://docs.google.com/spreadsheets/d/1P3jXcDgFQml4e8MKdvcq9Gzii-BmKf5fo0XCpr4Wmf8/edit#gid=0
139 Capgemini Research (2015)
140 Eurostat Database

The other indicators look at the online maturity for Enterprises within a country (three indicators) and the online maturity of Individuals within a country (three indicators).

Based on a percentile division of the scores for the indicators, countries can be compared in terms of their maturity. This will result in a matrix with different scores per country. Previous research by Capgemini[141] indicated three maturity levels. However, to better predict the growth in Open Data, an extra maturity level is distinguished. A country can be classified as being either a Trend Setter, Follower, Advanced Beginner or Beginner:




The rate by which the value of Open Data increases differs per maturity level. Vickery makes the assumption that the value of Open Data increases by 7% per annum.[142] However, this estimate does not take into account the differences in Open Data Maturity between countries. It is assumed that the growth rate of 7% can only be applied to the Trend Setters. Based on this upper bound, the growth percentage for the other three maturity levels needs to be estimated. The upper bound of 7% is calculated backwards using a ratio of 2. This ratio is used to determine the difference in percentage points between the different maturity levels. As can be seen in Table 3, this leads to a growth percentage of 1% of the value of Open Data for Beginners, and 3% for the Advanced Beginners. For the Followers, the growth percentage is 5%.

| Level | Percentage growth |
|---|---|
| Trend Setter | 7% |
| Follower | 5% |
| Advanced Beginner | 3% |
| Beginner | 1% |

*Table 3 - Growth percentage per maturity level*

141 Capgemini (2013)
142 Vickery, G. (2011)

### 6.3.3 Calculation techniques

Different calculation techniques were identified to elicit quantifiable results. Information was extrapolated to cover areas (countries or domains) for which too little information is available.

A means of calculating the value of Open Data in one country is to use data which is available from another country, and multiply the Open Data value by the ratio of GDP per country or some similar measure.[143] However, it should be kept in mind that provision of data sets per government varies and the commercial use of Open Data is concentrated in a small number of domains which may also differ per country.

## 6.4 Calculation of the metrics

This section provides more details around the calculation of the different metrics. The focus will be on the metric for market size, number of jobs created, and cost savings. The metric efficiency gains has a more qualitative approach.

### 6.4.1 Market size

In calculating the market size for Open Data from 2016 to 2020, a distinction can be made between the direct market size and the indirect market size. Together they form the total market size for Open Data. Direct benefits are monetised benefits that are realised in market transactions in the form of revenues and Gross Value Added (GVA). Indirect economic benefits are i.e. new job potential, new goods and services, time savings for users of applications using Open Data, knowledge economy growth, increased efficiency in public services and growth of related markets.

The direct market size for Open Data in 2020 can be calculated by extrapolating the 2005 Open Data market size for the EU25, used in the studies of MEPSIR[144] and Vickery.[145] The first step is to extrapolate the 2005 market size value for the EU25 to a value for the EU28+, based on GDP 2005 figures from Eurostat.[146] Then, the 2005 values should be extrapolated, first to their 2015 value and then to their 2020 value. To do so, the Open Data growth rate is taken into account, derived from the Open Data Maturity classification. Also, the values are increased with the (expected) inflation in the period of 2005-2020, based on Eurostat figures[147] and forecasts of the European Central Bank.[148] To calculate the percentage of the Open Data market size in GDP, the GDP of 2020 has to be forecasted. The forecast of the International Monetary Fund as presented in the World Economic Outlook Database can be used for this calculation.[149]

To calculate the indirect market size for Open Data, ratios can be applied that look at the difference between the direct and the total (direct and indirect) market size. Several of these ratios are mentioned in previous research (see Chapter 5). Research by Vickery[150] and Shakespeare[151] mention two almost similar ratios. Vickery found a ratio of 3,5, while Shakespeare found a ratio of 3,78. These ratios are used to estimate a range for the total market size for the EU 28+.

Next to calculating the overall Open Data market size in 2020, it is interesting to know how large the influence of Open Data will be in specific domains. In Section

143 PIRA (2000), p. 27
144 MEPSIR (2006)
145 Vickery, G. (2011)
146 http://ec.europa.eu/eurostat/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tec00001&language=en
147 http://ec.europa.eu/eurostat/web/products-datasets/-/tec00118
148 http://www.ecb.europa.eu/stats/prices/indic/forecast/ shared/files/reports/spfreport2015_Q2.en.pdf?da2241ab892f1c16774da6b7cbaee1e3
149 http://www.imf.org/external/pubs/ft/weo/2015/01/weodata/index.aspx
150 Vickery, G. (2011)
151 Shakespeare, S. (2013)

0, the overlap of sectors was already discussed. In this study, a combination of the sectors of Eurostat[152] and DemosEurope & WISE[153] will be used. The GDP per sector, as distinguished by Eurostat, is combined with the DemosEurope & WISE research into the potential gain of Open Data per sector. Weight factors can be assigned to these gains to determine the percentage per sector of the Open Data market size on country level. The country figures were used to calculate the aggregated EU28+ weighted percentages per sector.

### 6.4.2 Number of jobs created

Not all factors can be measured directly. Proxies were used when data for direct indicators was not available or feasible to collect at regular intervals. Proxies were developed contributing to the creation of composite indicators. Proxies were constructed from statistical data available.

Estimation techniques were used to develop a better understanding of the possible range of costs and effort associated with use of Open Data. Estimation is used when it is impossible to determine exact numbers. Estimation cannot and does not eliminate uncertainty; rather, the purpose of estimation is to obtain a reasonable assessment of likely costs or effort required. Estimating techniques forecast the cost and effort involved in pursuing a course of action.

Different estimations for the number of jobs created attributable to Big Data are available. However, the number of studies available that measure the number of jobs created in the field of Open Data is very limited. Nevertheless, enough evidence exists to support a causal relationship between the release of Open Data and an increase in the number of jobs in the private sector. There is a difference between the direct and indirect number of jobs created as a result of Open Data release. Start-ups that are using Open Data for their business are directly creating Open Data jobs, like Open Data analysts or product marketers. If these businesses that make use of Open Data also need a sales manager for their company as it gets bigger, this would be an indirect job that is created.

In order to calculate the increase in Open Data jobs in the private sector until 2020, two steps are essential. The first is to determine the number of Open Data jobs in any given year. Secondly, one has to know which indicators can be used to determine the growth in Open Data jobs until 2020.

A start can be made by looking at the total European population. However, not all EU citizens are considered part of the working population. The working population consists of all citizens in the age of 15 to 64 years old.[154] Not everyone that is part of the working population is defined as being employed. The EU Labour Force Survey[155] defines persons in employment as those aged 15 and over, who, during the reference week, performed some work, even for just one hour per week, for pay, profit or family gain. The labour force also includes people who were not at work, but had a job or business from which they were temporarily absent, for example, because of illness, holidays, industrial disputes, education or training.

Employment can be measured in terms of the number of persons or jobs, in full-time equivalents or in hours worked.[156] For this metric, employment is measured as the number of persons employed. The difference in full-time or part-time jobs is not taken into account, as employment is measured in persons.
For the jobs metric total employment with-

152 http://ec.europa.eu/eurostat/statistics-explained/images/6/6b/Gross_value_added_at_basic_prices%2C_2003_and_2013_%28%25_share_of_total_gross_value_added%29_YB15.png
153 DemosEurope & WISE (2014)

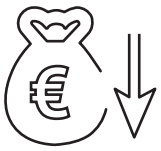
in the EU needs to be further qualified. It is often assumed that the jobs created by the re-use of Open Data will mainly be created within the IT sector. However, Open Data might be re-used/collected, aggregated and edited in the first place by IT people, but the further re-use of the data within the Open Data value chain (repackaging, distributing it) might be done by people outside of the IT sector (e.g. marketing and promotion, customer service). Thus, the scope of job creations is sought also beyond the IT sector.

A more comprehensive approach would be to look at employment within knowledge intensive activities. An activity is classified as knowledge intensive if employed tertiary educated persons represent more than 33% of the total employment in that given activity. Activities within the IT sector are part of these knowledge intensive activities. [157]

The number of persons employed in knowledge intensive activities is used in assessing the number of persons employed in Open Data. An estimate should be made which percentage of knowledge intensive jobs is related to Open Data. To do so, a series of Spanish studies looking into the re-use of Open Data in the private sector can be used as basis. These studies (conducted in 2011, 2012, 2014) have looked at the number of people directly employed in the Spanish private Open Data sector.

Next to being able to calculate the number of direct Open Data jobs in the private sector, a forecast of the number of Open Data jobs until 2020 is necessary. To do so, both the forecasted overall growth in employment and the forecasted growth of Open Data need to be taken into account. This is done by looking at Eurostat[159] and Cedefop figures.[160]

### 6.4.3 Cost savings



The potential costs saved thanks to the re-use of Open Data will be assessed for public administration at national level. There is a need to focus on public sector solely in order to make more accurate assumptions. Other studies often indicate an overall cost saving for society. The objective is to look only specifically at the cost savings part of the Houghton equation for public authorities or so-called agencies,[161] as can be seen in Figure 16.

$$\text{Benefit} = \frac{\textbf{Cost savings} + \text{Increased Returns}}{\text{Costs}}$$

*Figure 16 - Houghton, formula for estimating cost-benefits*

154 http://ec.europa.eu/Eurostat/statistics-explained/index.php/File:Population_age_structure_by_major_age_groups,_2002_and_2012_%28%25_of_the_total_population%29_YB14.png
155 http://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey
156 http://ec.europa.eu/Eurostat/statistics-explained/index.php/Employment_statistics
157 According to ISCED97, levels 5+6. For more detail see http://ec.europa.eu/Eurostat/cache/metadata/Annexes/htec_esms_an8.pdf
158 Datos.gob.es (2011), Datos.gob.es (2012), Datos.gob.es (2014)
159 http://europa.eu/rapid/press-release_IP-14-1362_en.htm
160 http://www.cedefop.europa.eu/files/3052_en.pdf
161 Houghton, J. (2011), p. 7

Providing Open Government Data for re-use can bring substantial cost savings. In order to assess what these cost savings are and where they mostly apply, the cost savings calculation of the Danish Basic Data Program can be used. The Danish Government set out a public sector-digitisation strategy to provide basic data from all layers of government (ministries, municipalities and regions). Between 2012 and 2020, certain categories of basic data like geographic, business register extractions, cadastral maps, real property data, and address data were gradually made freely available to all public authorities, private business and individuals.[162] The foreseen government savings are considered to be around 35 million EUR per annum, starting from 2020.[163]

The expected cost savings for the Danish government in 2020 can be expressed as a percentage of the total public sector expenditure of Denmark. This expenditure can be calculated by looking at the 2020 GDP of Denmark and the government expenditure as percentage of GDP in Denmark. The 2020 GDP of Denmark will be calculated as part of the market size calculation. The government expenditure percentage can be calculated by looking at the average government expenditure percentage for the period 2010-2014. Then, the size of the cost savings in Denmark can be expressed as a percentage of the Danish government expenditure.

Once the percentage of cost savings in government expenditure is known, the cost savings for the other EU28+ countries can be calculated. This calculation will be based on the World Economic Outlook[164] forecast of 2020 GDP and the average government expenditure percentage as reported by Eurostat for the period 2010-2014.[165]

### 6.4.4 Efficiency gains

The metric efficiency gains has a more qualitative approach compared to the other three metrics. It offers a combination of the insights gained around the efficiency gains of Open Data and real-life examples. Both are identified via desk research. Three exemplar indicators are assessed in more detail: how Open Data can save lives, how it saves time and how Open Data helps achieve environmental benefits.

This study will provide ex-ante estimations to give realistic figures of the direct and total impact of Open Data by 2020 with regards to the market size, number of jobs created, cost savings and efficiency gains. Several calculations techniques are applied. The aggregate calculations are set off against the individual country calculation findings and vice versa. The achieved results are discussed in the next chapter.

162 The Danish Government (2012)
163 Jetzek (2013a)
164 International Monetary Fund, http://www.imf.org/external/pubs/ft/weo/2015/01/weodata/index.aspx
165 http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tec00023

7

# The value created through Open Data

In this chapter, the results of the macroeconomic analysis are presented. Based on the methodology described in the previous chapter, the value created through Open Data is assessed. The direct and total benefits of the re-use of Open Data for the EU28+ for the period of 2016-2020 have been forecasted.

An important first step consists in classifying all EU28+ Member States using the Open Data Maturity (ODM) model. The ODM model shows that in 2005, 63% of the Member States could be classified as a Beginner whilst not a single country could be classified as a Trend Setter. These numbers changed substantially over the past 10 years. In 2015, 31% of the countries can be classified as a Trend Setter whereas only 19% is still a Beginner, as shown in Table 4. For 2020 it is forecasted that 88% of the countries will have become Trend Setters.

For the years 2015 to 2020, the percentage of Trend Setters is forecasted to increase from 31% in 2015 to 88% in 2020. Indeed in 2015, not all countries have yet opened an Open Data portal, some do, however these still require improvements to reach the levels of the best performing countries. One can forecast that by 2020, all countries will have a fully operating portal. Additionally, countries will also introduce improvements to increase their Open Data Maturity. In 2020, almost all EU 28+ Member States will have become Trend Setters as can be seen in Figure 17.

## 7.1 Market size

The first metric quantifies the potential size of the current and future Open Data market in the EU 28+. The results will be presented as an aggregated euro value as well as a percentage of the overall EU GDP. This section also outlines the additional growth that Open Data will generate in the period 2016-2020.

### 7.1.1 Value of market size

In determining the direct overall EU Open Data market size, the value of the Open Data market size for each EU28+ country is calculated and aggregated. As a basis, the research done by MEPSIR[166] and Vickery[167] is used. MEPSIR stated that the direct Open Data market size of the EU25 was 27 bn EUR in 2005. After extrapolating this number to the EU28+ Member States, the direct size of the Open Data market for the EU28+ is estimated at 28 bn EUR in 2005, which would represent 0.23% of the total EU28+ GDP at that time.

| Year | Beginner | Advanced Beginner | Follower | Trend Setter |
|---|---|---|---|---|
| 2005 | 63% | 9% | 28% | 0% |
| 2010 | 44% | 16% | 37% | 3% |
| 2015 | 19% | 6% | 44% | 31% |
| 2020 | 0% | 0% | 12% | 88% |

*Table 4 - Overview number of countries per ODM classification (in %), 2005, 2010, 2015, 2020*

166 MEPSIR (2006)
167 Vickery, G. (2011)

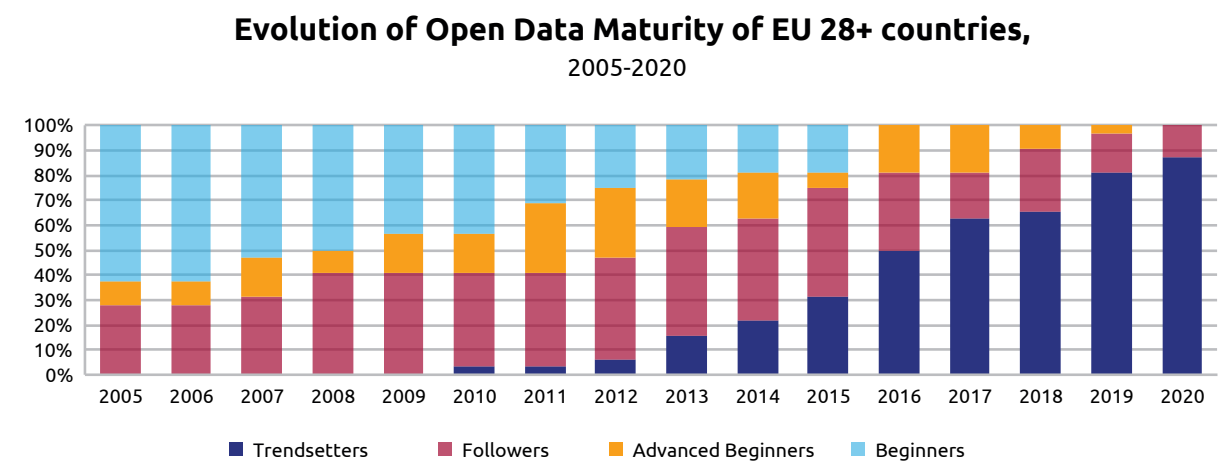



*Figure 17 - Evolution of Open Data Maturity of EU28+ countries, 2005-2020*

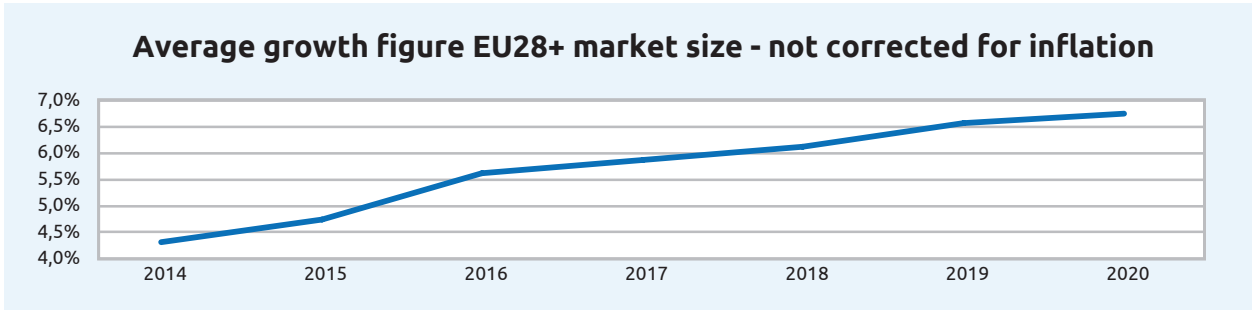



*Figure 18 - Average growth of direct market size in EU28+, 2014-2020*

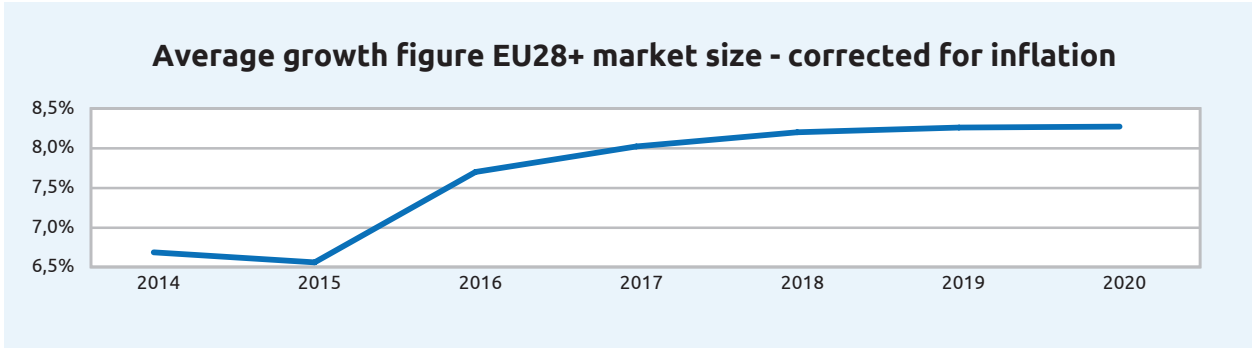



*Figure 19 - Average growth of direct market size in EU 28+ corrected for inflation, 2014-2020*

Based on the percentages per maturity level and the country scores from the Open Data Maturity model, a per annum growth rate can be determined per EU 28+ country. Using these numbers, an EU28+ average was calculated. Figure 18 shows that as countries become more mature, the average growth rate for the EU28+ increases.

Furthermore, the research by Vickery does not take into account inflation over the years. By combining the results from the maturity model with the (forecasted) inflation figures, the growth figures per annum effectively do change (Figure 19). The average growth equals 6.8%.

When the growth figures are applied to the 2005 market size, the current direct market size can then be calculated. For 2015, the direct market size of Open Data is expected to be 51 bn EUR for the EU 28+. This is an 82% increase compared to 2005. The direct market size for the period of 2016-2020 can also be calculated. Between 2016 and 2020, the market size is expected to increase by another 36.9%, from 55.3 bn EUR in 2016 to 75.7 bn EUR in 2020, as can be seen in Table 5 and Figure 20. The direct market size in 2020 per EU28+ country can be found in Appendix II - Direct market size per EU28+ country.
The indirect market size can be estimated using a ratio for the difference between direct and total market size (direct and indirect effect). Vickery found a ratio of 3,5 whilst Shakespeare found a ratio of 3.78. These ratios are used to estimate a range for the total market size for the EU 28+ which can be found in Table 6. The total market value of Open Data, combining the direct and indirect market size, is estimated between 193 bn EUR and 209 bn EUR for 2016 with an estimated projection of 265-286 bn EUR for 2020, including inflation corrections. By subtracting the direct market size from the total market size, the indirect market size is calculated as can be seen in Table 7. The estimates for the high bound of the total an indirect market size are plotted in Figure 21.

For the period 2016-2020, the cumulative direct market size is estimated at 325 bn EUR. The cumulative total market size for Open Data is forecasted to be between 1,138 and 1,229 bn EUR.

| 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|
| € 55.3 | € 59.7 | € 64.6 | € 69.9 | € 75.7 |

*Table 5 - Direct market size of Open Data in billions, 2016-2020*

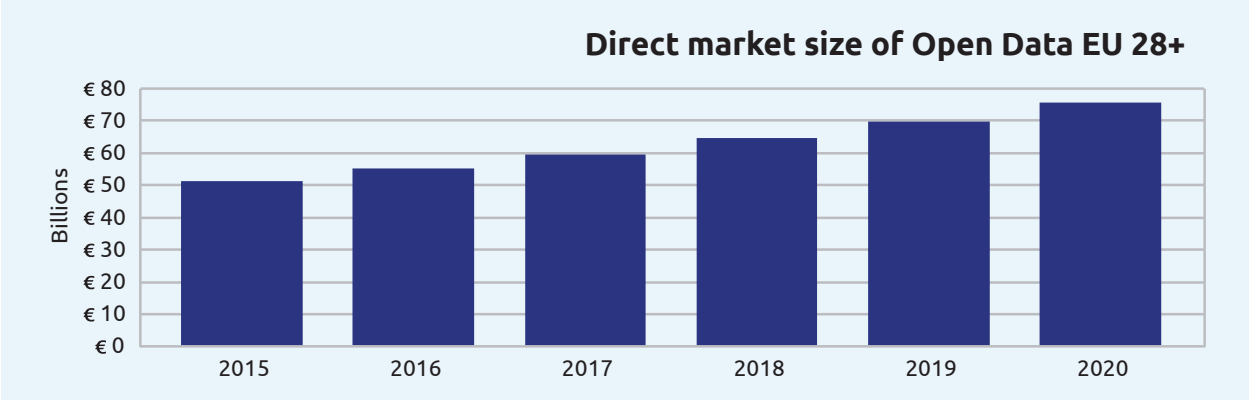



*Figure 20 - Direct market size of Open Data, 2015-2020*

| | 2017 | 2018 | 2019 | 2019 | 2020 |
|---|---|---|---|---|---|
| Lower bound | € 193 | € 209 | € 226 | € 245 | € 265 |
| Higher bound | € 209 | € 226 | € 244 | € 264 | € 286 |

*Table 6 - Estimated total market size of Open Data for EU28+ in billions, 2016-2020*

| | 2017 | 2018 | 2019 | 2019 | 2020 |
|---|---|---|---|---|---|
| Lower bound | € 138 | € 149 | € 161 | € 175 | € 189 |
| Higher bound | € 154 | € 166 | € 180 | € 194 | € 210 |

*Table 7 - Estimated indirect market size of Open Data for EU28+ in billions, 2016-2020*

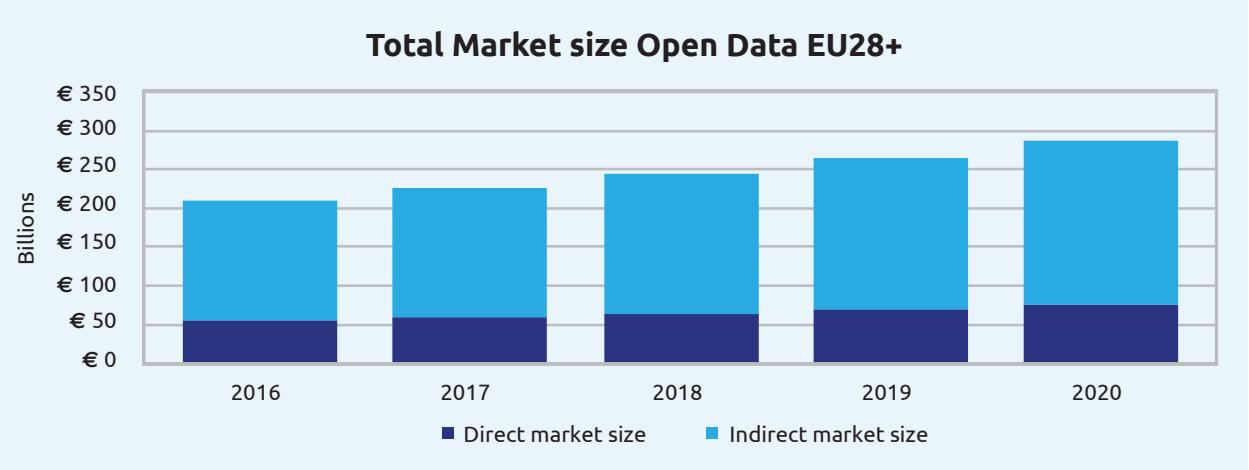



*Figure 21 – Total market size (high bound), split in direct and indirect size for EU28+in billions, 2016-2020*

### 7.1.2 Market share as percentage of GDP

In 2005, the direct market size of Open Data was equal to 0.23% of the total EU28+ GDP of 12,095 bn EUR. In the years 2006 to 2015, the direct market size of Open Data has grown more rapidly than the combined GDP of the EU28+, due to the high Open Data Maturity of the EU 28+ countries. For 2015, the combined GDP is forecasted to reach 14,847 bn EUR. This is an increase of 22.8% compared to 2005. However, the direct market size for Open Data in 2015 is estimated at 51.3 bn EUR, equal to 0.35% of the EU 28+ GDP. This is an increase of 49%.

For the period 2016-2020, the GDP is estimated to grow with the forecasted inflation figures only. This will lead to a GDP of 15,998 bn EUR in 2020, an increase of 7.7% compared to 2015. In this period, the direct market size of Open Data will have increased from to 51.3 bn EUR in 2015 to 75.7 bn EUR in 2020. The market share of Open Data as a percentage of GDP will have increased to 0.47%. This is a 36.9% increase in market share compared to 2015. Table 8 provides an overview of the expected share of Open Data per annum for the entire period. Figure 22 shows the forecasted increase in the share of GDP.

| | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|
| Share of GDP | 0.37% | 0.39% | 0.42% | 0.44% | 0.47% |

*Table 8 - Forecasted share of direct Open Data in EU 28+ GDP, 2016-2020*

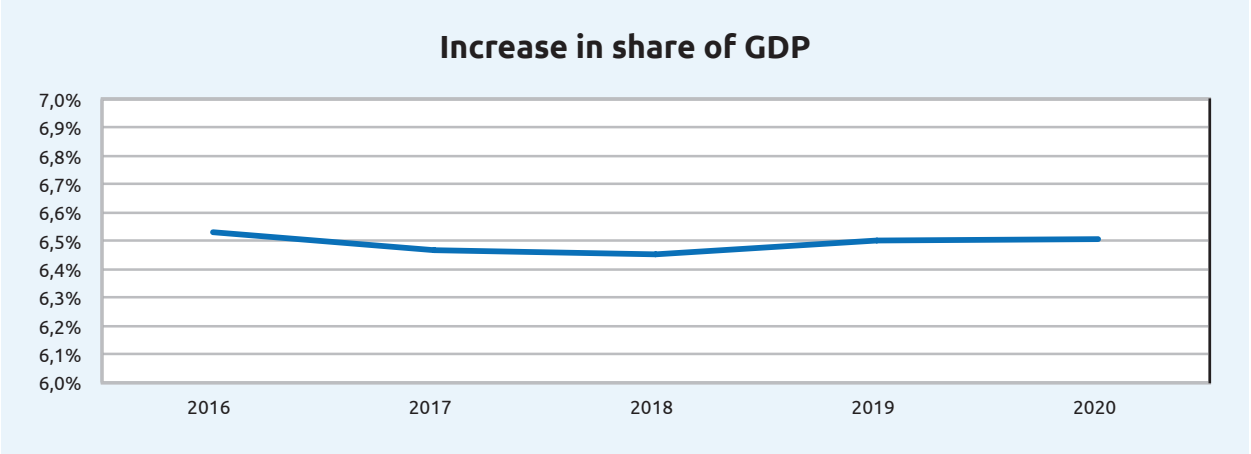



*Figure 22 - Forecasted increase in share of direct Open Data in EU 28+ GDP, 2016-2020*

### 7.1.3 Open Data market size per sector

Open Data per definition cross-cuts through different sectors of the economy. This had already been identified and quantified by DemosEurope & WISE by assigning different weight factors to the sectors. Furthermore, the McKinsey study illustrated potential growth. The sectors identified overlap largely with the sectors defined by Eurostat, as was illustrated in Section 5.3.1.

The weight factors derived from the DemosEurope & WISE research were combined with the sector size figures of Eurostat, measured in percentage of GDP. The GDP figures per country were used to calculate the aggregated EU28+ weighted percentages per sector. Public administration is by far the sector that will gain the most from opening up data, as can be seen in Table 9, confirming that the public sector is the first re-user of its own data. For agriculture, and the arts and entertainment sector, the benefits expected are smaller. Open Data still has a lot of potential in these sectors but will take more time to reach the full potential.

Using the weighted factor of Open Data value, the direct and total market size of Open Data for the EU 28+ can be divided over the sectors. The results for 2020 can be found in Figure 23 and Figure 24. For the total market size per sector, the higher bound ratio from Shakespeare is used.

168 Professional services include scientific, technical, administrative and support services
169 Public administration includes defence, education, health and social work activities

| Sector | Weighted factor |
|---|---|
| Agriculture | 0.50 |
| Industry | 13.27 |
| Construction | 3.58 |
| Trades & Transport | 13.15 |
| ICT | 8.90 |
| Finance and Insurance | 8.06 |
| Real estate | 11.88 |
| Professional services [168] | 10.95 |
| Public administration [169] | 29.21 |
| Arts, entertainment, recreation | 0.50 |

*Table 9 - Weighted factor of Open Data value per Eurostat sector*

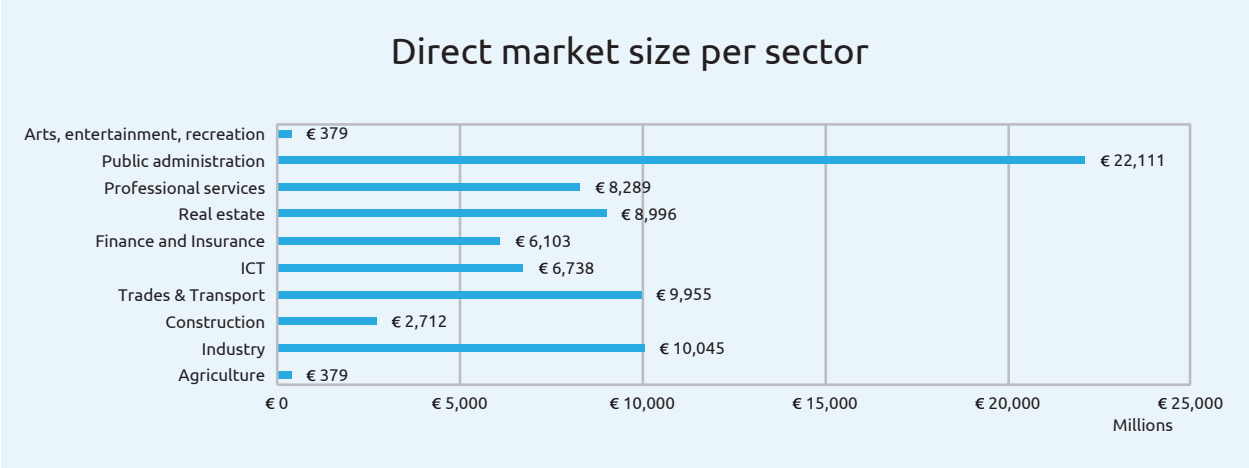



*Figure 23 - Direct market size of Open Data per market sector for EU28+ in millions, 2020*

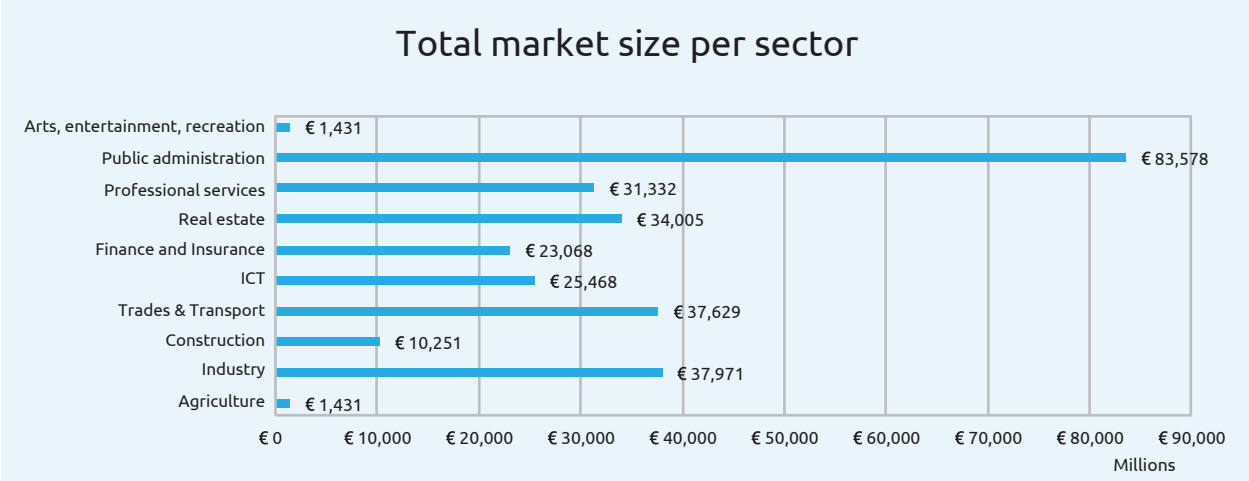
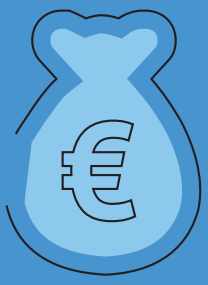
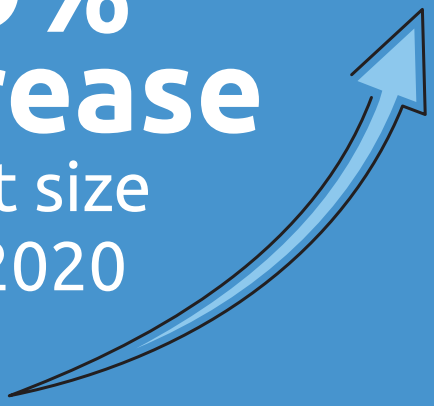



*Figure 24 - Total market size of Open Data per market sector for EU28+ in millions, 2020*

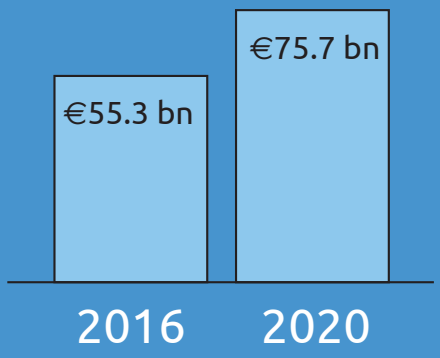
# € 325 billion
direct market size
for period 2016-2020

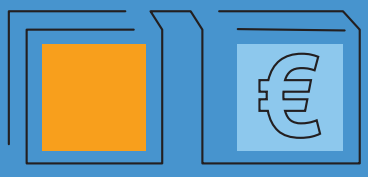


# 36.9% increase
market size
2016-2020

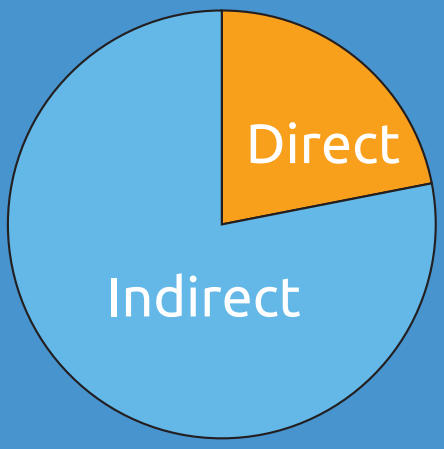


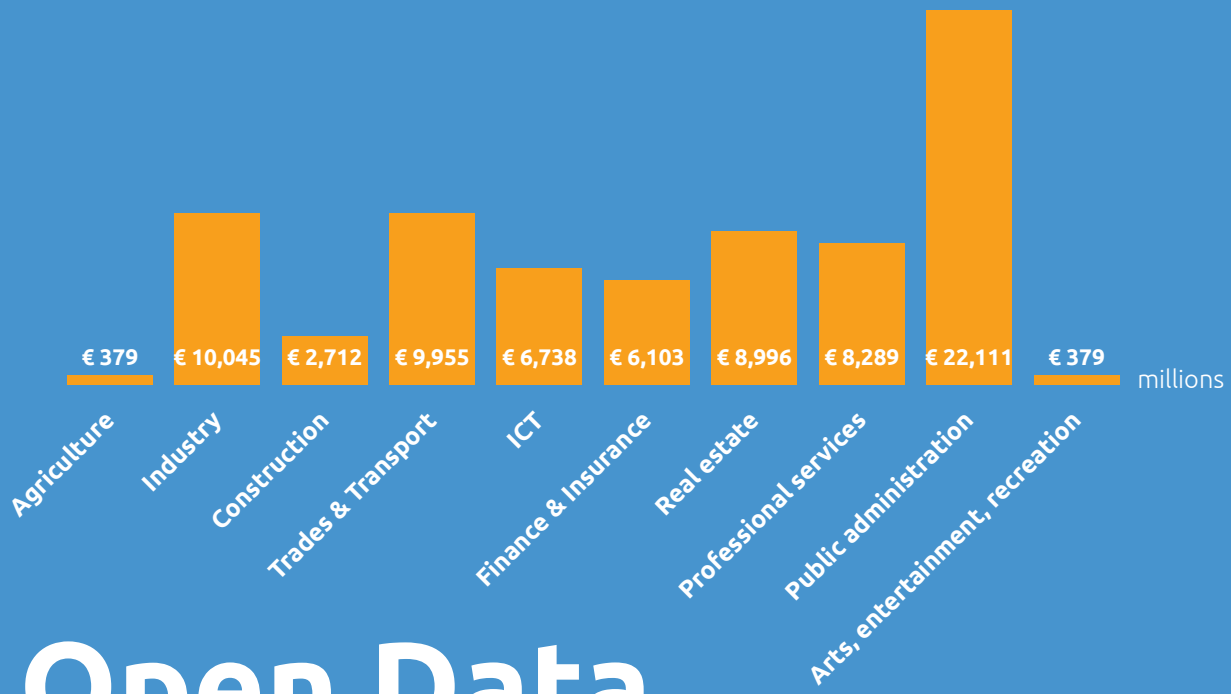
## Direct market size



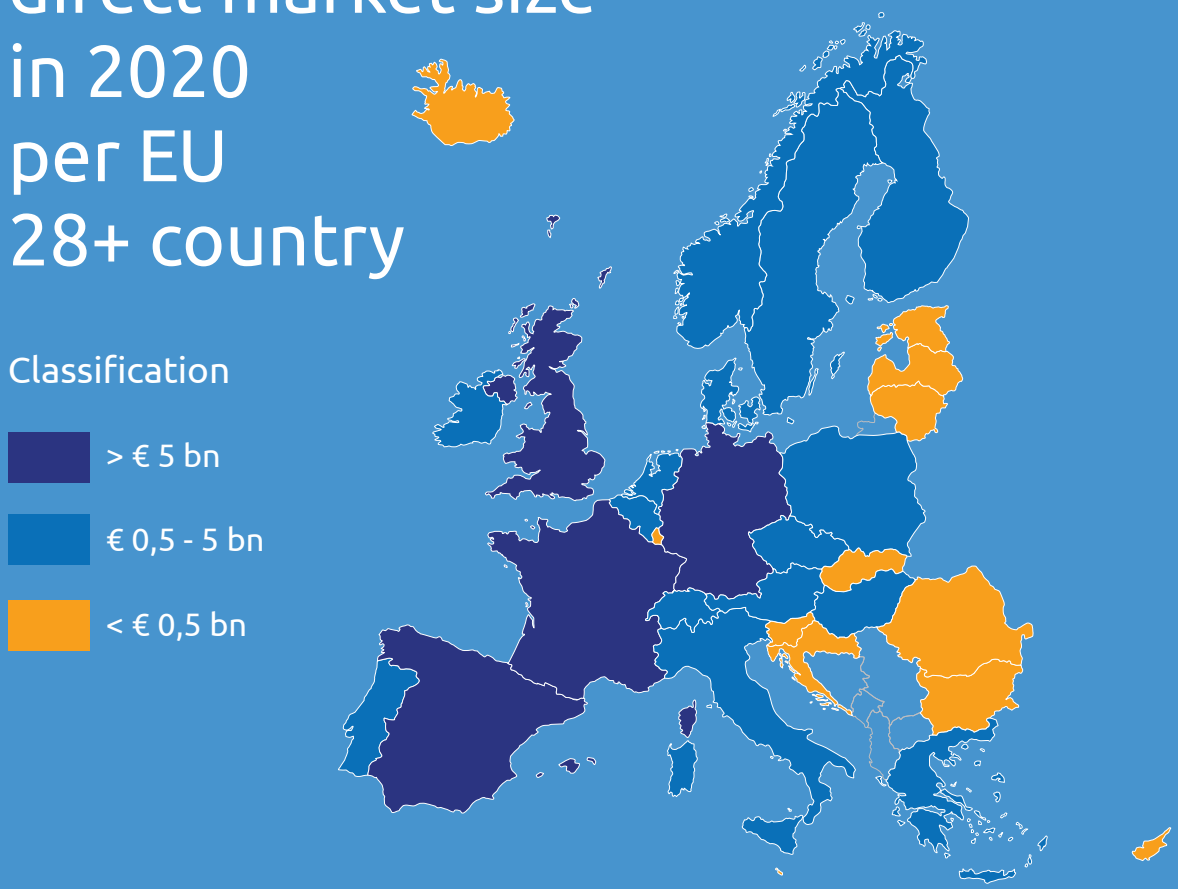
## Total market size






# Open Data per country

## direct market size in 2020 per EU 28+ country



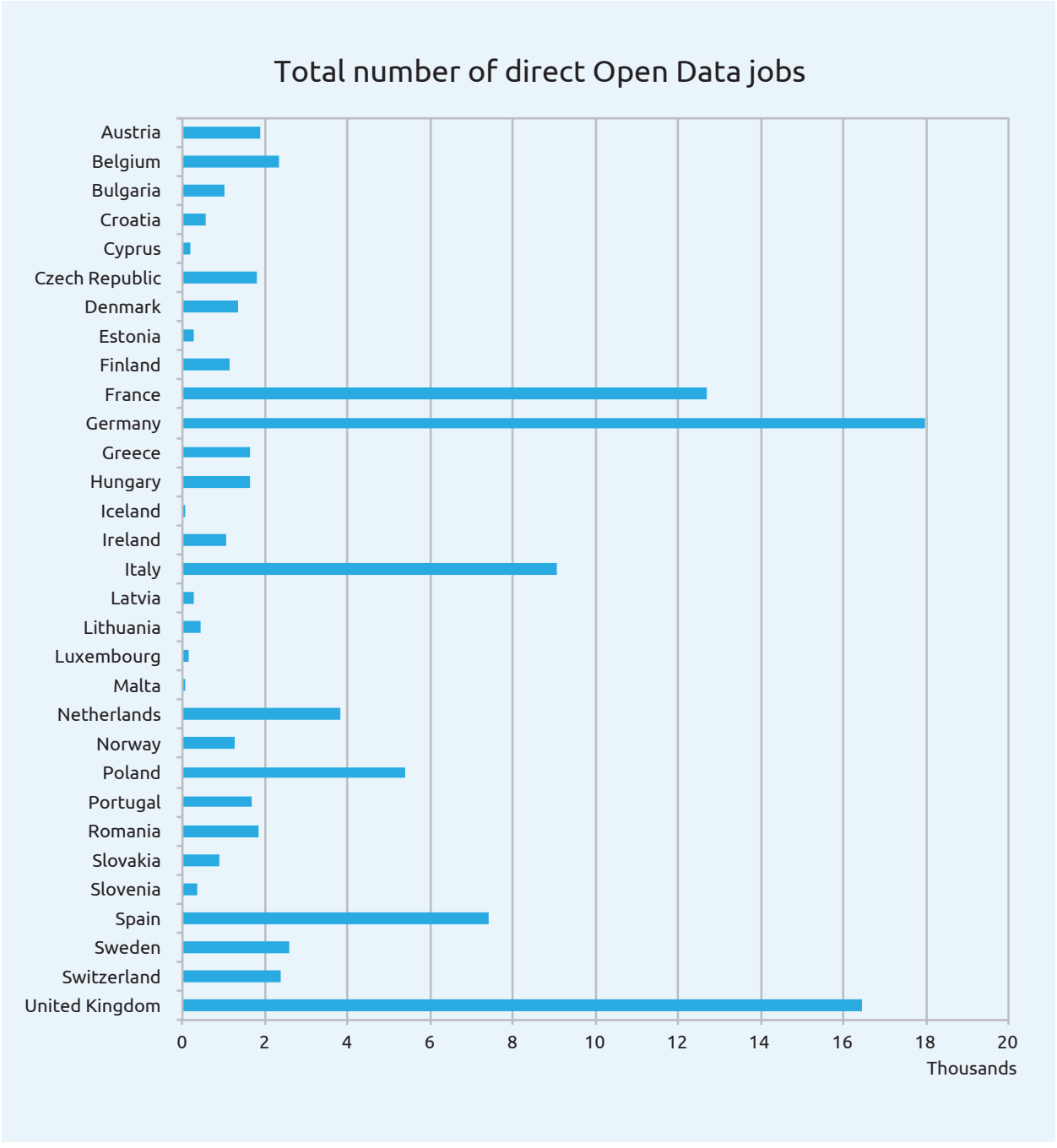



*Figure 25 - Total number of direct Open Data jobs per country, 2020*

### 7.2 Number of jobs created

The metric for the number of jobs aims at determining how many jobs directly related to Open Data will be created in the EU 28+ by 2020. In total, the EU28+ employed 219,936,400 people in 2014.[170] Within the EU28, 212,866,400 persons of the working population were employed. Thus Switzerland, Norway and Iceland together employed 7,070,000 persons in 2014. Cedefop's medium term forecasts indicate that the job market in the EU is expected to grow on average with 0.55% per annum up to 2020,[171] increasing employment to a total of 226 million persons in 2020 for the EU28. This growth is lower than the expected growth in GDP since employment recovery from the financial crisis is expected to be more modest and lagged.[172]

In 2014, 79.6 million persons were employed in knowledge intensive jobs within the EU28+.[173] Compared to the overall number of persons employed within Europe, 36.1% of the employed persons were employed within jobs consisting of knowledge intensive activities. Based on the data from the Spanish studies,[174] a range of Open Data jobs as a percentage of knowledge intensive jobs can be determined. As a lower bound, it can be assumed that the number of jobs directly related to Open Data was 0.074% of the knowledge intensive employment. For the upper bound, it can be assumed that the number of jobs is equal to 0.082% of knowledge intense employment. For the middle bound, the percentage is set at 0.078%.

Based on the expected development of the employment of persons in knowledge intensive activities and the expected growth in Open Data Maturity, the number of jobs per annum for the period 2016-2020 can be calculated, as can be seen in Figure 26. The upper, middle and lower bound of Open Data jobs are taken into account in the forecasts as well, providing a range for the forecasted number of direct jobs per annum in the EU28+ for the period 2016-2020.

Besides the total number of jobs directly related to Open Data in the EU 28+, the number of jobs per country is calculated. Figure 25 shows the total number of direct jobs in 2020 per EU 28+ country.

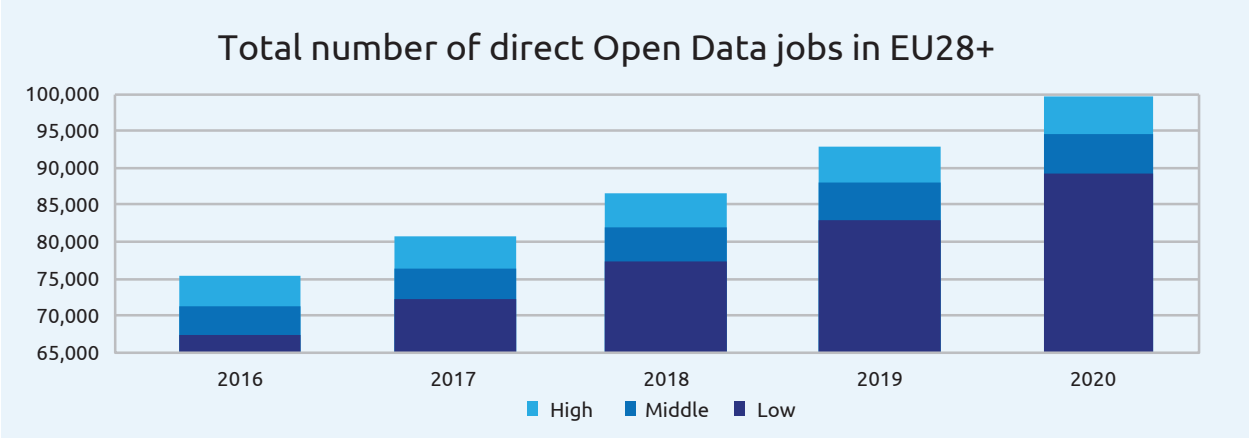



*Figure 26 - Forecasted total number of direct Open Data jobs (in persons) per annum, 2016-2020*

170 http://ec.europa.eu/Eurostat/web/lfs/data/database?p_p_id=NavTreeportletprod_WAR_NavTreeportletprod_INSTANCE_IFjhoVbmPFHt&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-2&p_p_col_count=1
171 Cedefop (2010)
172 Cedefop (2010)
173 http://ec.europa.eu/Eurostat/web/products-data sets/-/htec_kia_emp2
174 Datos.gob.es (2011), Datos.gob.es (2012), Datos.gob.es (2014)

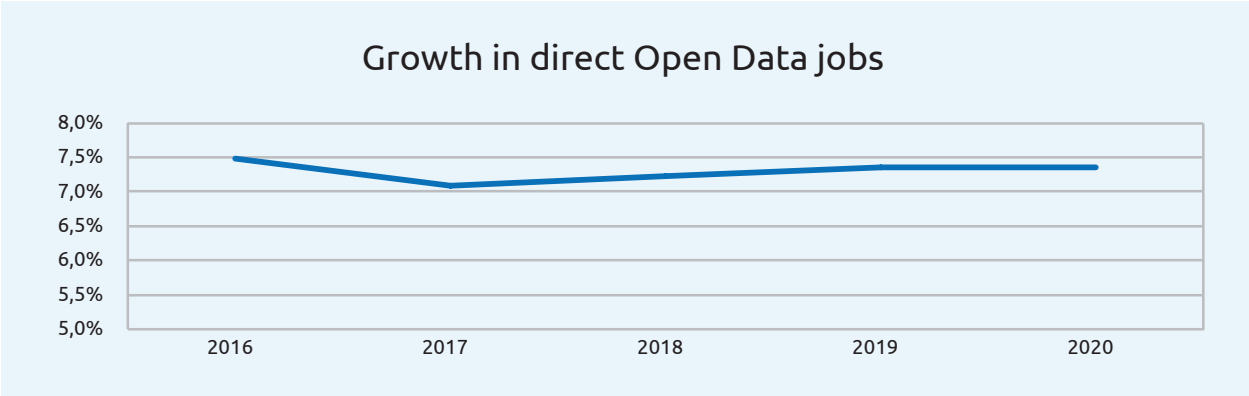



*Figure 27 - Percentage growth of total number of direct Open Data jobs, 2016-2020*

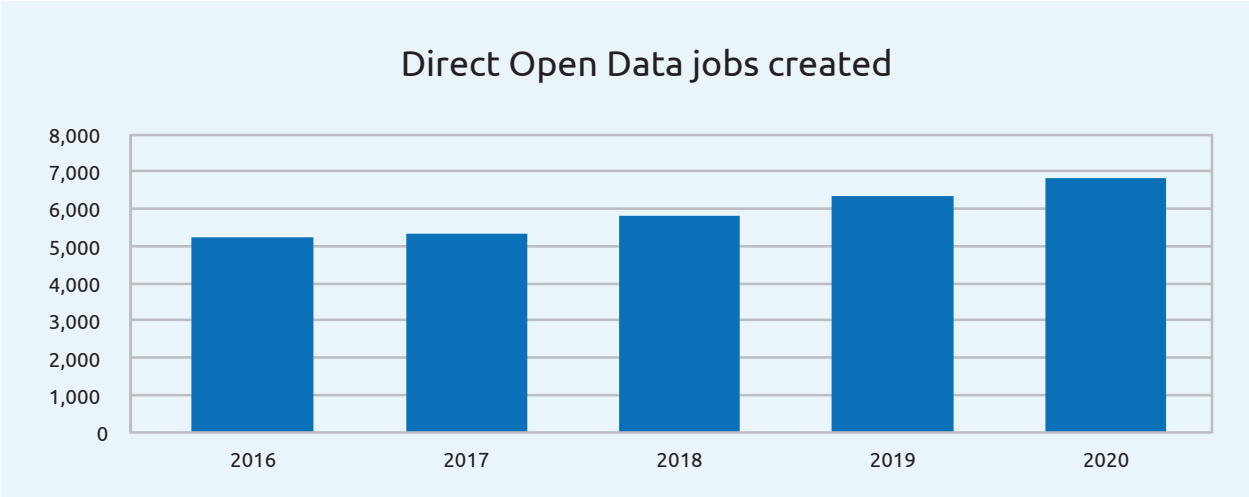



*Figure 28 - Number of created direct Open Data jobs, 2016-2020*

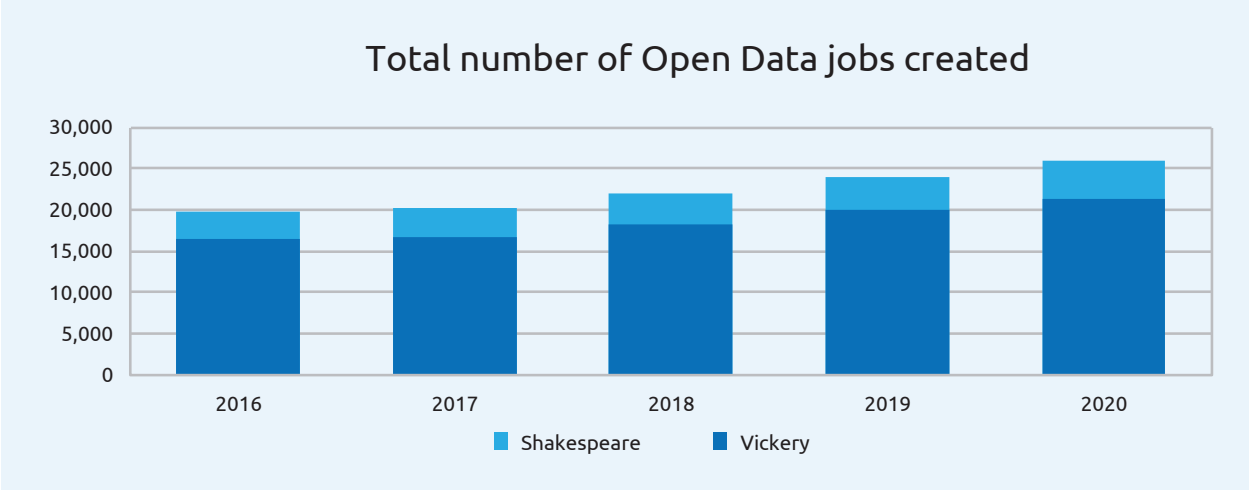


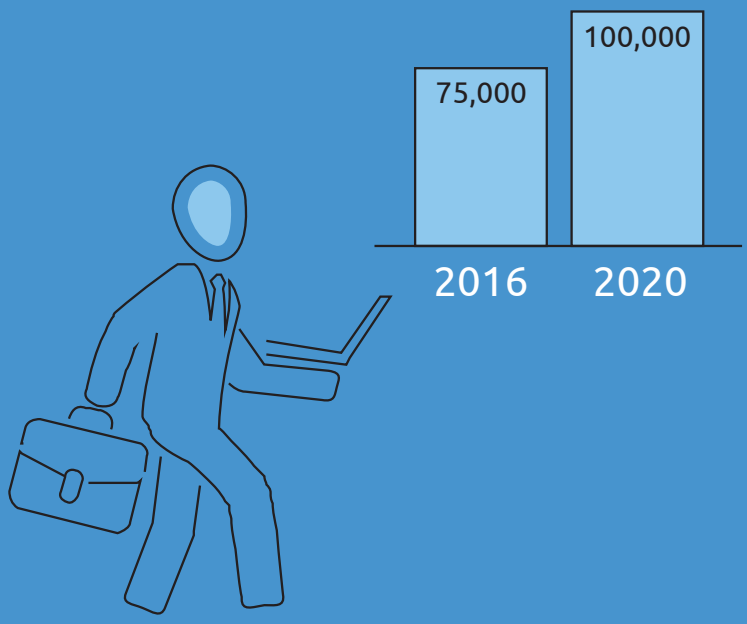

*Figure 29 - Number of created direct Open Data jobs, 2016-2020*

The forecasted total number of direct Open Data jobs in 2016 has an upper bound of 75,400 jobs. By 2020, the upper bound provides a forecast of just under 100,000 jobs for the total number of direct Open Data jobs. This equals a growth of 32% over a 5-year period. Per year, the increase in number of jobs is forecasted to grow on average with 7.3% as can be seen in Figure 27. The growth is highest in 2016 due to the high expected growth in employment in the EU28+. For the period 2017-2020, the forecasted growth in employment per annum is equal. Therefore, the difference in growth is caused by the difference in the Open Data growth rate. This rate is lower in 2017 than in following years. Because the expected Open Data growth and forecasted employment growth only differ slightly for 2019 and 2020, the growth percentage stabilises just under 7.4% in these years.

In the period of 2016-2020, the total number of Open Data jobs increases with almost 25,000 direct Open Data jobs. Every year new Open Data jobs are created. As can be seen in Figure 28, in the period 2016-2020 more than 5,000 Open Data jobs are created within the EU 28+ per year.

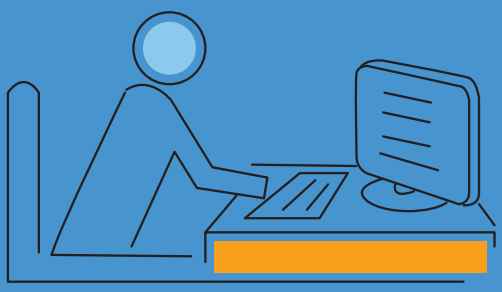
Besides knowing the number of jobs created directly in the field of Open Data, it is very interesting to know the total number of Open Data jobs created, including direct and indirect jobs. However, no ratios exist to calculate the number of total jobs when the number of direct jobs is known. As an estimate, the market size ratios by Vickery and Shakespeare can be used to calculate the number of total Open Data jobs. Vickery calculated a ratio of 3.5 whilst Shakespeare came to a ratio of 3.78. If these ratios are used, the number of total Open Data jobs in 2020 is estimated at 312,600 to 377,000 in total. The number of total jobs created in the period 2016 and 2020 is estimated at 92,500 up to 112,000 for the EU28+. Figure 29 shows the number of total Open Data jobs created per year for the period 2016-2020.

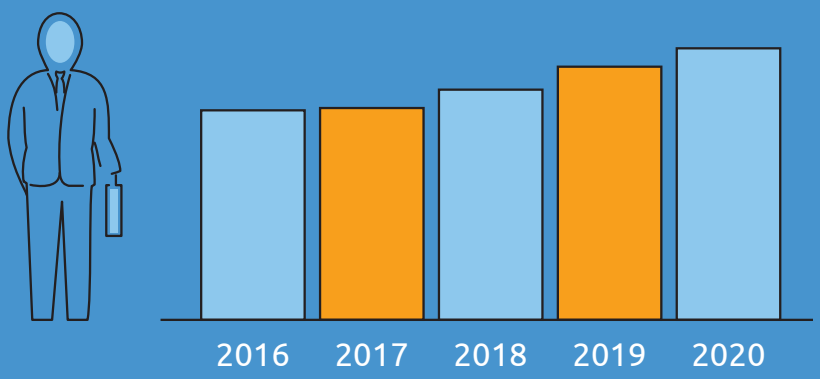
# Open Data jobs in the EU28+

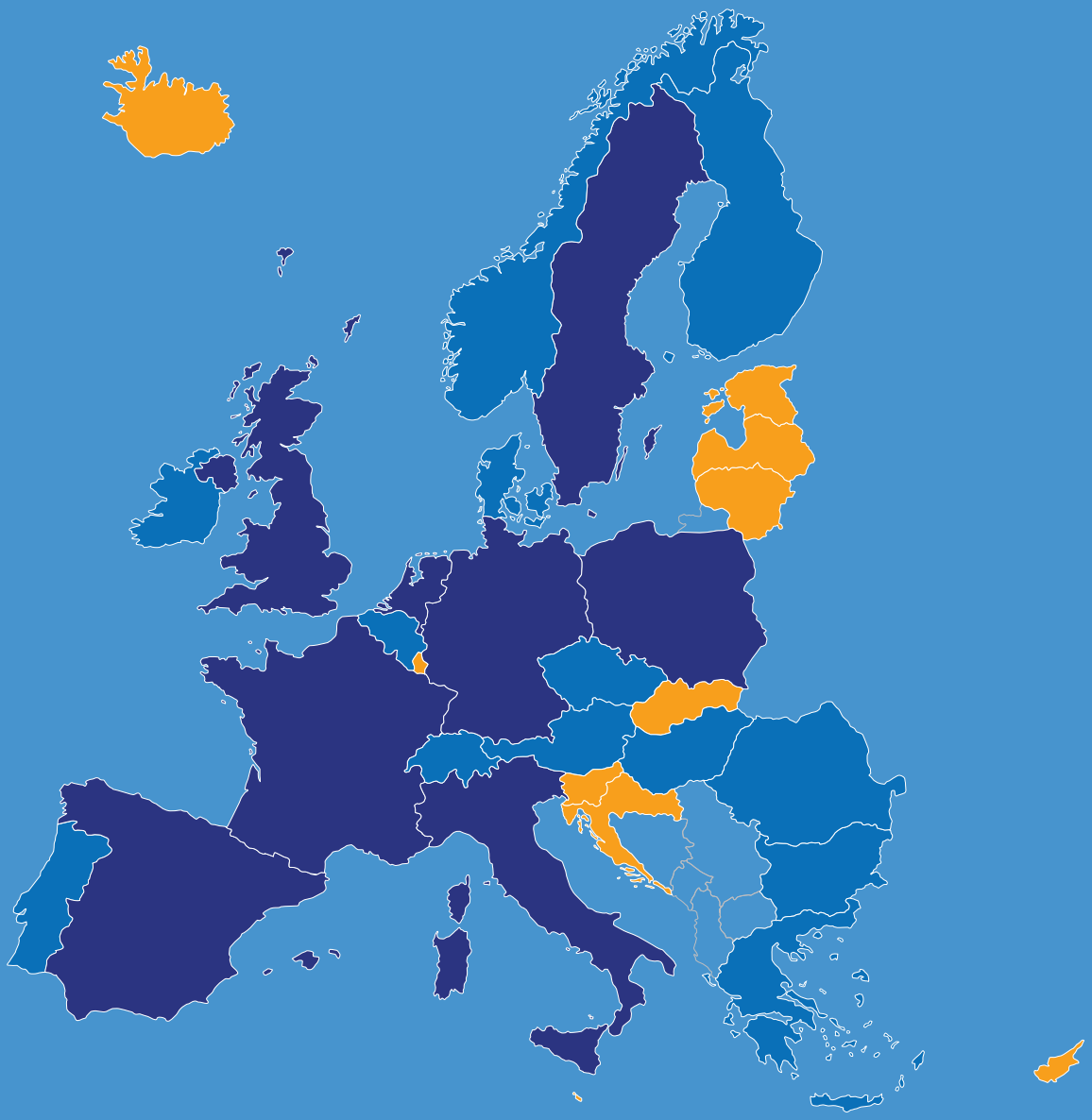



**25,000**
jobs created

**7.3%**
average increase
Open Data jobs







Classification

- > 2500 jobs
- 1000 - 2500 jobs
- < 1000 jobs

### 7.3 Cost Savings

Many administrations seek to further understand the cost savings they can realise thanks to Open Data. This indicator focuses specifically on this aspect. The method applied consists in assessing the cost savings part of the Houghton equation for public authorities or so-called agencies, as was explained in Chapter 6.

The estimation of the Danish government of 35 million EUR in cost savings in 2020 is used to calculate a cost savings percentage to be applied to all countries. Based on the forecasted Danish GDP for 2020 and the average government expenditure in the period 2010-2014, the cost savings can be estimated at 0.22% of the Danish government expenditure expected in 2020.

This approach can be sized to all other European countries. If the same principle is applied to the forecasted 2020 GDP of the other EU28+ countries, whilst taking into account their respective government expenditure averages, the cost savings per country can be calculated. These numbers can be found in Figure 30. The accumulated cost savings for the EU28+ in 2020 are forecasted to equal 1.7 billion EUR.

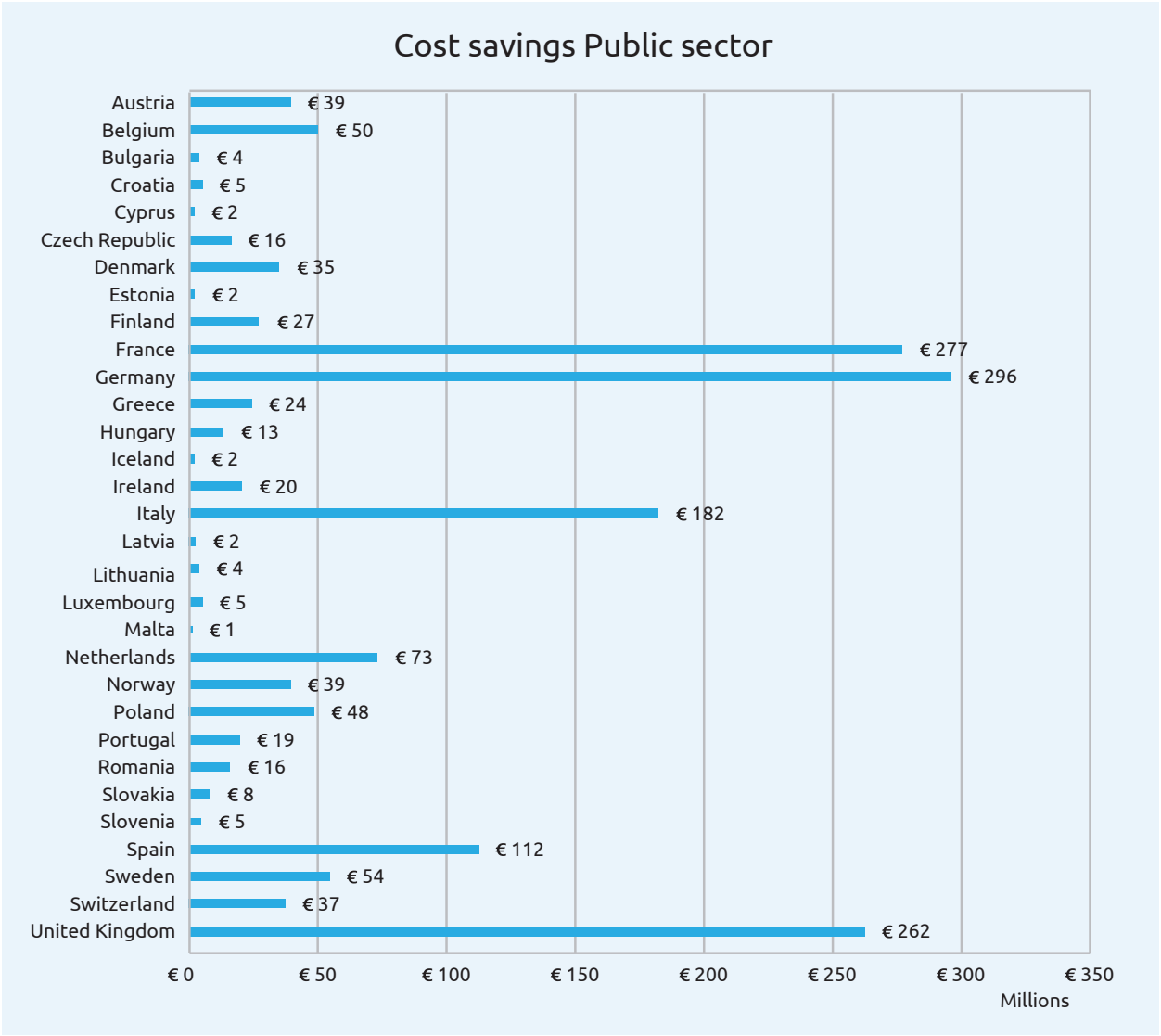
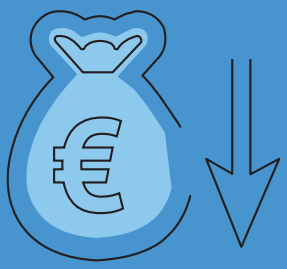
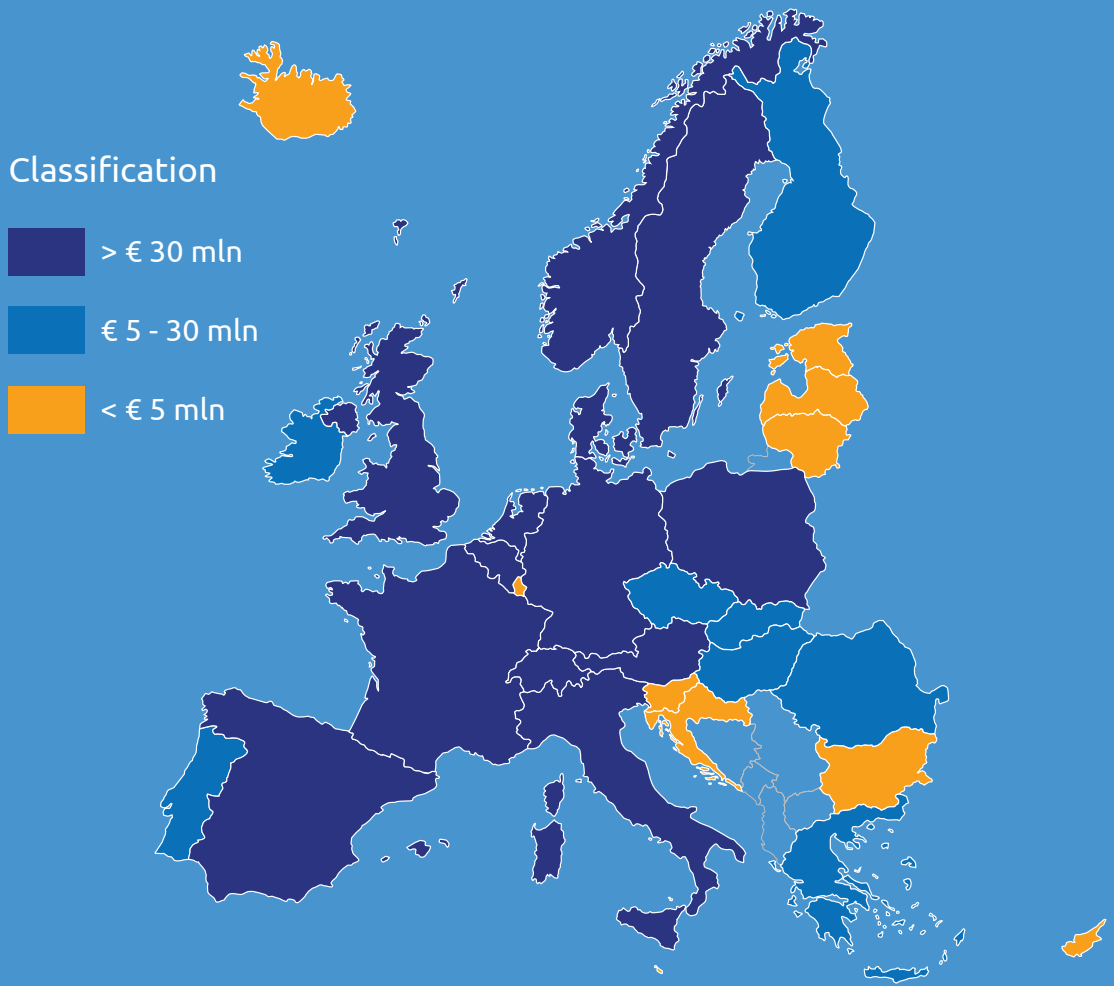



*Figure 30 - Cost savings on government expenditure per EU 28+ country, 2020*



# € 1.7 billion saved

## in costs EU28+ for Public Administrations in 2020



*"Better decision making is one of the main benefits of Open Data sharing."*

### 7.4 Efficiency Gains

The aim of efficiency is to improve resource allocation so that waste is minimized and the outcome value is maximised, given the same amount of resources.[175] To be able to make use of data, it is important that it is available under an open licence to be able to use it freely. Furthermore, if the discoverability of the Open Data is high, more people are able to find it and profit from the advantages that the use of Open Data enables. Openly sharing data can reduce search costs and make monitoring easier. It enables faster and easier access to information, better resource allocation, increased automation, standardisation and interoperability.

**OpenCoesione**[176]
The OpenCoesione website focuses on projects that are financed by Italian the department of Cohesion Policies (Dipartimento per le Politiche di Coesione). It shows how (much) money is spent on different subjects in different regions, with visualizations. The data are published for the public to assess whether the projects that are financed meet their needs and if resources are used effectively. By doing so, citizens are able to understand how this specific department within the government is spending their money and thereby transparency is increased.

Better decision making is one of the main benefits of Open Data sharing, also known as "data-driven decision making". This expression is often associated with the use of Big Data, which is defined as "high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making".[178]

**RomaScuola**[177]
In Italy a tool was developed to compare schools depending on such facets as frequency of teacher absence, internet connectivity, use of IT equipment for teaching, frequency of students' transfer to other schools and quality of education in accordance with the percentage of issued diplomas. The information provided is updated periodically based on data from Ministry of Education and RomaCapitale.

Better decision making is one of the main benefits of Open Data sharing, also known as "data-driven decision making". This expression is often associated with the use of Big Data, which is defined as "high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making".

**What Works Network**[179]
In the UK, the "What Works Network" initiative was introduced and is based on the principle that decision-making should be informed by the best available evidence on both what works and what does not work. It aims to improve the way government and other organizations create, share and use high quality evidence for decision-making. It also collects evidence on the effective implementation of current policy programmes and practices. The initiative should encourage practitioners, commissioners and policy-makers to use these findings to inform their decisions.

175 Jetzek et al. (2013a)
176 http://www.opencoesione.gov.it/
177 http://blogs.worldbank.org/ic4d/open-government-data-helping-parents-find-best-school-their-kids
178 http://www.gartner.com/it-glossary/big-data
179 https://www.gov.uk/what-works-network

Open Data is a subset of Big Data. Decisions are based on available information gathered from many different sources. For example, data is used by individuals to decide which car to buy, holiday to book or education to choose. In general, more data provides more potentially useful insights. Therefore, more Open Data can help individuals, businesses and the government to make better decisions based on more information available.

**MapReplace**[180]
A Google Chrome Extension from Norway that will replace Google Maps with other mapping services on any web site. MapReplace replaces Google Maps with maps from the Norwegian Mapping Authority, Finn.no (Norway) or Open Street Map. The benefit of replacing Google Maps with other map providers is that they provide better maps for certain areas. For example, the maps from the Norwegian Mapping Authority provide maps of superior accuracy for Norway.

The fact that new data is available that was not accessible before stimulates creative minds to look into new business opportunities. Most of the examples available regarding the use of Open Data in businesses come from start-ups. Germany and the UK have the highest number of start-ups in Europe. Especially in London the start-up economy is growing rapidly and is responsible for about 27% of all new London jobs.[181] However, larger companies are able to use Open Data to gather important information more easily. For example, airlines will use Open Data on passenger traffic, place of residence, nationality etc. as a means to inform their decision about opening new routes.

**UC**[182]
UC is a Swedish company active in the Finance and Insurance sector. The company creates analyses to make decisions for banks and companies easier. They provide companies, banks and individuals with credit reports, based on Open Data from various sources. This includes Open Data obtained via (amongst others) the tax authority, land surveys, District Court, companies, and registration offices. Also income data, marital status, and property information reports are used.

Open Data is not used only by the private sector, but by the public sector as well. Municipalities are linking different projects such as the creation of smart cities. A smart city uses digital technologies to enhance quality and performance of urban services, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens.

**CitySDK project**[183]
As a project funded by the European Commission, the CitySDK project is helping cities to open their data and giving developers the tools they need on how to deliver services in urban environments. Applications for mobile devices can be more easily developed including location and opening hours of tourist attractions, historical background information for specific buildings or transportation schedules. Combining information from all local sources enables better decision making for citizens on where to go to and how to get there.

*"Open Data is not only used by the private sector, but by the public sector as well."*

180 https://github.com/follesoe/MapReplace
181 http://www.theguardian.com/media-network/2014/nov/13/uk-germany-europe-tech-digital-startups
182 www.uc.se
183 http://www.citysdk.eu/about-the-project/

**Kannattaako kauppa**[184]
A Finnish website is providing a service which is forecasting the price of a square meter in a house or apartment. Based on Open Data from Statistics Finland, they modelled Finnish apartment prices and their trends on zip-code level, in the years 2005–2014. Then, price trends have been predicted for the year 2016 using advanced statistical modelling. The estimates from the model are available as an interactive visualization.

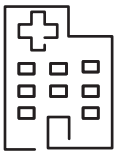
*"The number of healthcare providers that recognise the value of Open Data is growing."*

As shown in the examples, efficiency is an important factor in all companies of all sectors. To provide an illustration of the potential gains, three exemplar indicators are assessed and detailed. The first one is how Open Data can **save lives** through efficiency gains. The second one is **time saving** in the transportation sector. This sector is more mature in terms of sharing and using Open Data throughout Europe and will give a good indication of the potential benefits of Open Data for other sectors. The last one is focused on **environmental benefits**, as this is a subject of growing importance and will cross-cut through most if not all sectors of the economy.

### 7.4.1 Life saving

The number of healthcare providers that recognize the value of Open Data is growing. All European countries have a separate health section on their national Open Data portals and indicate that the healthcare data sets are among the most downloaded data sets.[185] The advantage of providing open healthcare data is to get better insight in the quality of healthcare. It does not only help patients to choose a healthcare provider based on treatment outcomes, but stimulates healthcare providers to share best practices as well.

The NHS shared MRSA bacteria infection rates per hospital in the UK.[186] By making these data available, it was possible for hospitals with high infection rates to contact the hospitals that were performing better and learn from their approach. Taking measurements to increase efficiency can save lives. Not only in the healthcare sector directly, but also other fields where life threatening situations occur. To obtain an estimate of the lives that can be saved by using Open Data, it is necessary to look at some health statistics first.



Besides, within the health care sector, there are several other ways in which Open Data can be used to save lives. By arriving earlier at the scene, fire brigades can make a larger difference. If information is available in

**LuckyMe**[187]
A Czech application called "LuckyMe" for iPhone and Apple Watch lowers the risk of users of getting mugged or assaulted. Unlike crime maps it reports the situation in an actual location at an actual time. A quick look at a watch or a phone shows the actual risk rate on a grade from 1 to 5 - one can for example check the risk rate before entering a dark street. Single incidents can be reported as well by users, either a prefilled option (robbery, intoxicated person, fight, assault, vandalism) or just as a subjective feeling from a given location on a grade 1 to 5. The risk rate is calculated from three data sources: data from ambulance, data from municipal police and data reported by users. Public datasets accordingly are filtered; we take only a selected type of incidents.

184 http://kannattaakokauppa.fi/
185 Capgemini Research (2015)
186 Capgemini (2013)
187 https://www.ackee.cz/blog/ackee-pragehacks-idea-stestickunaproti/

real-time, fire-fighters can arrive are at the scene of the fire sooner, increasing the chance of survival for people trapped in a fire. Another major cause of death which can potentially be reduced by using Open Data is related to road fatalities. Also, opening up crime figures has the potential to save lives.

### Cardiac arrest

Cardiovascular diseases, cancer and chronic obstructive pulmonary disease are the most common causes of death and account for 80% of the deaths in Europe.[188] Amongst these, disease of the circulatory system, i.e. heart disease, is the most important cause of death before the age of 65. It accounts for nearly 50% of the deaths for that age group. Cancer is the second leading cause (20%), while injuries and poisoning are responsible for 9% of deaths. In 2013, 350.000 European citizens were having a cardiac arrest outside the hospital environment.[189] It is important to be at the emergency location in time, because the outcome of a cardiac arrest is depending on the timing of the help received. If effective cardiopulmonary resuscitation (CPR) is administered within three to five minutes, it can double or triple a victim's chance of survival.[190] Every minute without CPR and defibrillation reduces the chance of survival by 10%.[191] Therefore, every minute counts. Open Data can help achieve this by analyzing where to place equipment and station personnel.

It is not only helpful in determining where to put the defibrillators, but Open Data can also be used to guide trained personnel to the emergency location. When the response time is decreased, the survival rate is increased.

**PulsePoint** [193]

In multiple countries, an application for mobile devices based on Open Data is introduced that decreases response time in case of a medical emergency and increases survival rates. Applications with the highest potential of saving lives are focused on preventing death by cardiac arrest. In the US the most popular application is called PulsePoint and combines 911 calls with location data. It is thereby not only able to point people that are trained to provide CPR in the right direction of the victim, but also to the nearest publicly accessible defibrillator.

**Trafford council** [192]

An officers group in Trafford was asked to find out where to put new Automated External Defibrillator (AEDs). To be able to do that, they mapped ambulance request data against openly available demographic and health indicators (e.g. physical activity, demographic details, obesity levels, mortality rates, and cardiovascular disease). To figure out the best places to put defibrillators, a crowd map with the locations of existing units was made to identify the gaps. After the identification of the locations that required a defibrillator, companies within a 500 meter radius were asked to contribute. The current map includes 72 defibrillators.

188 http://www.euro.who.int/__data/assets/pdf_file/0004/185215/Leading-causes-of-death-in-Europe-Fact-Sheet.pdf
189 http://www.gezondheid.be/index.cfm?fuseaction=art&art_id=14986
190 http://gcn.com/Articles/2015/04/14/Rescue-apps.aspx
191 https://londonsairambulance.co.uk/our-service/news/2014/08/goodsam
192 https://traffordinnovationlab.wordpress.com/category/digital-social-innovation/open-data-digital-social-innovation/
193 http://www.pulsepoint.org/

Open Data could be helpful to increase real-time access to necessary information and thereby enables a faster response when someone is in need of medical assistance. In the US, it was estimated that opening up private healthcare databases could have saved 90,000 people from getting unnecessary heart attacks and could have prevented 25,000 deaths in the US alone.[194] This emphasizes the importance of opening up not only government data, but private data sets as well.

*"Open Data could be useful to increase real-time access to information."*

**GoodSAM** [195]
In London (UK) a similar application was introduced. GoodSAM is an app that uses GPRS technology to alert trained first responders that are close to the emergency location. People who downloaded the application are able to press a button to call for help while their location is being identified. There are 5,000 medical emergencies in London each day, but also thousands of individuals that are able to provide medical assistance while waiting for an ambulance to arrive.

## Diabetes

One of the most common diseases nowadays is diabetes. There are about 60 million people with diabetes in Europe.[196] This is equal to 10.3% of men aged 25 and over and 9.6% of women. Open Data can contribute to better decision making by the individual patient. Meal planning is an important part of daily life for someone with diabetes, because a good schedule helps patients to prevent blood sugar levels from extreme highs and lows. Information regarding the amount of fat, carbohydrates and proteins should be available for all types of food to put together a healthy meal. Sanofi, a multinational pharmaceutical company, is committed to improving global diabetes management. Since 2011 they organize the Data Design Diabetes Innovation Challenge which aims at combating diabetes by integrating Open Data with human-centred design.[197] Every year a winner is chosen that is rewarded with $100,000 (EUR 91,089) for their innovative concept to be further developed.

**Ginger.io** [198]
The first winner of the Data Design Diabetes Innovation Challenge in 2011 was ginger.io. Sensor data collected through your smart phone combined with self-reported information is used to identify people who may need help. Healthcare providers receive a warning when there are changes in behaviour so they are able to deliver support to the patients at the moment they need it. Hence, healthcare providers are able to provide treatment and support more efficiently.

The Euro Diabetes Index 2014 also indicates that prevention is an area for improvement. European data on obesity show that in a number of European countries more than 25% of the adult population is considered to be obese (BMI >30). It is important to share data regarding diabetes prevention to learn from best practices. Sweden is considered the country with the best diabetes care.[199] As it was the only country that could provide data regarding all 28 indicators (subcategories Prevention, Case finding/Screening, Range and reach of services, Access to treatment/care, Procedures, Outcomes) that were taken into account, Sweden's best

194 http://techcrunch.com/2013/01/18/we-must-choose-privacy-or-medical-breakthroughs/
195 https://londonsairambulance.co.uk/our-service/news/2014/08/goodsam
196 http://www.euro.who.int/en/health-topics/noncommunicable-diseases/diabetes/data-and-statistics
197 http://www.datadesigndiabetes.com/
198 https://ginger.io/
199 http://www.healthpowerhouse.com/files/EDI-2014/EDI-2014-report.pdf

performance could be explained by the fact that they know what they are doing. This emphasizes the importance of gathering data regarding diabetes diagnosis and treatments to learn from. Data on quality indicators is also being collected in Sweden and guarantees continuous quality assessment of diabetes care. Providing those data to all diabetes care providers makes comparison possible and thereby stimulates quality improvement.

**Connect & Coach** [200]
The first winner of the Data Design Diabetes Innovation Challenge in 2011 was ginger.io. Sensor data collected through your smart phone combined with self-reported information is used to identify people who may need help. Healthcare providers receive a warning when there are changes in behaviour so they are able to deliver support to the patients at the moment they need it. Hence, healthcare providers are able to provide treatment and support more efficiently.

### Fire Department

Next to using Open Data for medical emergencies, it is also possible for the fire department to save lives. It is estimated that in 2004 over 8.000 people died in fires in the 27 countries of the EU.[201] More recent figures are only available for 21 EU countries in 2010 (excluding France and Belgium) with 3.235 deaths.[202] For fire-fighters, data is important to improve decision making. Data regarding works and other activities on the road, the presence of hazardous materials in buildings and water depths including obstacles below surface are very important for fire-fighters. The risks will be lower when this information is available in real-time and the chance of survival for people trapped in a fire will be higher, as the fire-fighters are at the scene of the fire sooner. They are able to make better judgments about the risks and equipment needed by using Open Data regarding the building they are on their way to.

**London Fire Brigade**
The fire brigade of London has developed a tool using public data allowing it to view emergency response times and fire incidents per ward. This means that they are better placed to know where to focus resources.[204] They also use software that lets the fire brigade use a technique known as modelling regression to target places that register as at high risk for fire. In those areas they will carry out home safety checks, advise people on fire safety and fit smoke alarms.[205]

### Road fatalities

Another major cause of death which can potentially be reduced is related to road fatalities. In 2011, more than 30,000 people died on the roads of the EU.[206] The European Commission has adopted the Road Safety Programme which aims to reduce the traffic-related death rate in Europe between 2011 and 2020. The most recent numbers of 2013 estimate the total number of road fatalities to be 25,900.[207] Data for 2014 is not available yet, but it was predicted that the number of fatalities decreased with 1% compared to 2013. The highest number of road fatalities per inhabitants was in Romania, followed by Latvia and Lithuania, while the lowest road fatality rates were reported for Sweden

200 http://phrql.com/connect-coach/
201 Nibra (2009)
202 https://www.genevaassociation.org/media/874729/ga2014-wfs29.pdf
203 https://www.w3.org/2013/share-psi/wiki/images/8/86/Share-psi-2_0-samos-workshop-bartvanleeuwen.pdf
204 http://diginomica.com/2015/07/15/cabinet-office-says-open-data-government-needs-to-go-viral-but-is-whitehall-ready/#.VazvYvntlBd
205 http://www.bbc.com/news/business-21902070
206 http://ec.europa.eu/transport/road_safety/specialist/statistics/index_en.htm
207 http://ec.europa.eu/transport/road_safety/pdf/observatory/trends_figures.pdf

and the UK being the second safest. This is due to the fact that West-European countries are more focused on reducing the number of accidents. Planning has played the biggest part in reducing accidents in Sweden.[208] Roads are built with safety prioritised over speed or convenience. Open Data can also help prevent those casualties. Software that can predict where and when an accident will occur already exists.

**CRASH program** [209]
In London (UK) a similar application was introduced. GoodSAM is an app that uses GPRS technology to alert trained first responders that are close to the emergency location. People who downloaded the application are able to press a button to call for help while their location is being identified. There are 5,000 medical emergencies in London each day, but also thousands of individuals that are able to provide medical assistance while waiting for an ambulance to arrive.

Accident statistics and data analysis are needed to identify trends and to assess the effectiveness of strategies and measures to reduce death and injury. Texting and driving is a major cause of road accidents. It is 23 times more likely to cause an accident while using your phone while driving.[210] The prevalence of talking on a cell phone while driving at least once in the past 30 days among drivers aged 18–64 years ranged from 21% in the UK to 69% in the US in 2011.[211] The prevalence of drivers who had read or sent text or e-mail messages while driving at least once in the past 30 days ranged from 15% in Spain to 31% in Portugal and the US.

**LifeSaver** [212]
This application automatically locks your phone when it detects that you are driving. It also includes a map with an overview of the location of people that were caught texting while driving to stimulate driving safely. If you are unlocking your phone while driving, a text message notification is send to your contact. The LifeSaver app enables monitoring your loved ones.

### Potential lives saved

Based on the number of citizens having a cardiac arrest outside the hospital and the percentage that received CPR from bystanders, **7,000 lives a year** can be saved only by introducing applications that make it possible for bystanders to be at the emergency location **one minute earlier**. This does not even take into account the possibility that a higher percentage of the survivors will be resuscitated by bystanders instead of medical professionals. As it is possible for everyone to access the exact location of an emergency in real-time, the time to get to the location for the ambulances will be reduced as well.

It is difficult to give an estimation of the effectiveness of the CRASH program. However, traffic fatalities have **dropped by 5.5%** in the US. So in theory, when this program would be further developed and rolled out in Europe, it would have a potential of saving **1,425 lives** a year (i.e. 5,5% of the European road fatalities).

## 7.4.2 Time saving

Another interesting way of looking at efficiency gains is through time savings due to better availability of information regarding

208 http://www.economist.com/blogs/economist-explains/2014/02/economist-explains-16
209 http://www.govtech.com/computing/GT-Software-Predicts-When-Where-Accidents-Occur-on-Tennessee-Highways.html
210 http://lifesaver-app.com/
211 http://www.cdc.gov/mmwr/pdf/wk/mm6210.pdf
212 http://lifesaver-app.com/

public transportation schedules and traffic jams. Many cities and public transport organizations provided API's to be used for application development. It is important to focus on reducing travel time, as individuals tend to commute over longer distances.

**Warszawski Ninja** [213]
Warsaw Ninja, in Poland, is an app for public transport users to share information about problems and delays en route. In every big city with a complicated public transport grid citizens experience problems when trains or trams get stuck on the way or if construction works cause delays. Warsaw Ninja allows users to share all transport-related problems in real time allowing them to make informed commute decisions.

Congestion costs in Europe are about 1% of GDP every year.[214] The average commuting time in 2005 in Western Europe was 38 minutes.[215] The commuting time of people using public transport was on average 30-40% longer compared to people travelling by car. Therefore, the average commuting time was higher for countries with a higher percentage of commutes using public transport.

The European average for motorists stood at 5.74 seconds of delay for every kilometre in 2012.[217] In Malta the average is much higher with commutes spending an extra hour of unnecessary travelling. The most congested country in 2014 was Belgium with an average of 50 hours wasted in congestion per person in one year time.[218] Milan was the most congested city with 61.2 hours wasted. Those European nations struggling with high unemployment and low or negative growth in 2013 typically recorded lower traffic congestion than in 2012. Understanding how Open Data can be used to reduce travelling time can be a valuable commodity. Furthermore, a shorter travel time results in lower fuel use and reduced CO2 emission. Paris is facing a smog problem due to the amount of traffic in the city and increasing pollution levels. The amount of PM10 particles, which can cause severe health problems and increase cancer formation, per cubic metre in Paris reached 180 micrograms, more than twice the safe limit of 80 micrograms.[219]

One way of reducing travel time is through a better distribution of all cars that are on the road at the same time. Providing people with an alternative route will increase the distribution on different roads and reduce the length of traffic jams. The most

*"Understanding how Open Data can be used to reduce travelling time can be a valuable commodity."*

**Never Run** [216]
NeverRun is a Czech application for everybody who commutes daily in Prague, showing the public transport in the town. The app shows the position of all transport vehicles around the user. The user then knows if he or she should rush to catch a metro train or relax instead. The app uses data supplied by Magistrát hl. m. Prahy, providing position data of all means of transport.

213 https://konkurs.danepowarszawsku.pl/pl/projekt/warszawskininja
214 http://ec.europa.eu/transport/themes/strategies/doc/2011_white_paper/white_paper_2011_ia_full_en.pdf
215 http://economix.blogs.nytimes.com/2011/10/14/world-of-commuters/
216 http://neverrun.github.io/
217 http://www.independent.com.mt/articles/2015-01-30/local-news/Study-shows-that-delays-on-Malta-s-roads-are-almost-triple-the-European-average-6736129728
218 http://inrix.com/scorecard/key-findings-us/
219 http://www.economist.com/blogs/charlemagne/2014/03/car-ban-french-capital

popular kind of applications for mobile devices based on Open Data is probably those regarding transportation. There are many different applications available, so the examples selected all focus on another aspect of transportation.

**TravelSmarter** [220]

An interesting application that was launched as part of the OUTSMART European project is called TravelSmarter. It provides transport alternatives for the routes that are entered, based on real-time information on the status of the transport system. User's preferences regarding the preferred kind of route – the fastest, the shortest, the cheapest, the most environmentally-friendly or the healthiest route – are taken into account. A pilot was done in the city of Birmingham. This application is focusing on different travel options at the moment that you want to leave.

A more effective way of distributing cars is not only by providing different routes at the same time, but by distributing traffic over time. The chance of traffic jams is much lower if the total number of cars on the road is lower. Commuters all travel during rush hours, because they have to be at work around the same time. Specific regulations are needed to make it possible to work whenever and wherever you want. A trend towards working more from home is emerging in Europe. In the UK, home workers represented up 13.9% of the total workforce employed during the first quarter of 2014.[221]

**Wild! van de Spits** [222]

A Dutch example of using Open Data to reduce travel time is through distributing the number of cars over time. "Wild! van de Spits" uses number plates registration of traffic camera's to select people driving during rush hours and invite them to participate in their project to decrease traffic jams. By rewarding people for travelling outside rush hours, it is possible to reduce individual travel times.

Another important factor that is causing delays for motorists is looking for a parking space. The total number of parking spaces in the 28 EU countries is estimated to be 440 million, approximately two spaces for every passenger car.[223] Each car travels for an average of one hour per day. Every day 20 minutes are lost looking for a parking spot.[224] The average motorist wastes a total of 2,549 hours of their life driving through the streets before finding a space to park.[225] In addition to providing information about parking spaces available, more recent applications have explored how to estimate how long a given car will stay parked. This will in turn provide an estimate of how much time the parking space should be made available by. Also, a lot of applications focus on public transport. As an individual you are bound to the time schedule that exists, but it is possible to reduce waiting time when real-time information is available.

### Potential time saved

The expression "time is money" highlights that time is valuable, because you can use that time to earn money and thereby increase your economic activity. Opportunity costs are the costs that occur, because

220 http://www.ferrovial.com/en/press-room/news/travelsmarter-initiative-reduce-traffic-congestion/
221 http://www.theguardian.com/news/datablog/2014/jun/04/proportion-of-employed-working-from-home-reaches-record-high
222 https://www.wildvandespits.nl/Openbaar/Home.aspx
223 http://annualreport2013.q-park.com/strategy/car-parking-market
224 https://www.mobypark.nl/

**Carambla – Park Smartly** [226]
This Belgian application offers a smart alternative for parking. An "eBay for city parking" where owners list their parking spaces on Carambla. Owners can earn a financial return on excess capacity and benefit from increased security by embracing smart city mobility. Car owners easily find, book and pay for parking after reserving on the website, or directly claiming the spot through the Carambla smart phone app

**Tranquilien** [227]
In France an application is launched that is not only providing information about the time a train leaves, but it is using predictive modelling to indicate which trains have the most seats available. The predictions are based on multiple data sources, like population density, attractive locations, day of the week, time of the day, weather etc. Travellers are able to provide information during their travelling as well.

you did not do something else that would generate value with your time.[228] In this case, while you are stuck in a traffic jam you could have gone shopping and spent a certain amount of money. The money not spent in this period of time is the opportunity cost. It is important for economic growth to minimize the waste of time.

The examples show possibilities to decrease time wasted in traffic jams or waiting on delayed public transport. Instead of spending time waiting, it can better be used working or spending money through shopping, or simply taking a rest, a walk and avoiding health complications. These examples contribute to the economy in different ways, i.e. more time spent to produce money-making products and services as well as buying products that increase the number of sales for a company and thereby their revenue. The amount of time wasted could be reduced through the use of Open Data based applications.

Based on the total passenger kilometres for 23 European countries in 2012, a reduction of 10% waiting time will save **629 million hours** of unnecessary waiting time on the road in those 23 European countries. In 2014, average hourly labour costs were estimated at 24.6 EUR in the EU28.[229] The value of commuting time (VOCT) is estimated as the trade-off between wage and commuting time, based on the effects wage and commuting time have on the probability of changing jobs. The estimated VOCT is found to be relatively large, in fact about 1.8 times the net wage rate.[230] The average value of commuting time would be 44.28 EUR per hour on average in Europe. Those 629 million hours are worth **27.9 bn EUR** per year.

*"The amount of time wasted could be reduced by using Open Data-based applications."*

### 7.4.3 Environmental gains

A topic of growing concern is the greenhouse effect and the overall impact of climate change. Governments are searching for new ways of reducing the toxic effects of, for example, $CO_2$ emission and improvement of waste management. Open Data can be useful to reduce those adverse effects as well, by providing more insight into the specific areas where those problems cause the most health risks and act on them.

225 http://www.telegraph.co.uk/motoring/news/10082461/Motorists-spend-106-days-looking-for-parking-spots.html
226 https://carambla.com/
227 http://tranquilien.com/
228 http://dictionary.cambridge.org/dictionary/business-english/opportunity-cost
229 http://ec.europa.eu/Eurostat/statistics-explained/index.php/Hourly_labour_costs
230 Swärdh, J. (2009)

**RE:CYCLE** [231]

In Bulgaria, a website is created to list recycling sites. The project was prompted by distrust of citizens if their garbage was actually recycled. The website displays recycling sites on a map. These sites can then be further filtered by selecting the type of site (point depot, sales network, ...) or the type of material (paper, non-ferrous metals, batteries , stalko, ...).

## Air pollution

Air quality is an important subject where Open Data can have a major impact. Especially in France, air quality is gaining more attention. The air pollution annual cost is estimated at 101.3 billion EUR according to a report titled "Air pollution, the cost of inaction" from the French Senate published in the summer of 2015.[232] The study equally takes into account the health damage from pollution, but also its impact on building refurbishing, ecosystems and agriculture. Fine particles and ozone are causing 42,000 to 45,000 premature deaths in France per year.

**Plume Labs** [233]

An application focused on air quality is called Plume Labs. It tracks the hourly pollution levels in sixty cities in the world, including ten cities in France, four cities in Belgium and four cities in the UK. The air quality is shown using an index number, whereby above 150 is considered "critical", while anything above 100 is considered "harmful". The start-up uses the data made public by different agencies engaged in a policy of Open Data, for example Airparif in Paris.

**Päästöt.fi** [234]

A Finnish website shows industrial emissions in all EU countries and in Iceland, Norway, Serbia and Switzerland. The website shows the emissions level on a map, based on the European Pollutant Release and Transfer Register (E-PRTR) database. The service helps to relate the orders of magnitude of emissions. It also provides citizens with the possibility to compare regions when making the decision to work or live in a region.

## Energy saving

Individual households can equally benefit from Open Data, by assessing their energy consumption. Awareness is raised when the energy consumption of all households is shown and comparisons can be made between equal households in terms of family members and their specific energy consumption. People that use more energy than the average comparable household are stimulated to decrease their energy consumption and thereby also save money on their bills. This applies not only to individuals, but also to organizations and the public sector.

231 http://www.obshtestvo.bg/project/recycle.html
232 http://www.industrie-techno.com/cout-de-la-pollution-la-start-up-plume-labs-veut-democratiser-le-quantified-environment.39198
233 https://www.plumelabs.com/
234 http://paastot.fi/

**Husets Web** [235]

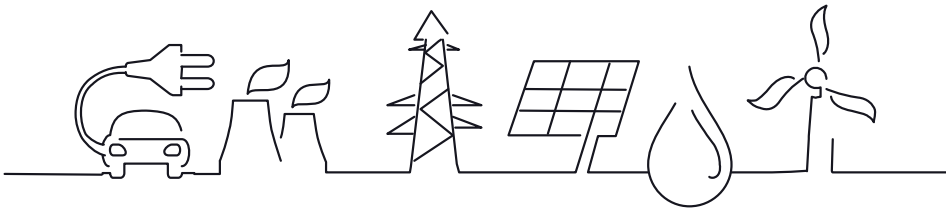
In Denmark, Husets Web provides intelligent and dynamic calculations of energy saving measures that can help individual homeowner save energy and money. The calculator uses information about Danish building architecture, 200 years of building statistics, and information about heating systems. This information is combined with data on the specific property which is drawn from public databases. In addition, the homeowner can add his own data about the property and about actual energy consumption. The calculator produces an individual Energy Report which provides an overview of energy improvements, like the report an energy consultant would make.

**Windsor and Maidenhead council** [236]

Since 2009-2010 the council used 16% less gas, electricity, oil and transport fuel in its buildings and vehicles - including a 7% reduction between 2011-2012 and 2012-2013 worth £126,000 (€178,400) after starting to publish real-time data on energy use. They installed automated meter readers to monitor the usage of gas and electricity. Better meters will be acquired to further reduce the energy consumption.

**Opower** [237]

A relatively new energy tech company, founded in 2007, is Opower. It helped people around the world save 5 billion kilowatt hours of energy and $575 million (EUR 524 million) in utility bill savings. They achieved this result not only by providing people with information on their own energy consumption, but compared to other similar households to create individual customer profiles. The company had grown with about 400 employees operating in three continents in 2013. There were almost 100 available positions posted on their webpage at the end of 2013. At the moment, Opower has 560 employees and is still growing. A good example to illustrate that a new company can really create a lot of jobs.

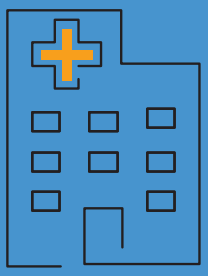


235 http://www.rbwm.gov.uk/web/news_10913_energy_reduction_sustainability_strategy.htm
236 http://www.rbwm.gov.uk/web/news_10913_energy_reduction_sustainability_strategy.htm
237 http://www.opower.com/company

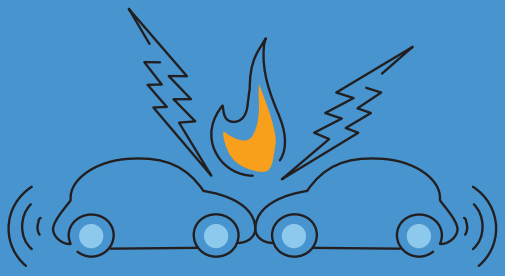
more Open Data can help make

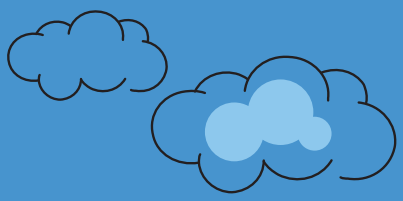
# better decisions

**7,000 lives**
saved due to
quicker response

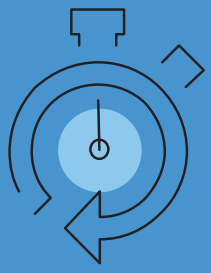


**5.5% less**
road fatalities

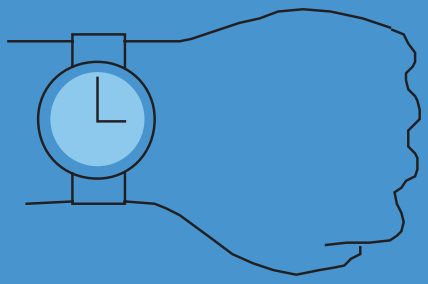




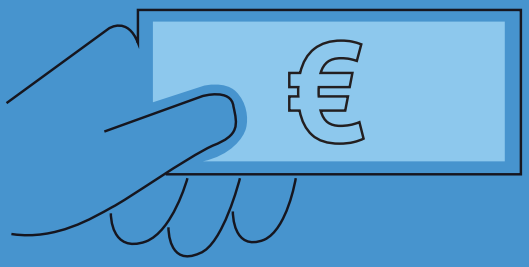
Congestion
**costs are 1% of GDP**

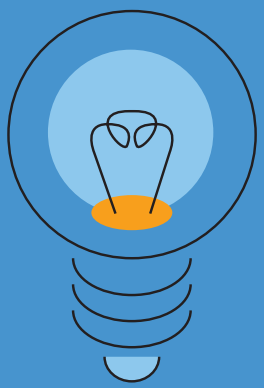


2,549 hours
**wasted**
finding parking



**629 million**
hours saved is
equivalent to
**€ 27.9 bn**



**16% less**
less energy used

8

# Realising the value of Open Data

In conducting the macroeconomic analysis of the impact of the re-use of Open Data for Europe, several observations are made. The objective is therefore to offer governments with a series of recommendations on how to measure the success of their Open Data initiatives and accelerate on their Open Data journey. Certain recommendations could be made in order to enhance the quality of calculations, but also to make better use of Open Data.

## 8.1 Understanding Open Data benefits

The majority of the studies performed previously are ex-ante estimations of the benefits of Open Data. No comprehensive and detailed ex-post evaluations have been undertaken so far. It is necessary to conduct research ex-post into the benefits of Open Data. However, the necessary data to do so is at the moment hardly available. Governments should be encouraged to keep close track of figures related to the costs and benefits of their own provision and re-use of Open Data and of society as a whole. Several recommendations can be made along those lines.

**The costs and benefits of releasing data should be further detailed**. Governments receive numerous requests for information from citizens, the private sector but also via internal requests from one administration to another. Handling all of these requests cost time and money. If this information was to be published as Open Data via a marginal cost model, the Request for Information Costs could be substantially reduced. To measure this reduction, it is recommended to release information about Request for Information Costs. The effect of releasing Open Data on governments should also be measured. Several effects could be achieved by making Government Data more easily available, e.g. on Open Data portals. The size of these effects should be measured:

- Cost savings achieved by Open Data;
- Increased transparency by Open Data;

**Furthermore, a marginal or free cost model for Open Data is needed.** This is already recommended by previous studies but nonetheless very important in increasing the use of Open Data. The availability of Open Data at maximum marginal cost price (and preferably free of costs) is likely to promote innovation and the development of new products and services around Open Data. The price elasticity of demand for Open Data is high: public sector agencies in various countries have witnessed a strong growth in demand for information they provide after switching from cost-based pricing of Open Data to free or maximum marginal cost priced information.

**Government Portals should maintain site analytics** in order to obtain important information on who uses the websites, which data sets are being downloaded and how many downloads take place. An example of a national portal for which site analytics is available is the portal of data.gov.uk. This kind of information is useful in order to calculate for instance cost savings.

**On Open Data portals, feedback mechanisms should be created.** The research of Open Data should be a multi-stakeholder effort and various actors and sectors should be involved in the process.[238] Feedback mechanisms enable the interaction

238 Granickas (2013), p. 27

between the supply and demand side of Open Data.

Missing data sets can be requested. Also, bugs or improvements can be reported. An opportunity to deliver feedback can also promote engagement between a portal and its users. In fine, such crowd sourcing activities will increase the quality of public data.

**Also, governments should conduct surveys into the re-use of Open Data in the private sector.** Actual estimates are needed to determine:

- Number of companies involved in Open Data;
- Size of companies involved in Open Data;
- Employment in the Open Data market;
- The influence of Open Data per Eurostat recognized sectors should be measured.[239]

Furthermore, the private sector may wish to contribute in identifying future public data sets that should be released and could contribute more directly to current and future business needs.

**Finally, the work force should be empowered to make the most of Open Data.** Big and Open Data are still a new field of business, both growing rapidly. The number of people employed in these sectors is also growing. According to former EU's digital agenda commissioner Neelie Kroes, the number of "digital jobs" in the EU is growing by about 100 000 every year. Yet different studies forecast that the number of job vacancies will exceed the number of people able to fill those positions. This is due to a skills gap: the number of graduates with the required information communications technology (ICT) skills is not keeping pace with the demand. Especially the low numbers of students choosing technical studies creates a problem on the supply side for those Big Data jobs. More students should be encouraged to choose courses in technical and scientific subjects and mathematics throughout all levels of education, beginning at the earliest possible age.[240] As Figure 31 shows, the most important hard skills are subject matter expertise, data & technical skills, and math & statistics knowledge. Governments can play a key role in make these subjects more attractive to younger generations.

However, e-skills also require a lot of soft skills, like collaboration, problem solving and communication. These soft skills are needed for several reasons. Creativity and curiosity are needed to assess the possibilities of a data set. Obviously, someone working with data needs to have the technical capabilities to process the data. But to start processing the data, one has to have an idea what to do with the data. Which possibilities does the data set offer? Which insights can possible be created? This requires soft skills.

Still, the solution does not lie solely with the government. Businesses need to consider a short, medium and long term strategy to prevent falling behind and to stay competitive. A short-term way of using data is to run professionally organised hackathons where others prototype products or services with data provided by companies. A mid-term possibility is to invest in training for the staff in data science, management and engineering (but to recruit as well). A long-term strategy would be to build strong partnerships with communities who are working with young programmers to build a solid pipeline of technical talent.[241]

*"The solution does not lie solely with the government, businesses also need to take action."*

239 http://ec.europa.eu/eurostat/product?code=nama_nace10_c&language=en&mode=view
240 https://bertmaes.wordpress.com/report-skills-shortage/
241 http://www.yourreadybusiness.co.uk/open-data-bridging-the-digital-skills-gap/


*Figure 31 - Skills required to work with Big Data*

### 8.2 Moving forward with Open Data

The potential value of Open Data for the EU28+ has been identified for the period 2016 – 2020. The total market size for Open Data is estimated at 325 bn EUR. In the same period, nearly 30,000 Open Data jobs can be created. Furthermore, potentially 1,705 million euro of costs savings can be reached in 2020 by the national governments of the EU28+. Also, several cost savings for society exist. Examples of lives and time saved as well as environmental gains were discussed.

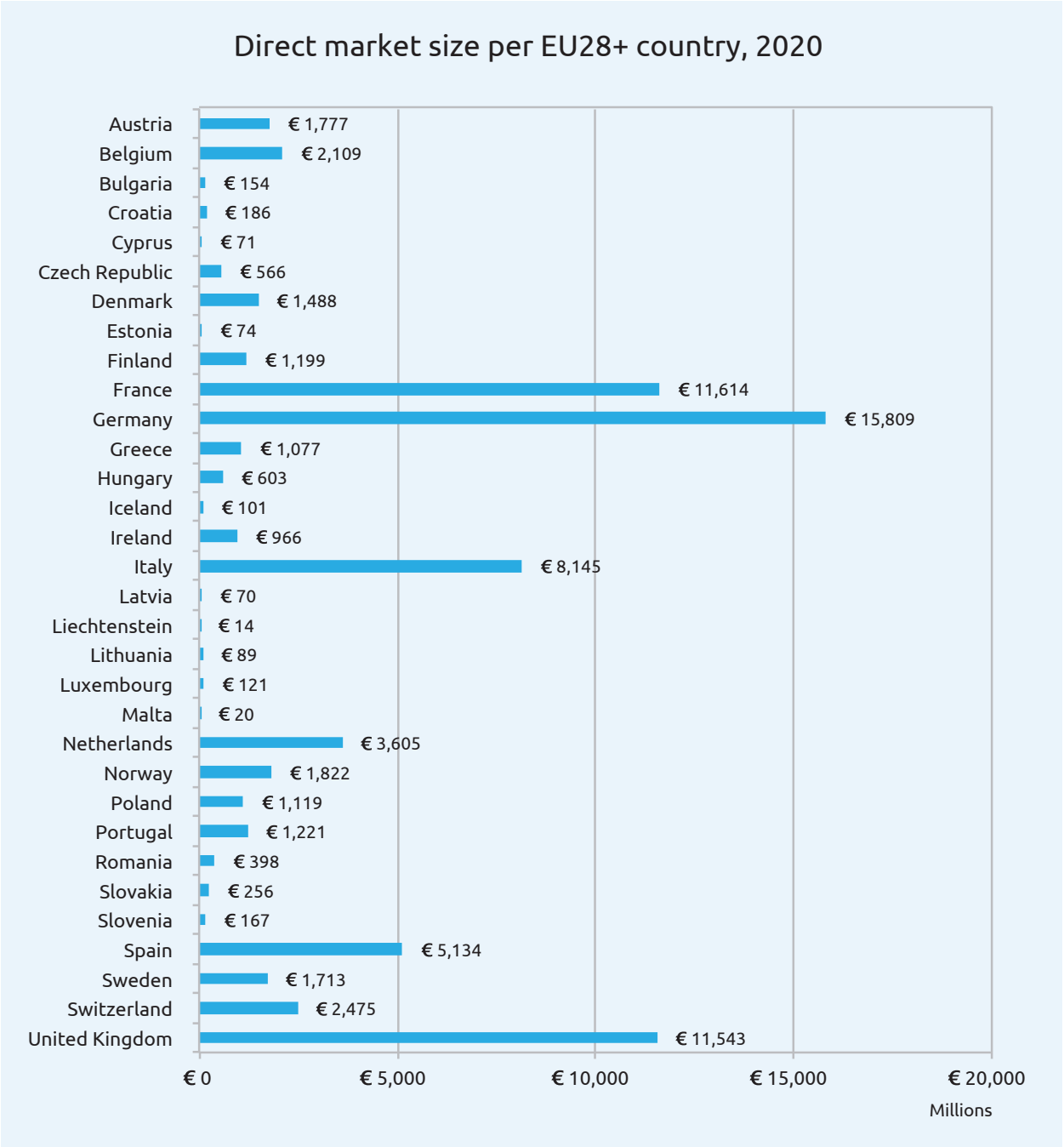
The potential of Open Data is tremendous. However, to realize this potential, the EU28+ countries have to move forward with Open Data. In 2015, it was established that 31% of the EU28+ countries were Trend Setters with regard to Open Data. Yet, still 25% are (Advanced) Beginners. Some countries do not even have a national Open Data portal. To reach the potential of 325 bn EUR by 2020, the percentage of Trend Setters has to increase to 88%. Although all countries either implemented or are in the process of implementing the revised PSI Directive, other accelerations are needed as well: increased portal usability, machine readable data, increase in the release of public data, etc. In the previous section, several recommendations were already mentioned. Also, training and support should be offered within the EU28+ countries to accompany civil servants in making the most out of Open Data. Furthermore, best practices between the countries need to be shared. That way, the full potential of Open Data can be reached.

# Appendix I - Abbreviations Maturity graph

| Country Abbreviations (in alphabetical order) | |
|---|---|
| AT | Austria |
| BE | Belgium |
| BG | Bulgaria |
| CH | Switzerland |
| CY | Cyprus |
| CZ | Czech Republic |
| DE | Germany |
| DK | Denmark |
| EE | Estonia |
| EL | Greece |
| ES | Spain |
| FI | Finland |
| FR | France |
| HR | Croatia |
| HU | Hungary |
| IE | Ireland |
| IT | Italy |
| LI | Liechtenstein |
| LT | Lithuania |
| LU | Luxembourg |
| LV | Latvia |
| MT | Malta |
| NL | Netherlands |
| NO | Norway |
| PL | Poland |
| PT | Portugal |
| RO | Romania |
| SE | Sweden |
| SI | Slovenia |
| SK | Slovakia |
| UK | United Kingdom |

II

# Appendix II - Direct market size per EU28+ country



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